Coordination of Hours within the Firm

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Abstract

Teamwork has become increasingly important in many firms, yet little is known about how coordination of hours among heterogeneous coworkers affects pay, productivity and labor supply. In this paper we propose a framework where differently productive firms choose whether or not to coordinate hours in exchange for productivity gains. In this framework, we show that more productive firms select into coordinating hours and pay compensating wage differentials, leading to attenuated labor supply responses and spillovers from tax changes. Next, we bring the model predictions to the data using linked employer-employee registers in Denmark. We first document evidence of positive correlations between wages, productivity and the degree of hours coordination - measured as the dispersion of hours - within firms. We estimate that hours coordination can explain around 4% of the variance of firm-level wages. We then estimate labor supply elasticities using changes to the personal income tax schedule in 2010 which affected high-wage earners differently. We find evidence of higher labor supply elasticity in firms with lower hours coordination. Furthermore, we find evidence of spillover effects on hours worked by coworkers not directly affected by the reform that are consistent with our model of firm level coordination of hours.

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1 Introduction

Over the past few decades firms have become more collaborative, with coworkers spending a greater share of their working time interacting with each other (Delarue et al., 2008; Cross and Gray, 2013). One key aspect of cooperation within firms is that it necessitates some degree of coordination of hours. Specifically, a greater need for interaction may require that coworkers work a more similar number of hours, despite possibly different labor supply preferences. While existing studies suggest that greater cooperation is associated with improved worker productivity (e.g. Hamilton et al., 2003; Chan, 2016), to date little is known about how hours coordination affects worker behavior or firm performance.

A better understanding of hours coordination however, is important for at least two reasons. First, hours coordination is an unexplored dimension along which firms differ that may help explain the observed link between productivity and wages in a firm.[1] Second, coordination can serve as a mechanism that amplifies or attenuates the effects of policies that affect labor supply. In the specific case of tax reforms, this could provide an explanation for the low elasticity of labor supply to tax changes found in several other studies (e.g. Chetty, 2012).

In this paper we first document the features of coordinated firms. We propose a novel measure of hours coordination and show how this correlates with other characteristics of the firm. Importantly, we find that coordination positively correlates with firm productivity and predicts wage differentials across firms. Next, we explore how coordination can distort the effects of a policy change. We examine the effects on labor supply of a Danish tax reform that predominantly affected high income workers, who, arguably, have a different desired number of work hours than low income workers. In low-coordination firms, we find sizable labor supply responses, while in high-coordination firms we estimate insignificant labor supply elasticities for high income workers. Furthermore, we find labor supply spillovers on low income workers who were not directly targeted by the tax reform.

We conceptualize the link between firm profitability, coordination of hours, wages and labor supply elasticities in a framework where differently productive firms employ workers with

[1] It is well documented that productivity and wage differentials across firms strongly correlate (see Card et al., 2016b for a summary of these studies).

heterogeneous desired work hours. In this framework, firms can choose whether to coordinate hours or not. Coordination enhances productivity but requires hours worked to be the same across heterogeneous coworkers. We derive three main predictions. (1) More productive firms coordinate hours and pay compensating wage differentials for imposing sub-optimal hours. (2) Coordination attenuates the labor supply responses of workers targeted by a tax change. (3) In coordinated firms a tax change that affects one type of workers has spillovers on hours worked by other coworkers.

We test these predictions using linked employer-employee registers of the Danish population. Denmark is a particularly fitting setting for our study. In fact, in 2010 the government mandated a personal income tax reform that substantially lowered the marginal tax rates on high incomes while leaving almost unchanged the marginal tax rates of low income workers. Additionally, the Danish data allow us to link number of hours worked to individual and firm characteristics. Furthermore, compared to other European countries, Denmark has a relatively flexible labor market where employers have considerable discretion in setting wages and hours (Botero et al., 2004; Hummels et al., 2014).

We measure coordination using the standard deviation of average hours worked across skill groups in a firm. In doing so we assume that workers in different skill groups have different labor supply preferences, and that a lower dispersion of hours implies a greater overlap of workers at the workplace. Therefore low dispersion is interpreted as high-coordination.[2] Validation exercises performed using alternative measures of coordination from O*NET, the Survey of Adult Skills, and the Danish Time Use Survey support this interpretation. A descriptive analysis based on our coordination measure reveals that more coordinated firms are more productive, employ better able workers, are less likely to employ part-time or hourly workers, require a more intense use of social skills (Deming, 2015), and are more likely to be in the service sector.

With our measure of coordination in hand, we first explore how the degree of coordination at a firm relates to the wage premium paid to workers. We estimate the premium as the firm fixed effect from a regression of hourly wages on individual, firm fixed effects and time

[2] Ideally we would measure coordination based on the degree to which coworkers with different labor supply preferences work at the same time of the day or interact with each other. Unfortunately data of this type do not exist on a such large scale. We focus on full-time workers because Danish Time Use Survey data reveal that part-timers are more likely to start working later during the day or to work over weekends.

varying characteristics (Abowd et al., 1999). Then we regress this premium on our measure of coordination. In line with the model, we find a strong and positive association between the firm component of wages and coordination of hours across and within sectors. This correlation is robust to a number of firm characteristics that are known to affect wage inequality across firms.[3] Conditional on other characteristics, we estimate that a one standard deviation increase in coordination is associated with a 0.5% increase in wages. In the same specification, exporter status has a similar predictive power while firm size is not as predictive as coordination.

After controlling for measures of firm productivity the correlation between wages and coordination is insignificant. This suggests that only highly productive firms can afford to pay higher wages to achieve greater coordination. Specifically, we estimate that coordination can explain around 4% of the wage inequality due to productivity across firms within 3-digit industries. While descriptive, these findings suggest that a relevant part of the documented correlation between the firm-component of wages and productivity may reflect wage differentials for greater coordination in more productive firms.

In the second part of the paper we analyze the effects of a tax reform which abolished the middle bracket of a 3-bracket progressive tax schedule and lowered the top tax rates. This resulted in a sizeable reduction of the marginal tax rates of workers who used to be in the top and middle tax bracket prior to the reform (high-skilled).

To identify the attenuating effects of coordination we estimate the elasticity of hours worked by high-skilled workers in high versus low-coordination firms. In doing so, we use the tax reform as an instrument for the observed changes in after-tax wages (Gruber and Saez, 2002). In line with the model predictions, we find an elasticity close to zero and insignificant in high-coordination firms, and a negative and significant elasticity of -0.1 in low-coordination firms.

Next, we test the existence of labor supply spillovers estimating the elasticity of hours worked by low-skilled workers to the tax-driven change of average hours worked by high-skilled coworkers. We find an elasticity of 0.88 that implies an increase of 0.85 hours worked by low-skilled for each additional hour provided by high-skilled coworkers. Consistent with our

[3]For instance, we control for firm size (Mueller et al., 2015), exporter status (e.g. Helpman et al., 2016), the skills and gender composition of the workforce (Card et al., 2016a, Song et al., 2016), average number of hours, unionization rate (e.g. Dickens, 1986), overtime premiums (Cardoso et al., 2012).

framework we find a lower elasticity among workers in low-coordination firms. Importantly, the effects of coordination that we document do not reflect other time invariant firm characteristics, and are based off workers who stayed at the same employer throughout the reform.

Our findings of attenuating and spillover effects have a variety of implications. First, the elasticity of labor supply captures only a part of the efficiency costs associated with a tax change (Feldstein, 1999) since it neglects the indirect effects on untargeted coworkers. Including spillovers we estimate an increase of 15% in the marginal excess burden from the 2010 Danish tax reform. Second, due to hours coordination, using workers who are not directly targeted by a tax change as a control group can produce downward biased estimates of the labor supply elasticity (e.g. Eissa, 1995; Blundell et al., 1998). Finally, the effects of coordination are not only relevant to the evaluation of tax policies. They also apply to any policy that affects the preference over hours of one group of workers in a firm, such as parents or old workers.[4]

This study relates to multiple strands of the literature. First, we speak to the set of studies that analyze the effects of taxation when employers impose constraints on hours (Chetty et al., 2011; Best, 2014; Battisti et al., 2015). Some of these studies show evidence of bunching of workers who do not directly face tax schedule kinks that is consistent with our finding of labor supply spillovers. Using newly available data on hours and the quasi-experimental variation deriving from a tax reform, we provide firm-level evidence of a mechanism - coordination of hours - through which preferences over hours spill over to other coworkers.[5]

Second, we contribute to the extensive literature on wage and productivity differentials across firms (e.g. Syverson, 2011; Card et al., 2016b). Specifically, we offer a look inside firms by modeling, and empirically quantifying, the importance of coordination of hours as a

[4]In this sense our research supports the findings of a growing body of literature that emphasizes the importance of employer-employees interactions in shaping workers' responses to policy changes. For instance, Choi et al. (2004); Gelber (2011); Chetty et al. (2014); Fadlon et al. (2016) document the importance of employers in determining employees' contribution to retirement plans.

[5]Battisti et al. (2015) present evidence of reduced intertemporal elasticities from structural simulations of a policy that only affects a fraction of the firm workforce. This evidence is consistent with the attenuating effects of coordination on steady-state elasticities that we document. However, we are able to measure coordination using firm-level data on hours and base our evidence on a real preference shock deriving from a tax reform. Our results also help to shed light on existing evidence at more aggregate levels. Kahn and Lang (1991) finds the elasticity of actual hours to be lower than the elasticity of desired hours. Our findings suggest that such difference may be linked to firm-level coordination. Hamermesh et al. (2008) documents synchronization of working schedules across US states. Our results indicate that coordination among coworkers is associated to co-movement of hours.

rationale that leads more productive firms to pay higher wages. In this respect, our results document a specific mechanism that can explain recent findings suggesting that compensating differentials are an important source of wage inequality across firms (Sorkin, 2015; Lavetti and Schmutte, 2016).[6] Relative to the literature on compensating differentials from less desirable hours, our results emphasize the importance of looking at the dispersion of hours in a firm as a way to measure dis-amenities from lower flexibility at the workplace (e.g. Rosen, 1986; Abowd and Ashenfelter, 1981; Hamermesh, 1999; Goldin and Katz, 2017; Card et al., 2016a; Mas and Pallais, 2016).

Finally, our study complements a recent literature that highlights the positive correlation between social skills and wages (Heckman and Kautz, 2012; Deming, 2015). We document, in fact, that workers in highly coordinated firms make more intense use of social skills. Compensating differentials from coordination can therefore be viewed as a channel through which higher wages are associated with social skills.[7]

The remainder of the paper is organized as follows. Section 2 presents the conceptual framework, Section 3 describes the data and the institutional setting. Section 4 presents the empirical relation between coordination, wages and firm productivity. Section 5 quantifies the effects of coordination on the elasticity of labor supply. Finally, Section 6 concludes.

2 Conceptual framework

Underlying the standard labor supply model is the assumption that employers are indifferent to the hours supplied by their employees. Hours worked however vary across sectors and, most notably, across firms within a sector. Figure 1 shows the distribution of weekly hours worked across six major sectors in Denmark. The distribution is considerably more concentrated in the service sector than in agriculture, manufacturing or construction, even though the latter

[6] While we can not exclude the possibility that wage premiums partially reflect rent sharing, drawing on a correction exercise in the spirit of Lavetti and Schmutte (2016) would suggest that, in that case, our estimates of compensating differentials due to coordination would be a lower bound for the actual compensating differentials. Siow (1987) found higher wages in industry-occupations with less volatile hours. Our research moves to the linked employer-employee level. This allows us to measure the dispersion of hours between coworkers and examine how this relates to wage inequality across firms.

[7] In this respect our empirical findings support the theoretical work that links synchronization of working schedules to the potential for better communication and cooperation (Lewis, 1969; Weiss, 1996).

sectors are more unionized than services.

The variation in the hours worked between sectors, however, accounts only for a small part of the overall variation in hours. A decomposition of the variance of total annual hours worked in Denmark into between and within sector variability first, and then into cross and within firm variability shows that cross-firm variation explains more than 35% of the overall variance, whereas merely 4% of the overall variation occurs between 1-digit sectors (Figure 2).[8] This descriptive evidence suggests that employers may indeed affect their workers supply of hours. Motivated by this evidence, in this section we propose a model where firms endogenously choose whether to restrict the range of hours available to their employees. Then we examine how this affects wages and labor supply elasticities.

2.1 Workers

There are two types i of workers, N_H workers with high skill ($i = H$) and N_L workers with low skill ($i = L$). Workers have preferences over a continuum of consumption goods $\omega \in \Omega$ and leisure ℓ_i of the following type (Dixit and Stiglitz, 1977; Prescott, 2004):

$$U\left(Q_i, \ell_i\right) = \log\left[\int_{\omega\in\Omega} q(\omega)^{\frac{\sigma-1}{\sigma}}\, d\omega\right]^{\frac{\sigma}{\sigma-1}} + \eta\, v\left(\ell_i\right), \tag{1}$$

where $(Q_i)^{(\sigma-1)/\sigma} \equiv \int_{\omega\in\mathbf{\Omega}} q_i(\omega)^{(\sigma-1)/\sigma}\mathrm{d}\omega$ is the (exponentiated) consumption index for a worker of skill i and $\sigma > 1$ is the elasticity of substitution between any two goods. We assume that the utility of leisure function $v(\ell_i)$ is increasing and concave with $v'(\ell_i) > 0$ and $v''(\ell_i) < 0$.

Workers can take employment either in the non-coordinated or in the coordinated labor market. In the non-coordinated labor market, workers face equilibrium wages w_i^* and pick their optimal hours $h_i^* = 1-\ell_i^*$, allowing for an optimal consumption level Q_i^* with individual product

[8] The variance of hours is decomposed into between and within group components as follows:

$$\frac{1}{N_t}\sum_i\left(h_{it} - \overline{h_t}\right) = \frac{1}{N_t}\sum_g\sum_{i\in g}\left(h_{it} - \overline{h_{gt}}\right) + \frac{1}{N_t}\sum_g N_{gt}\left(\overline{h_{gt}} - \overline{h_t}\right)$$

Where workers are indexed by i and years by t, g denotes groups (i.e. firms or sectors) while N_{gt} and N_t denote respectively the number of groups and the number of workers. h_{it}, $\overline{h_{gt}}$ and $\overline{h_t}$ are respectively the worker hours, the average hours within each group and the average hours across all workers. The variance is decomposed in each year between 2003 and 2008. Figure 2 shows average shares across all years. To the extent that hours are measured with errors the within firms component of the variance may be overestimated which means that hours between firms may vary even more than our measure shows.

demand $q_i^*(\omega)$, and resulting in a utility level $U_i^* \equiv U(Q_i^*, h_i^*)$ (see Appendix A.1).

In contrast, workers employed in the coordinated labor market must work for a prescribed number of hours $\hat{h}$ regardless of their skill level. In the coordinated market, firms offer skill-specific hourly wages $\hat{\mathrm{w}}_H$ and $\hat{\mathrm{w}}_L$ that are discussed in the next subsection. Workers in this segment consume $\hat{Q}_i$ and $\hat{q}_i(\omega)$, resulting in utility $\hat{U}_i \equiv U(\hat{Q}_i, \hat{h}_i)$.

Workers face a skill-specific tax rate t_i that generates tax revenues distributed through a lump-sum transfer T that balances the government's budget. The overall labor market for each skill group clears so that $N_i^* + \hat{N}_i = N_i$ for equilibrium wages w_i^* and $\hat{\mathrm{w}}_i$.

2.2 The wage-hour function

We assume perfect worker mobility between firms in the non-coordinated and coordinated segments of the labor market. An implication is that, in equilibrium, a coordinated labor market can only co-exist with the non-coordinated labor market if workers are indifferent between employment in either market segment. The indifference condition for each type i worker between coordinated and non-coordinated labor market segments is:

$$U\left(\frac{\hat{\mathrm{w}}_\mathrm{i}}{P}\,\hat{h}\,(1-t_i) + \frac{T+\bar{\pi}}{P},\,\hat{h}\right) = U\left(\frac{\mathrm{w}_\mathrm{i}^*}{P}\,h_i^*\,(1-t_i) + \frac{T+\bar{\pi}}{P},h_i^*\right), \tag{2}$$

where $P^{\sigma-1} \equiv \int_{\omega\in\mathbf{\Omega}} p(\omega)^{-(\sigma-1)}\,\mathrm{d}\omega$ is the (exponentiated) price index, and $\bar{\pi} \equiv \int_{\omega\in\mathbf{\Omega}} \pi(\omega)\mathrm{d}\omega/(N_H + N_L)$ represents the equal distribution of firm profits as dividends. This condition implicitly defines the wage rates $\hat{\mathrm{w}}_i$ for each type i worker as a function of the hours worked $\hat{h}$. To illustrate this, in Figure 3 we assume that $\hat{h} > h_i^*$. For the sake of clarity in the figure we ignore T and $\bar{\pi}$ and assume $t_i = 0$, $P = 1$. Figure 3 shows that the wage rate $\hat{\mathrm{w}}_\mathrm{i}$ that makes the worker indifferent between working h_i^* at the rate $\mathrm{w_i}^*$ and working $\hat{h}$ is greater than the equilibrium wage $\mathrm{w_i}^*$. Since this applies to any hours choice $\hat{h} \neq h_i^*$, condition (2) defines a function $\hat{\mathrm{w}}_i(\hat{h})$, that has $\mathrm{w_i}^*$ as parameter, and that we refer to as the *wage-hour function*.

Regarding the properties of this function, under standard regularity conditions on the shape of the utility function, it can be shown that $\hat{\mathrm{w}}_i'(\hat{h}) < 0$ if $\hat{h} < h_i^*$. In this case a marginal increase in $\hat{h}$ shortens the distance between $\hat{h}$ and h_i^* thus requiring a lower extra compensation to make the worker indifferent between working $\hat{h}$ and working h_i^*. Similarly, $\hat{\mathrm{w}}_i'(\hat{h}) > 0$ if $\hat{h} > h_i^*$, whereas if $\hat{h} = h_i^*$ no extra compensation is needed and thus $\hat{\mathrm{w}}_i'(\hat{h}) = 0$. Additionally, it can be shown that $\hat{\mathrm{w}}''(\hat{h}) > 0$ (Appendix A.2).[9] Therefore, the resulting wage-hour function is U-shaped with minimum at the equilibrium wage w_i^* where hours $\hat{h} = h_i^*$.

The economic insight behind this function is that firms in the coordinated market need to offer higher wages to both skill groups when the coordinated hours differ from optimal hours.[10]

2.3 Firms

There is a continuum of firms, each producing a different variety ω of consumption goods under monopolistic competition. Every firm produces with a constant-returns-to-scale technology $q(\omega) = \gamma\,\phi\,G(n_H h_H, n_L h_L)$, where ϕ is a productivity parameter that differs from firm to firm under some probability distribution (similar to Melitz, 2003), γ is a Hicks neutral productivity shifter that varies with hours coordination and $G(\cdot,\cdot)$ is the production function. The firm employs n_H high-skilled and n_L low-skilled workers. In what follows we denote with $G_H(\cdot,\cdot)$ the first derivative of $G(\cdot,\cdot)$ with respect to its argument $(n_H h_H)$, and with $G_L(\cdot,\cdot)$ the first derivative with respect to $(n_L h_L)$. For simplicity, we do not allow for market entry (Chaney, 2008). However, firms can choose whether to operate in the non-coordinated or in the coordinated labor market. In the non-coordinated labor market $\gamma = 1$ so that firms produce with productivity ϕ. In the coordinated labor market $\gamma = \hat{\gamma} > 1$ so that firms can raise their productivity to $\hat{\gamma}\phi$ but must pay a fixed cost $\hat{F}$ to achieve hours coordination.[11]

2.3.1 Non-coordinated labor market

In the non-coordinated labor market, firms take equilibrium wages w_i^* and workers' preferred hours h_i^* as given. Thus they choose the number of high and low-skilled workers that minimizes costs:

$$C^*(\omega) \equiv \min_{n_H, n_L} \mathrm{w}_\mathrm{H}^* n_H h_H^* + \mathrm{w}_\mathrm{L}^* n_L h_L^* \qquad \text{s.t.} \quad G\left(n_H h_H^*, n_L h_L^*\right) \geq q^*(\omega)/\phi. \tag{3}$$

[9] As we show in Appendix A.2 there are condition on the curvature of the leisure preferences or economy-wide productivity that ensure $\hat{\mathrm{w}}''(\hat{h})$ to be positive.

[10] In presence of search frictions, coordinated firms would still pay higher wages compared to their non-coordinated peers as long as search costs do not exceed the utility losses from accepting standardized hours $\hat{h}$

[11] The fixed costs of coordination can be thought of as the infrastructure needed to sustain coordinated production such as office space, conference rooms, scheduling software, and the like.

The first-order conditions imply that

$$\frac{G_H(n_H^* h_H^*, n_L^* h_L^*)}{G_L(n_H^* h_H^*, n_L^* h_L^*)} = \frac{\mathrm{w}_\mathrm{H}^*}{\mathrm{w}_\mathrm{L}^*}.$$

As by convention, we assume $G_H(\cdot,\cdot) > G_L(\cdot,\cdot)$ so that $\mathrm{w}_\mathrm{H}^* > \mathrm{w}_\mathrm{L}^*$ and $h_L^* \neq h_H^*$, with $h_L^* < h_H^*$ if the substitution effect prevails and the opposite if the income effect prevails.

2.3.2 Coordinated labor market

Firms in the coordinated labor market offer contracts for a single number of hours $\hat{h}$ that workers of all skill levels must accept, but offer skill-specific wages along the wage-hours function $\hat{\mathrm{w}}_i(\hat{h})$ so that each type i worker is indifferent between employment in the coordinated or non-coordinated labor market. This results in the following cost minimization problem:

$$\hat{C}(\omega) \equiv \min_{n_H, n_L, h} \hat{\mathrm{w}}_\mathrm{H}\, n_H\, h + \hat{\mathrm{w}}_\mathrm{L}\, n_L\, h \qquad \text{s.t.} \quad h\, G(n_H, n_L) \geq q^*(\omega)/(\hat{\gamma}\phi)$$
$$\text{and} \quad U\left(h\frac{\hat{\mathrm{w}}_i}{P}(1-t_i) + \frac{T+\bar{\pi}}{P}, h\right) = U(Q_i^*, h_i^*)$$
$$\text{for } i = H, L.$$

From which the first-order condition that implicitly defines $\hat{h}$ is (see Appendix A.3):

$$\hat{n}_H\, \hat{\mathrm{w}}_\mathrm{H}'(\hat{h}) = -\hat{n}_L\, \hat{\mathrm{w}}_\mathrm{L}'(\hat{h}). \tag{4}$$

Condition (4) has several implications. First, it implies that optimal hours $\hat{h}$ are in between h_L^* and h_H^*. In fact, since $h_H^* \neq h_L^*$, $\hat{h}$ cannot be equal to either h_L^* or h_H^*. Furthermore, if $\hat{h}$ is greater than h_L^* and h_H^* then $\hat{\mathrm{w}}_H' > 0$ and $\hat{\mathrm{w}}_L' > 0$ and thus (4) cannot be satisfied. For a similar reason, $\hat{h}$ cannot be smaller than h_L^* and h_H^* to satisfy (4). Second, (4) establishes that optimal hours are such that marginal costs of increasing hours in coordinated firms equal marginal benefits. To understand this let us consider the case in which high-skilled desire to work more than low-skilled workers ($h_H^* > h_L^*$). For any choice of coordinated hours $h_L^* < \hat{h} < h_H^*$ a marginal increase in $\hat{h}$ moves them closer to h_H^*. Therefore, it results in lower wage premiums paid to high-skilled and thus in wage bill savings in the amount of $\hat{n}_H\, \hat{\mathrm{w}}_\mathrm{H}'$. However, the same increase in hours moves $\hat{h}$ further away from h_L^*. Thus it results in higher wages paid to low-skilled workers and therefore in a higher wage bill in the amount of $\hat{n}_L\, \hat{\mathrm{w}}_\mathrm{L}'$. At the optimum savings from marginally higher hours equal costs. Finally, (4) implies that $\hat{h}$ is set to be closer to the desired hours of the larger group of workers in the firm.[12]

Based on (4), both high and low-skilled workers in coordinated firms work suboptimal hours and therefore are compensated with wage premiums. It follows that:

Prediction 1 *Firms that coordinate work-time to a common number of hours for both skill groups pay higher hourly wages than non-coordinated firms, which take the supply of work hours as given.*

2.3.3 Endogenous market segmentation

We now establish the conditions for the existence of the coordinated labor-market segment in equilibrium. A firm producing variety ω maximizes its profits by setting the variety-specific price $p(\omega)$ given total demand. Maximized profits in the two segments are (Appendix A.4):

$$\begin{aligned} \pi^*(\phi) &= \left(\frac{\sigma-1}{\sigma}\right)^{\sigma-1}\left(\frac{P}{\mu^*}\right)^{\sigma-1}\frac{E}{\sigma}\,\phi^{\sigma-1}, \\ \hat{\pi}(\phi) &= \left(\frac{\sigma-1}{\sigma}\right)^{\sigma-1}\left(\frac{\hat{\gamma}P}{\hat{\mu}}\right)^{\sigma-1}\frac{E}{\sigma}\,\phi^{\sigma-1}-\hat{F}, \end{aligned}$$

where $E = PQ$ are economy-wide expenditures, and μ^*, $\hat{\mu}$ are respectively minimized marginal production costs in the uncoordinated and coordinated segment. Based on this, a firm with productivity ϕ will choose to enter the coordinated labor market if and only if

$$\hat{\pi}(\phi) > \pi^*(\phi).$$

If $\hat{\gamma} > \hat{\mu}/\mu^*$, this inequality can be rewritten in terms of a firm's productivity ϕ

$$\phi > \frac{\sigma}{\sigma-1}\frac{\hat{F}^{1/(\sigma-1)}}{E^{1/(\sigma-1)}P}\frac{\hat{\mu}}{\hat{\gamma}-\hat{\mu}/\mu^*} \equiv \hat{\phi}, \tag{5}$$

where $\hat{\phi}$ is the productivity threshold above which firms select into the coordinated segment. Intuitively, the higher the fixed cost $\hat{F}$ of coordinating or the higher the marginal cost $\hat{\mu}$ of producing in the coordinated market, the more elevated the entry threshold would be. Conversely, a less competitive market with a high overall price level P and a larger aggregate economy with higher E facilitates entry and therefore reduces the entry threshold. The inequality would be reversed if $\hat{\gamma} < \hat{\mu}/\mu^*$ and a coordinated labor market would not exist. Therefore we can state:

[12] A greater $\hat{n}_i$ in (4), raises the marginal costs of increasing $\hat{h}$ if $\hat{h} > h_i^*$ or decreases the marginal benefits of increasing $\hat{h}$ if $\hat{h} < h_i^*$. This implies that $\hat{h}$ moves closer to h_i^* as $\hat{n}_i$ goes up.

Prediction 2 *If a firm's productivity premium resulting from coordinating work hours is sufficiently large, $\hat{\gamma} > \hat{\mu}/\mu^*$, a coordinated labor market co-exists with a non-coordinated labor market. Firms with productivity above a unique threshold $\hat{\phi}$ coordinate work time, whereas firms with productivity weakly below that threshold remain non-coordinated.*

Assuming $\hat{\gamma} > \hat{\mu}/\mu^*$, we indicate with $\hat{M}$ and M^* respectively the total mass of non-coordinated and coordinated firms in equilibrium. It follows that the total number of each type i worker in the two labor market segments is $\hat{N}_i = \hat{M} \cdot \hat{n}_i$ and $N_i^* = M^* \cdot n_i^*$.

2.4 The effect of a tax rate change on hours worked

In this section we explore the consequences of a change of the tax rate faced by high-skilled workers t_H on optimal hours in the coordinated sector of the economy. Based on (4), one can derive the following expression (see Appendix A.3):

$$\frac{d\hat{h}}{dt_H} = -\left[\hat{\mathrm{w}}_{\mathrm{H}} \frac{U_{cc,H} U_{\ell,H}}{U_{c,H}^2 \left(1 - t_H\right)} + \frac{P\, U_{\ell,H}}{U_{c,H} \hat{h} \left(1 - t_H\right)^2}\right] \times \left[\hat{\mathrm{w}}_H''(\hat{h}) + \alpha\, \hat{\mathrm{w}}_L''(\hat{h})\right]^{-1}, \qquad (6)$$

where $U_{cc,H}(< 0)$, $U_{c,H}(> 0)$ and $U_{\ell,H}(> 0)$ are respectively the second derivative of the utility function relative to consumption, the marginal utility of consumption and the marginal utility of leisure for high-skilled workers, whereas $\alpha = \hat{n}_L/\hat{n}_H$.[13]

Since $\hat{\mathrm{w}}_i''(\hat{h}) > 0$ (Section 2.2), the sign in (6) depends on the first term in brackets that is made of two terms. Starting from the left the first term captures the income effect, while the second term is the substitution effect. If the income effect prevails over the substitution effect, the derivative is positive. In that case, desired hours of high-skilled workers go up when t_H increases and so do the hours worked in the coordinated sector. Conversely the derivative is negative if the substitution effect prevails over the income effects. Based on this we can state:

Prediction 3 *(Spillovers) At firms that coordinate work-hours, changes in tax rates that only affect high-skilled have spillover effects on hours worked by low-skilled workers. Hours worked by high and low-skilled workers move together.*

[13] Here we consider the case of a generic additive separable utility function of which (1) is an example. Since firms simultaneously optimize hours worked and the number of workers of each type, the envelope theorem implies that $\alpha = \hat{n}_L/\hat{n}_H$ is not affected by changes of t_H.

Hours worked by high-skilled in coordinated firms however, are less elastic to the tax change than high-skilled hours in uncoordinated firms. To visualize this in Figure 4 we plot the case, consistent with our empirical findings, in which high-skilled workers desire to work more hours than low-skilled, the tax rate on high-skilled workers goes down, and the income effect from the tax change prevails. In this case, as t_H goes down desired hours decrease from h^*_{0H} to h^*_{1H}, and thus optimal hours in coordinated firms shift down from $\hat{h}_0$ to $\hat{h}_1$. If hours in the coordinated sector were to go down as much as desired hours do ($| \hat{h}_1 - \hat{h}_0 | = | h^*_{1H} - h^*_{0H} |$), the benefits for coordinated firms to marginally increase hours would remain unchanged relative to the pre-tax change period. At the same time however, the marginal costs from increasing hours would be lower because coordinated hours after the tax change are closer to the desired hours of low-skilled workers. Therefore, due to convexity of the wage-hours function, a marginal increase in hours would imply a lower increment in wage premiums to low-skilled workers than prior to the tax change. As a result, marginal benefits would exceed marginal costs and hours would optimally move up. This implies that $| \hat{h}_1 - \hat{h}_0 | < | h^*_{1H} - h^*_{0H} |$ and therefore:

Prediction 4 *(Attenuation): High-skilled workers in coordinated firms are less responsive to tax rate changes compared to workers in uncoordinated firms.*

The model also implies that the magnitude of the spillovers on low-skilled workers is increasing in the relative share of high skilled-workers. This is shown graphically in Figure 4 where the dashed line corresponds to a lower α. In this case, as an effect of the tax change, the equilibrium moves from C to D implying a greater reduction in hours than in the case of a higher α.[14]

Finally, in this setting a tax change that moves coordinated hours has effects on wage rates in the coordinated segment. While our main analysis focuses on the hours worked, in Appendix A.5 we discuss the consequences of a tax change on wage rates.

[14] The algebra behind prediction 4 remains difficult to treat even assuming specific functional forms for the utility function. Therefore, we only propose a graphical examination of this prediction. In the model of this section we do not explicitly consider unions. As long as unions' preferences reflect workers' preferences, including unions would not change the main predictions. However, the magnitude and timing of the effects might be affected due to union's rents or the timing of the renegotiation of the collective labor agreements. In the empirical analysis however, we do not find sizable differences between highly versus lowly unionized firms.

3 Institutional Framework and Data Sources

We base the empirical part of the study on a panel of Danish workers. In this section we describe the main features of the Danish labor market and the main sources of our data.

3.1 The Danish labor market

Denmark is a particularly fitting setting for our study. In fact, a soft employment protection legislation combined with a generous social safety net makes the Danish labor market one of the most flexible in the world (Botero et al., 2004). In the past, wages and working time used to be set at the industry level through collective bargaining, but over time the system has gone through a decentralization process that has made the negotiation much more firm-level based.

As an effect of this process and despite the fact that around 70% of the workers in the private sector are unionized, the wages of about 85% of them are negotiated directly at the worker-firm level (Hummels et al., 2014). The wage premium for workers who work overtime is usually equivalent to 50% of the normal wage for the first 3 hours and 100% of the normal wage for each hour of overtime that exceeds the first 3 hours (Appendix B.1).

Regarding the working time regulation, sectoral agreements usually define the normal week to be composed of 37 hours on average and by not more than 8 hours of overtime work. Firms however, have made increasing use of "opening clauses", which allow the union representatives at the company to develop local regulations that can deviate from sector-level agreements. In 2008 about 60% of full-time workers in the private sector were estimated to be covered by this type of local regulation (Dansk-Arbejdsgiverforening, 2012). Similarly, the length of the reference period to determine the average number of weekly hours has been substantially increased. In 2008 it was 12 or more months for about 77% of the workers in the private sector (Dansk-Arbejdsgiverforening, 2012).[15] In addition, an increasing number of employers have made use of local framework agreements that allow working time conditions to be negotiated between employers and employees at the individual level. In 2005 around one third of the

[15] In 1988 the length of the reference period did not exceed 6 moths and it was of 0 to 4 months for 68% of the workers.

private firms had signed an agreement of this type (Jørgensen, 2006). Finally, workers have the option to convert hours of vacation in earnings at their relative wage rates. This provides extra variation in yearly hours of both salaried and hourly workers. The relative flexibility that Danish firms have in setting hours is consistent with the substantial variation in hours worked across firms within sectors that we observe in the data (Figure 2).

3.2 The data

In this section we outline our data sources and construction (for more details see Appendix B). The empirical analysis is based on data from multiple sources (Appendix Table D.1). We use data on individual socio-economic characteristics such as tax returns, earnings and education from the Integrated Database for Labor Market Research (IDA) that collects annual data on the entire Danish population. Data on annual hours of regular and overtime work are extracted from *Lønstatistikken* (LON).[16] Unfortunately, not all workers in IDA can be matched to LON. For our study however, it is particularly important to observe hours of as many workers as possible within a firm. For this reason we only consider firms in which the number of hours worked in a year are available for at least 95% of their workforce. Hourly wages are obtained as annual earnings over the sum of regular and overtime hours worked.

We use firm-level data from the Firm Statistics Register (Firmstat) and the Danish Foreign Trade Statistics Register that provide information on firm characteristics such as number of employees, industry affiliation, accounting and trade data. These registers cover the totality of private firms with more than 50 full-time equivalent employees and a representative sample of smaller private firms. We link each employee to the highest paying employer in week 48 of each year using the Firm-Integrated Database for Labor Market Research (FIDA). For workers whose spell in week 48 lasted less than 1 entire year, we use annualized hours and earnings.

We focus on full-time employees who were 15 to 65 years old in the period 2003-2011 when data are available from all sources. Following the official definition in place during that period, we define full-timers as those working more than an average of 26 weekly hours over a year

[16] Normal hours include vacation, weekends, legal holidays or lunch breaks, whereas unpaid leave and overtime hours are excluded. Data on hours are reported by employers.

period, which are about 90% of the workers in the sample.[17] We leave out part-timers for two main reasons: first, because they are more likely to work at unusual hours or fewer days in a week and this can be problematic for measuring coordination (Section 4.3). Second, because focusing on full-timers makes our results more easily comparable to other studies, especially those on wage inequality across firms.

The final sample that we use includes more than 400,000 employees and around 8,300 firms. Table 1 shows descriptive statistics on individual and firm characteristics. In column 1 we consider the entire population (IDA), the second column is based on the sample of workers in IDA that can be linked to data on firms (FirmStat) and hours (LON). The last column refers to the final sample composed by firms where data on hours are reported for 95% or more of the workforce. Moving from the first to the second column, we notice that workers are older, more educated and earn more. This reflects the characteristics of the firms covered in FirmStat that are private and predominately large (average firm size of 51). Workers in columns 2 and 3, instead, show similar socio-economic characteristics. This suggests that our final sample, while providing better information on hours worked among coworkers, does not substantially distort the composition of the population for which records on individual, firm characteristics and hours are available.

4 Coordination and wage differentials across firms

4.1 The empirical model

In this section we study the relationship between employer-specific wage premiums and the coordination of hours. To do so we use an empirical model that relates the average wage premium paid by each firm j to all its workers over the time period of the study ($\widehat{\psi_{j(i,t)}}$) with a measure of the average coordination of hours over the same period (σ_j) and a vector of average firm controls ($\bar{Z}_j$). The estimating equation is as follows:

$$\widehat{\psi_{j(i,t)}} = \delta_0 + \delta_1 \, \sigma_j + \delta_2 \, \bar{Z}_j + v_j \tag{7}$$

[17] The weekly hours used to identify part-time workers are calculated by dividing regular annual hours by 52.

where $\widehat{\psi_{j(i,t)}}$ is the firm fixed effect from a firm-worker fixed effect model of the type described in Abowd, Kramatz and Margolis (1999) (henceforth AKM) that we discuss in Sections 4.2. The term σ_j measures the average dispersion of hours worked across skill groups in a firm. Higher dispersion is interpreted as lower coordination. In Section 4.3 we discuss the details behind this variable. Based on prediction 1 from the stylized model, we expect $\hat{\delta_1}$ to be negative.

Existing studies have shown that wage differentials across firms correlate with a number of other firm characteristics some of which may confound the estimated correlation between coordination of hours and wages. For this reason in our empirical specifications we include in $\bar{Z}_j$ an extensive set of controls aimed at reducing these concerns. Among the controls we include detailed geographic and industry fixed effects, controls for the composition of the workforce of a firm both in terms of gender and ability, as well as other firm characteristics such as firm size or exporter status all of which have been found to correlate with wage differentials across firms.

Furthermore, one may worry that a negative correlation might be driven by institutional factors. In particular, workers in high paying firms may work longer hours, and in doing so they may "bunch" at 37 hours that is the upper limit imposed on the average number of hours by most of the collective labor agreements. For a similar reason, if workers in high paying firms are more likely to work overtime, higher wages may reflect statutory overtime premiums rather than compensating wage differentials. To take these factors into account, first, in all the specifications we control for the average number of hours worked. Then, in a set of robustness checks, we explicitly explore these potential concerns by excluding firms that bunch at 37 hours and by considering only the earnings from regular hours.

While we control for a large number of confounding factors, in the absence of an exogenous change in coordination, the results of this analysis remain of a correlational nature. However, due to the little evidence that exists on coordination of hours among coworkers we see this analysis as an important first step towards the understanding of a relevant economic phenomenon.

A growing number of studies have found evidence of a positive correlation between wage and productivity differentials across firms (e.g. Card et al., 2016b). In the setting of our study the coordination of hours can be seen as a factor by which higher productivity in a firm translates into higher wages through compensating wage differentials. To measure the share of the correlation between wages and productivity in a firm that can be predicted through coordination, we first estimate equation (7) omitting σ_j and including measures of firm productivity such as value added and total factor productivity (TFP). From this alternative specification of equation (7) we obtain the partial R-squared associated with value added and TFP. This measures the share of the variance of $\widehat{\psi_{j(i,t)}}$ that is explained by productivity once we control for the variables in $\bar{Z}_j$. Then we measure the predictive power of hours coordination as the ratio of the partial R-squared associated to σ_j from equation (7) and the partial R-squared associated to valued added and TFP. From now on we refer to this ratio as the *Coordination share*.

4.2 The firm component of wages

We estimate the average wage premium paid by a firm to all workers as the firm fixed effect in the following regression model:

$$ln\, \mathrm{w_{ijt}} = \alpha_i + \psi_{j(i,t)} + \beta_1 X_{ijt} + r_{ijt} \tag{8}$$

where $\mathrm{w_{ijt}}$ is the gross hourly wage earned by individual i in firm j in year t. X_{ijt} is a vector of time varying controls while α_i controls for individual fixed effects.[18] The variable of primary interest to us is the firm fixed effect $\psi_{j(i,t)}$ that measures the fixed component of the wage that is specific to firm j once we control for individual fixed and time varying characteristics.

Equation (8) is similar to the model used in AKM and several other studies. But, unlike in most other studies, we use hourly wages rather than annual or monthly earnings as a dependent variable to better fit the first model prediction that refers to wage rates. Furthermore we consider both male and female workers since coordination of hours involves all coworkers in a firm regardless of their gender. As in other studies, we focus on full-time workers only.

We estimate equation (8) using the methodology developed by Abowd et al. (2002) to identify sets of connected firms. These consist of firms that have movers in common. In the

[18]Following Card et al. (2013), we include in X_{ijt} a set of interactions between year dummies and educational attainments as well as interaction terms between quadratic and cubic terms in age and educational attainments. In addition, we also control for firm characteristics that change over time such as value added, sales, capital per employee, exporter status and the share of hourly workers. These extra firm controls isolate the average wage premium paid by a firm from temporary fluctuations due to firm-level shocks. The results obtained when we only include individual characteristics are noisier but still in line with the baseline regression and are shown in the robustness section. We estimate this regression on all workers and firms for which data on hourly wages, individual and firm characteristics are available (column 2 in Table 1).

analysis that follows we focus on the largest set of connected firms. Due to the high mobility that characterizes the Danish labor market and the relatively long time period considered, the largest connected set contains more than 99% of the workers and firms in the sample so that restricting the analysis to this group results in negligible changes in the parameters estimated from equation (8) (see Table D.2 in the Appendix). The simultaneous identification of the firm and the individual wage component requires setting to zero either one firm fixed effect or one individual fixed effect. Thus the firm effect $\psi_{j(i,t)}$ has to be interpreted as the proportional wage premium or discount paid by firm j to all employees.

The AKM wage decomposition rests on the assumption of exogenous worker mobility conditional on observables. Following Card et al. (2013), in Appendix C we present a number of tests performed with the aim to investigate the plausibility of this assumption by analyzing the wage trends of movers. The results of these tests suggest that endogenous mobility is unlikely to be a major issue in our setting and, therefore, that the matching between firms and workers in our sample is predominately based on a combination of permanent firm and individual characteristics. Other recent studies reach similar conclusions (e.g. Card et al., 2013; Card et al., 2016a; Song et al., 2016).

4.3 Coordination of hours: measures and facts

Ideally, we would measure coordination based on the degree to which coworkers with different labor supply preferences work at the same time of the day or interact with each other. Unfortunately, data of this type do not exist on a large scale. In what follows we introduce an alternative measure of coordination based on the number of hours worked. Then we use survey data to validate it, finally we discuss how this measure correlates with other firm characteristics.

Our measure of coordination is the standard deviation of hours worked across skill groups:

$$\sigma_{jt} = \left[\frac{1}{S_{jt}} \sum_{s=1}^{S_{jt}} \left(\tilde{h}_{sjt} - \mu_{jt} \right)^2 \right]^{1/2}, \tilde{h}_{sjt} = \frac{1}{N_{sjt}} \sum_{i=1}^{N_{sjt}} h_{isjt} \tag{9}$$

where S_{jt} is the number of skill groups in firm j in year t, N_{sjt} is the number of workers in skill group s in a firm-year while $\tilde{h}_{sjt}$ is the average number of annual hours (regular and overtime) in skill group s in firm j at time t. Finally, μ_{jt} is the average of $\tilde{h}_{sjt}$ across skill groups. We interpret a low value of this standard deviation as implying greater overlap of workers at the workplace and thus greater coordination. σ_j in equation (7) is the average of σ_{jt} over the years 2003-2011.

In measuring coordination, we use skill groups to proxy for differences in desired hours. Labor force survey data on desired hours support this assumption showing that desired hours increase with skills (Table D.7). We use two alternative definitions of skill groups. First, starting from the estimated coefficients from equation (8), we measure skills as the sum of the fixed and the time varying individual components of the hourly wages: $\widehat{s_{ijt}} = X_{ijt}\hat{\beta}_1 + \hat{\alpha}_i$ (Iranzo et al., 2008 and Irarrazabal et al., 2014). We thus assign workers in each year to one of 10 skill groups defined as deciles of the distribution of $\widehat{s_{ijt}}$. Given that this measure of skills is based on fixed and time varying individual characteristics, it might reflect more closely a worker's hours preference, thus also capturing the possible sorting of similar workers across firms. In a setting where wages depend on hours however, $\widehat{s_{ijt}}$ might still reflect equilibrium outcomes to the extent that those are not fully captured by the firm component of wages in equation (8). For this reason in Appendix D.2 we present the results of a parallel analysis in which we define skills at the intersection of 3 educational groups (i.e. primary, secondary and tertiary education) and 3 broad occupational categories (i.e. manager, middle manager and blue collar). The results obtained from these two alternative definitions of skills do not differ in a sensitive way.

Since we do not observe the days and times when workers provided hours, our measure of coordination may be misleading if coworkers work a similar number of hours at different times of the day, in different days of the week or in different periods of the same year. For the latter case, since the great majority of the workers in our sample work for the entire year this is unlikely to play a major role.[19] Furthermore, by focusing on full-time workers in private firms we reduce concerns regarding whether they work different days of the week or at different times of the working day. In fact, descriptive evidence from time use survey data (TUS) indicates that around 70% of full-time workers in Denmark start working between 7am and 9am.[20] Of the remaining 30% the great majority are employed in either manufacturing or the health-care

[19] More than 75% of the workers in our sample have yearly employment spells that last more than 360 days.

[20] We use 2001 Time use survey data in Denmark . Details on this survey can be found in Appendix C.2.

sector. However, the former sector emerges as one of the least coordinated from our analysis (Section 4.3.2) while most the health-care sector is public and thus excluded from the sample. Similarly, around 60% of full-time workers in TUS do not work on weekends and those that do work are mostly concentrated in the health care sector.

While focusing on full-timers reduces the concerns mentioned above, this may come at the cost of ignoring some of the variation that is of interest to us. In particular firms at low degree of coordination may hire relatively more part-timers. This concern, however, is mitigated by the fact that our measure of coordination strongly correlates with the share of part-timers, so that, based on σ_{jt}, more coordinated firms also hire fewer part-timers (Section 4.3.2).

4.3.1 Validation exercises

In this section we use O*NET data to validate our measures of firm level coordination. O*Net is a survey that provides information on 277 occupation-specific descriptors such as work style, work content, interests and experience on 965 occupations. It is based on an ongoing survey of workers in the United States. We use the US survey because a similar survey is not available in Denmark. For each descriptor O*Net provides a measure of its importance in each of the occupations surveyed. We match this information to Danish registers based on occupation.[21] We select the 3 descriptors in O*NET that capture aspects of a job that involve coordination of hours across skills. Similar descriptors are used in other studies to capture skill complementary (Bombardini et al., 2012). The descriptors are: *Contact*: "How much does this job require the worker to be in contact with others (face-to-face, by telephone, or otherwise) in order to perform it?"; *Teamwork*: "How important is it to work with others in a group or team in this job?"; *Communication*: "How important is communicating with supervisors, peers, or subordinates to the performance of your current job?".

The measure of importance of these 3 descriptors ranges between 1 and 100. We take the median score across coworkers each year as a measure of the importance of each factor in a specific firm in that year.[22] In Figure 5 we plot the standard deviation of hours versus

[21] We map the ISCO-88 classification of the Danish registers to the SOC classification in O*Net using the cross-walk provided by the National Crosswalk center.

[22] We break ties in median scores using the average.

the importance of the 3 descriptors across firm-year observations. A negative and statistically strong correlation emerges between each of the above descriptors and the standard deviation of hours across skill groups. That is, in firms where coordination of hours is low the importance of aspects that involve coordination is also low.

In Appendix C we discuss an additional set of validation exercises based on the Survey of Adult Skills and the Danish Time Use Survey. The evidence emerging from these surveys is consistent with the evidence we found with data from O*NET.

4.3.2 Coordination and firm characteristics

In this section we document a few facts that emerge when we look at the correlations between our measures of coordination and a number of firm characteristics.

Table 2 shows the standardized coefficients obtained from a regression of coordination on a number of firm characteristics. A few interesting facts emerge from the table. First, firms that coordinate are more profitable: they have higher value added, sales per employee and total factor productivity. This evidence supports our theoretical framework in which more productive firms select into coordination. Along the same lines, firms that coordinate are more likely to be exporters and to employ a greater share of tertiary educated workers. Second, less coordinated firms employ relatively more hourly and part-time workers suggesting that greater flexibility in these firms is achieved through the hiring of these workers. Third, lower coordination is associated with higher unionization rates. This suggests that low dispersion of hours is not systematically linked to institutional constraints imposed by unions.

Existing studies document that that managerial ability in a firm strongly correlates with the use of more advanced management practices and higher productivity (Ichniowski et al., 1997, Bloom et al., 2015). In a recent study by Bender et al. (2016) managerial ability is measured as the average individual fixed effect (α_i) from an AKM model among the workers in the top quartile of the distribution of α_i in each firm. In Table 2 we look at the correlation between this measure of managerial ability and hours coordination and we find a strong positive association between the two. This suggests that hours are more coordinated in better managed firms.

Deming (2015) highlights the importance of social skills in reducing the costs of coordination among workers. To examine how coordination of hours correlates with social skills at the firm level we construct 4 measures of social skill intensity within firms. These are based on the same O*NET descriptors used in Deming (2015) to measure the intensity of social skills at the occupational level (i.e.*Coordination*, *Negotiation*, *Persuasion* and *Social Perceptiveness*).[23] Consistent with Deming (2015) we find a strong and negative correlation between the dispersion of hours in a firm and social skill intensity.

Table 3 compares coordination in different sectors. Based on this, firms in the service industry coordinate more on average than those operating in the agriculture, manufacturing or construction sectors. Most of the correlations discussed in this section however, hold within narrowly defined sectors suggesting that they are driven by differences across firms within sectors (Table 2).

4.4 Results

In this section we discuss the correlation between the firm component of wages and hours coordination. We start by estimating this correlation across all firms and checking for the importance of other confounding factors. Then we study how wages and coordination of hours correlate across firms within sectors and finally we assess the importance of coordination in linking productivity to wages in a firm.

Column 1 in Table 4 shows the standardized correlation between coordination and the firm component of wages excluding controls for other firm characteristics. In line with the model prediction, higher coordination in a firm is associated with higher relative wage premiums.

However, from the discussion of the previous section one may worry that this correlation may be driven by other firm characteristics. Thus in columns 2 we control for firm size and exporter status to account for the fact that large firms and exporters pay higher wages (e.g. Mueller et al., 2015, Helpman et al., 2016, Macis and Schivardi, 2016). We also include region fixed effects to control for geographic differences in pay. In this last specification we also

[23]Coordination in O*NET is defined as measuring the importance of "Adjusting actions in relation to others' actions", Negotiation as "Bringing others together and trying to reconcile differences", Persuasion as "Persuading others to change their minds or behavior" and Social Perceptiveness as "Actively looking for ways to help people".We match O*NET to the Danish registers based on occupation and we take the average importance of each one of these descriptors in a firm as a measure of social skill intensity in that firm.

control for the share of female workers in the firm because females are more likely to sort in low paying firms or to bargain lower wages (Card et al., 2016a). Finally, we control for the share of unionized workers as a way to capture rents from unions (Dickens, 1986), and the average number of hours worked to control for compensating differentials due to long hours.

In line with the literature, we find that firm size and export status are positively associated with wages, and that better paying firms employ fewer female workers. Importantly, as in other recent studies we find no evidence of compensating differentials due to long hours (Card et al., 2016a). In contrast, we find that the magnitude, the sign and significance of the correlation between wages and coordination is unaffected by these controls. This result highlights the importance of measuring relative hours in a firm to capture dis-amenities from working time.

In column 3 we add to the previous specification extra controls for the skill composition of the workforce in a firm. Recent studies in fact, show that the sorting of better able workers in better paying firms is important in determining wage inequality between firms (Card et al., 2013, Song et al., 2016). We control for the skill composition of the workforce in two ways. First we include controls for the share of workers in each skill group. Then, to account for the fact that workers in the same skill group might differ across unobserved dimensions, we also control for the average values of the individual fixed effect (α_i) in each quartile of the firm distribution of α_i. The average α_i in the top quartile of the firm distribution has been found to correlate strongly with better managerial practices (Bender et al., 2016). Therefore this extra set of controls provides also a way to proxy for differences in managerial practices across firms. The findings from this specification are reassuring because the coefficient attached to coordination retains its sign and significance while the magnitude increases.

The correlation remains negative and of similar magnitude when we exclude from the analysis firms that bunch at 37 hours (average hours between 36.5 and 37.5) or when we consider earnings and coordination from normal hours only, thus excluding overtime (columns 4 and 5). This suggests that the results are not affected much by these other institutional factors.

From the results of the previous section, we know that coordination positively correlates with the intensity of social skills in a firm. These skills have been associated to higher wages (Deming, 2015). In light of this, one possible reason for the higher returns associated to social skills may be that they allow for a greater degree of hours coordination that requires compensating wage differentials. However, to the extent that the returns to social skills are associated to other factors such as, for instance, the low substitutability with new production technologies, it is important to check how much of the correlation between coordination of hours and wages can be linked to social skills. Thus in column 6 we add to the baseline specification the 4 measures of social skill intensity described in the previous section. We find that around 1/3 of the correlation estimated in column 3 can be associated to these skills, suggesting that most of the returns from coordination are not driven by social skills.

The strong correlation between the firm component of wages and coordination of hours persists within 1, 2 or 3-digit sectors (columns 1 to 3 in Table 5) suggesting that coordination plays a non-negligible role in predicting wage inequality across firms within sectors.[24]

In most of the specifications the magnitude of the correlation between wages and coordination is greater than the association between wages and firm size or capital per employee, and of comparable magnitude as export status. These findings establish hours coordination as an important predictor of between-firm wage inequality. From column 3 in Table 4, we infer that an increase of hours coordination by one standard deviation (95 yearly hours) is associated with an increase in firm-level wages equivalent to 0.5%.[25]

If we maintain the baseline assumption that there are no mobility frictions between coordinated and non-coordinated firms, this correlation reflects the compensating differential to keep workers indifferent between the two labor-market segments. In contrast, if we allow for mobility frictions, we cannot exclude the possibility that the cross-firm wage differentials also reflect rent sharing at better paying firms (Burdett and Mortensen, 1998). In the case of mobility under frictions, Lavetti and Schmutte (2016) have recently proposed an estimation procedure to account for this, by which the estimated correlation between wages and firm dis-amenities is a lower bound of the actual compensating differentials. We may therefore interpret our findings as arguably indicative lower bounds for relevant compensating differentials from hours

[24]The correlation within 2 or 3-digit industries is less precisely estimated. This is likely due to outliers. If coordination is measured through the median absolute deviation from the median hours in fact, the coefficients are negative and strongly significant (columns 4 to 6 in Table 5).

[25]The effect is obtained by multiplying the coefficient (0.07) by the standard deviation of the firm-component of wages (0.26) that gives a 0.0156 log wage change equivalent to around 1 DKK or 0.5% of the average wages.

coordination. This interpretation is in line with other recent studies that identify compensating differentials as an important determinant of wage inequality across firms using alternative methodologies (e.g. Sorkin, 2015).

In Appendix C.3 we discuss a set of additional robustness checks to the results presented in this section including, for instance, a discussion of measurement errors in hours.

4.4.1 Coordination of hours, wages and firm productivity

A growing literature finds that the firm components of wages strongly correlates to productivity in a firm (e.g. Card et al., 2016b). In our stylized model more productive firms select into coordination and pay wage premiums. Consistent with this, conditional on measures of firm productivity, such as value added per employee, the coefficient on the standard deviation of hours goes down and becomes insignificant while value added per employee strongly and positively correlates with wage premiums (column 8 in Table 5).

To get a sense of the importance of hours coordination in explaining the wage inequality across firms that is due to productivity we use the *coordination share* described in Section 4.1. In line with the evidence provided in the previous paragraph, this measure rests on the assumption that coordination only affects wages through productivity. We estimate a coordination share of 20% across all firms (column 3 in Table 4) and of 4% within 3-digit industries (columns 3 in Table 5). This suggests that coordination predicts a non-negligible share of the variation of firm wages that is linked to productivity differentials between and within sectors, and that cannot be explained by other factors that are known to affect wages and productivity.

5 Coordination, labor supply and tax rate changes

5.1 The 2010 Danish Tax Reform

We base the analysis presented in this section on the changes to the Danish personal tax schedule mandated by the 2010 tax reform. This reform led to a substantial decrease of the marginal tax rate on labor income faced by high income earners while it left the tax rate of low income workers almost unchanged. To the extent that low and high income workers differ in desired work hours, the reform provides an ideal setting to test for spillovers and attenuating effects from coordination.

The Danish income tax system is based on different types of income that are aggregated in multiple ways to form different tax bases taxed at different rates. A detailed description of the tax system can be found in Appendix B.5. For what concerns our analysis, prior to the 2010 reform income was taxed using a three-bracket progressive tax schedule (Figure 6). As an effect of the 2010 reform the middle tax bracket was abolished while tax rates at the bottom and top bracket went down by respectively 2 and 7 percentage points between 2008 and 2011. The reform also increased the income amount at which the top bracket starts that went up by around 9% in real terms between 2008 and 2011. This led to a substantial decrease of the marginal tax rate on labor income faced by workers in the middle and top tax bracket. For them in fact, marginal tax rates went down respectively by around 16% and 10% (Figure 7). The decrease was less pronounced in the bottom bracket where the marginal tax rate went down by around 4% (more details in Appendix B.5).[26]

Based on this, from now on, we refer to low-skilled workers as the workers who were either tax exempt or in the bottom tax bracket in 2008 (left of the dashed line in Figure 8). Conversely, we define high-skilled workers as the workers who were in the middle or top tax bracket in 2008. From this group however, we exclude workers who were in the top bracket in 2008 and who, based on the 2008 real income and the tax schedule in place after the reform, are predicted to be in the bottom tax bracket in 2011. We refer to these workers as the residual group. Workers in this group had incomes just above the lower limit of the top bracket in 2008 (dotted line in Figure 8). When the reform increased this limit (solid line in Figure 8) and abolished the middle bracket, these workers ended up (mechanically) in the bottom bracket after the reform.

Relative to the high-skilled, workers in the residual group experienced a net-of-tax rate change about 3 times as large (Figure 9). As an effect of this, while for high-skilled workers the income effect prevails and hours go down as a consequence of the reform (Section 5.6.1), for workers in the residual group the substitution effect prevails and the estimated labor supply elasticity is positive but insignificant (Appendix C.4). In Appendix C.4 we argue that the

[26]The net-of-tax rate in the top, middle and bottom bracket went up respectively by 3%, 15% and 19%.

insignificant effects may be due to the fact that these workers are close, in terms of income, to the top bracket and thus unwilling to work more hours to avoid substantially higher taxes.

Since the supply of hours in the residual group is unchanged by the reform and in order to keep the empirical framework as close as possible to the stylized model, in the baseline specification we only study the spillovers from high to low-skilled workers. However, we then show that including the residual group does not affect the conclusions of the baseline analysis. Based on this classification, around 34% of the workers in our sample are low-skilled, 54% are high-skilled, the remaining 12% are in the residual category (Figure 9).[27]

5.2 The Tax Data

We base the tax analysis on records from the Danish Tax Register that collects detailed information on all the items that determine individual tax liabilities in Denmark. Marginal tax rates however, are not directly observable. For this reason we use the available tax records to simulate marginal tax rates for each worker using a simulator model of the Danish tax system. We do so by extending the tax simulator used in Kleven and Schultz (2014) to the years 2006-2011. In this simulator marginal tax rates on labor income are obtained as the increase in tax liabilities due to a rise of labor income by 100 DKK. In particular, since the tax liability T() is a function of labor income (z_{LAB}) and other income components ($z_1, ...z_N$), the marginal tax rate on labor income is derived as follows $\tau = [T(z_{LAB} + 100, z_1, ...z_N) - T(z_L, z_1, ...z_N)]/100$.

In the empirical models that we use we relate changes of labor supply to changes in marginal tax rates over 3-years intervals. In the baseline specification we focus on the interval 2008-2011. We do this to reduce the possibility that the effects measured could capture lagged effects of a prior tax reform that occurred in 2004. However, as a robustness check, we also consider the years 2006 to 2008, but we exclude the years prior to 2006 as they would be too close to the 2004 reform. Intervals of 3 years are commonly used in the taxation literature (e.g. Feldstein, 1995, Gruber and Saez, 2002). In particular, a recent study by Kleven and Schultz (2014) that analyzes the effects of a large number of tax reforms in Denmark, argues in favor of intervals of

[27] The share of workers in the low, high and residual group in the entire population is (respectively) 50%, 40% and 10%. The greater share of high-skilled workers reflects the characteristics of our sample where large firms that employ more educated workers are over-represented (Table 1).

3 years as the right compromise to account for the sluggishness of the response to tax reforms while preserving the variation and power from the tax change.[28]

5.3 The attenuating effects of coordination

We analyze the effect of the tax reform on the labor supply of high-skilled workers using the following empirical model:

$$log\left(\frac{h^H_{it+3}}{h^H_{it}}\right) = \beta_0 + \beta_1\, log\left(\frac{1-\tau^H_{it+3}}{1-\tau^H_{it}}\right) + \beta_3\, X_{ijt} + \upsilon_{ijt} \tag{10}$$

In this model the dependent variable is the log change in hours worked by high-skilled workers between 2008 and 2011. We relate this to the individual variation of the marginal net-of-tax rate on labor income (1-τ) that occurred over the same period. We control for a number of individual (i) and firm (j) characteristics X_{ij} measured in 2008 (time t). The effect of the reform is captured by β_1 that measures the elasticity of hours worked to changes of the marginal net-of-tax rate.

To test whether the response of high-skilled workers in more coordinated firms is lower than that of similar workers in less coordinated firms, we estimate this model separately on workers employed in high versus low-coordination firms. In presence of attenuating effects, the elasticity β_1 is expected to be smaller, in absolute terms, for workers in high-coordination firms.

In this specification the labor supply elasticity is inclusive of the income effect. In Appendix C.5 we make an attempt to separate the uncompensated elasticity of labor supply from the income elasticity. However, our study is based on a single tax change that mostly affected workers in the upper part of the income distribution. Therefore, unlike in other existing studies, we have limited variation in tax rates across the income distribution that is needed to separately estimate the two effects in a precise way. Despite the noisy estimates, the results in Appendix C.5 support our baseline findings.

[28]Studying changes over 3 years intervals also minimizes the concerns related to the inter-temporal shift of earnings for tax avoidance purposes that likely happened between 2009 and 2010 (Kreiner et al., 2016).

5.4 The spillover effects of a tax change

In firms that coordinate hours worked, a tax rate change that targets one type of workers can affect hours worked by other workers in the same firm (prediction 3). We test this prediction by relating the effects of a tax-driven change in hours worked by high-skilled workers to changes in the supply of hours of low-skilled coworkers. The estimating equation takes the following form:

$$log\left(\frac{h^L_{ijt+3}}{h^L_{ijt}}\right) = \alpha_0 + \alpha_1\, log\left(\frac{\overline{h^H_{jt+3}}}{\overline{h^H_{jt}}}\right) + \alpha_2\, log\left(\frac{1-\tau^L_{it+3}}{1-\tau^L_{it}}\right) + \alpha_3\, X_{ijt} + \epsilon_{ijt} \tag{11}$$

The dependent variable in this model is the log change in the number of hours worked by low-skilled worker i in firm j between 2008 and 2011. The regressor of key interest is

$$log\left(\frac{\overline{h^H_{jt+3}}}{\overline{h^H_{jt}}}\right) = log\left(\frac{H^{-1}_{jt+3}\sum_{h=1}^{H_{jt+3}} h_{hjt+3}}{H^{-1}_{jt}\sum_{h=1}^{H_{jt}} h_{hjt}}\right) \tag{12}$$

This term captures the log change in the average number of hours worked by high-skilled workers in firm j. We isolate the tax related component of this change using the average variation of the marginal net-of-tax rate on labor income among high-skilled in firm j as an instrument for the change in hours. Section 5.5 describes this instrument in details. Based on the model prediction, we expect α_1 to be positive and greater in magnitude in more coordinated firms.

The term $log\left(1-\tau^L_{it+3}/1-\tau^L_{it}\right)$ in equation (11) captures the changes of the marginal net-of-tax rate on labor income faced by low-skilled between 2008 and 2011. Since the reform lowered the marginal tax rate paid by low-skilled, this term controls for the direct effect of the reform on the supply of hours of low-skilled workers. Finally, X_{ijt} is a vector of firm and individual controls measured in 2008.

The empirical specifications that we have so far discussed differ from the standard model in the taxable income literature (e.g. Gruber and Saez, 2002) along two important dimensions. First, we estimate the effect of tax changes on hours worked rather than on labor income. In our setting in fact, a tax rate change can move hours and wage rates in opposite directions making it difficult to interpret the overall effect on labor income. Second, in equation (11) we augment the standard model with one extra term that captures the spillover effects of the tax change among coworkers. This is done to reflect a key feature of our framework where hours worked by one type of workers depend on the hours worked by the other workers in the same firm. Section A.6 in the appendix describes how to adapt the standard economic model underlying the empirical specification used in the literature to the specific features of our setting.

5.5 Identification

The identification of the effects of the reform from equation (10) and (11) needs to address multiple issues. First, due to the non-linearity of the tax schedule, the marginal tax rate in the post-reform period depends on post-reform income that is endogenous to the supply of hours. This creates a correlation between $\Delta\, log\ (1 - \tau_{it})$ and the error terms in our specifications. Second, changes of the supply of hours by high-skilled workers in equation (11) might be correlated to changes of the supply of hours worked of low-skilled coworkers in endogenous ways. This might be the case, for instance, if both types of workers experience the same unobserved local labor market shocks, local policy reforms or changes specific to a firm (e.g. firm organizational changes, changes to the technologies used in production).

To address the first set of concerns, following the literature (e.g. Gruber and Saez, 2002) we construct a set of instruments based on mechanical tax rate changes that are driven only by variations of the tax laws. In practice, for each individual in the sample we use a simulator of the Danish tax system to obtain marginal tax rates on labor income (τ_{Mit+3}) in the post-reform period (time $t + 3$) based on income in the pre-reform period (time t) adjusted for inflation. We then construct the mechanical change of the marginal net-of-tax-rate on labor income of high-skilled workers as $log\left(1 - \tau^{H}_{Mit+3}\right) - log\left(1 - \tau^{H}_{it}\right)$ and we use this as an instrument for the observed change $\Delta\, log\ \left(1 - \tau^{H}_{it}\right)$ in equation (10). Similarly, we use the mechanical change of the marginal net-of-tax rate of low-skilled workers $log\left(1 - \tau^{L}_{Mit+3}\right) - log\left(1 - \tau^{L}_{it}\right)$ as an instrument for the observed change $\Delta\, log\ \left(1 - \tau^{L}_{it}\right)$ in equation (11).

By holding real income constant between t and $t + 3$ these instruments exploit the variation of the marginal tax rates due to changes of the tax schedule only. To give a sense of the identifying variation, Figure 9 plots the average mechanical change of the marginal net-of-tax rates among high and low-skilled workers between 2008 and 2011. Due to the nature of the reform, the change is more pronounced for high-skilled (18%) than for low-skilled (2%).

While these instruments are exogenous to post-reform income they still depend on pre-reform income which is problematic if the latter correlates with the error term. The literature has focused on two main channels through which this may occur (e.g. Slemrod, 1998, Saez et al., 2012). First, the labor supply of workers at different levels of pre-reform income might follow different long term trends unrelated to the tax reform. Second, high incomes in one year tend to have lower income in the following periods and vice versa (i.e. mean reversion). This might generate a negative correlation between the error term and the instruments.

To deal with this, we follow the existing literature and we perform a set of additional regressions in which we control for pre-reform income in a flexible way. Overall however, we find that our baseline results are not affected in a noticeable way by these controls. This may be due to the fact that, unlike in most other studies, we estimate separate regressions on rather homogeneous groups of workers (i.e. low-skilled and high-skilled). Furthermore, we study a relatively short time period thus limiting the concerns related to long term trends.

Turning to the identification of the spillover effects (α_1) from equation (11), we use simulated marginal tax rates to construct the mechanical change of the average marginal net-of-tax rate on labor income faced by high-skilled workers in each firm j:

$$log\left(\frac{\overline{1-\tau^H_{Mjt+3}}}{\overline{1-\tau^H_{Mjt}}}\right) = log\left[\frac{H^{-1}_{jt+3}\sum_{h=1}^{H_{jt+3}}\left(1-\tau_{Mhjt+3}\right)}{H^{-1}_{jt}\sum_{h=1}^{H_{jt}}\left(1-\tau_{Mhjt}\right)}\right] \tag{13}$$

We then use this term as an instrument for $log\left(\overline{h^H_{jt+3}}/\overline{h^H_{jt}}\right)$ in equation (11). This instrument isolates the component of the change in hours of the high-skilled due to the tax reform from other confounding factors. Its validity hinges on the assumption that the instrument affects hours worked by low-skilled workers only through changes in the average hours of high-skilled coworkers (i.e. the exclusion restriction). This assumption may be violated if, for instance, the tax reform, while changing the supply of hours of high-skilled workers, led also to the adoption of new technologies that required a different supply of hours by low-skilled workers. In that case in fact, hours worked by low-skilled workers would vary through channels different from coordination for reasons correlated to the instrument. However, we fail to find significant effects of the reform on firm size, physical capital and the share of high relative to low-skilled workers in a firm, suggesting that firm technologies were not affected by the reform (Appendix C.6).

Finally, one general concern of the instruments that we use is that they might capture other unobserved changes that occurred between t and $t + 3$ thus confounding the estimated effect of the tax reform (e.g. other policy reforms or macroeconomic shocks). For this reason we present additional specifications in which we follow the workers from the baseline regressions back to 2006, then we estimate our baseline models on all 3-year intervals between 2006 and 2011 adding base-year fixed effects. These specifications also allow to control for unobserved characteristics specific to all firm workers by using firm fixed-effects. While these models have some advantage over the baseline, they result in weaker first stages (Section 5.6.2) and are more likely to capture lagged effects of the 2004 tax reform.

5.6 Results

5.6.1 Coordination and attenuating effects

Table 6 shows the elasticity of hours worked by high-skilled workers to the net-of-tax rate estimated from equation (10). In columns 1 to 3 we estimate the regression on all high-skilled workers in the sample while in columns 4 to 7 we differentiate between workers in high versus low-coordination firms. The base year in all the specifications is 2008. We measure the degree of coordination of each firm in the base year using the standard deviation of hours worked across skill groups described in Section 4.3. Highly coordinated firms are in the bottom half of the distribution of the standard deviation across firms, while low-coordination firms are in the top half. To attach each workers to the right measure of coordination we restrict the analysis to high-skilled who are at the same firm in 2008 and 2011.[29]

The first column in Table 6 shows the OLS estimates while all other columns are based on the IV model described in the previous section. In absence of controls for pre-reform income,

[29] Relative to the other workers in our sample, the workers we use for estimation are on average one year older, the high-skilled have lower average annual earnings (by about 2,000$). However, the workers in the two groups look similar across many other dimensions such as gender, hours worked, geographic location and education.

the elasticity from the IV model in column 2 is around -0.07. Probably due to mean reversion, the elasticity goes up to -0.05 when we control for income in 2008 (column 3). Based on this estimate, total hours of high-skilled went down by around 0.8% or about 15 hours on a yearly basis as an effect of the reform.[30]

When we break the sample between workers at firms with high (column 4) versus low (column 5) degree of coordination however, we find substantial differences between the two groups. In line with the model predictions, we estimate a statistically significant elasticity of around -0.1 in low-coordination while in high-coordination firms the elasticity is insignificant and of about -0.02. The two elasticities are statistically different at the 5% level. The difference across workers in the two types of firms is even more pronounced when we consider regular hours only (columns 6 and 7). Therefore based on these estimates, hours worked by high-skilled workers in firms with high degree of coordination were not significantly affected by the reform, while high-skilled hours in low-coordination firms went down by around 1.6%, that is 30 hours per year, 20 of which are estimated to be regular hours.[31]

The difference between the two elasticities widens as we move towards the extremes of the distribution of coordination. In fact, workers in the top 25% most coordinated firms show even lower elasticities than in the baseline. Conversely, workers in the bottom 25% least coordinated firms are more responsive than the baseline (columns 1 and 2 in Table 7). This suggests that the attenuating effects increase with the degree of hours coordination in a firm.

The differential effects in the two types of firms are not driven by unobserved characteristics of a firm or by other unobserved factors that occurred between 2008 and 2011. In fact, the results hold conditional on firm and base-year fixed effects (columns 3 to 5 of Table 7).

In agreement with the existing literature, we find an average elasticity of hours across all firms close to zero (Pencavel, 1986, Triest, 1990, Chetty, 2012). However, we document pronounced attenuating effects associated to coordination that provide a mechanism to explains

[30]-0.5% is obtained as the product of the the elasticity (-0.047) and the average log change of the net-of-tax rate between 2008 and 2011 (17%). -0.8% is then multiplied by the average number of hours worked in 2008 by the high-skilled workers in the estimating sample (i.e. 1924) to obtain the change in hours due to the reform.

[31]The average change in hours worked is derived as the product of the elasticities in low-coordination firms (i.e. -0.097 for total hours and -0.061 for regular hours), the average net-of-tax rate change (17%) and the average number of hours worked by high-skilled workers in low-coordination firms (i.e. 1914 total hours and 1858 regular hours).

the low elasticity of previous studies. Other studies that use a similar methodology and focus on labor income (rather than hours) find small and positive elasticities in Denmark (Kleven and Schultz, 2014). However, these studies consider the entire population while we focus on full-time workers in private firms for whom data on hours are available. Using a comparable sample to analyze the effects on labor income we find results that are in line with other studies (Appendix C.4).

While coordination attenuates behavioral responses, it also lowers the dead-weight burden of taxation on high-skilled. Based on our results, we can conclude that if workers in high-coordination firms were to change their supply of hours as workers in low-coordination firms do, then the marginal excess burden would be twice as large as the one estimated from the tax reform.[32]

5.6.2 Coordination and spillovers

Table 8 shows the estimated elasticity of low-skilled hours to the average hours of high-skilled coworkers obtained from equation (11). In these specifications the base year is 2008 and we focus only on low-skilled workers who are at the same firm in 2008 and 2011. Column 1 shows the OLS estimates, while columns 2 to 7 show the IV estimates. In the first 5 columns we estimate the effects on regular hours while in the last two we examine the effects on total hours.

In line with our theory, we estimate positive and significant spillovers that are robust to controls of pre-reform income (columns 3 and 4).[33] Specifically, we estimated an elasticity of regular hours of low-skilled workers to average hours of high-skilled coworkers of 0.9. This implies an increase of 0.85 hours worked by low-skilled workers for each additional hour that high-skilled coworkers provide on average. Based on this, we estimate that normal hours of low-skilled coworkers went down by around 8 hours (or 0.5%) on a yearly basis as an effect of the reform.[34] Thus, while the elasticity of low-skilled to high-skilled hours is high, the estimated

[32]The marginal excess burden (MEB) is defined as the ratio between the change in tax revenues due to behavioral responses to the tax reform and the total change in tax revenues (see also Appendix A.6.1).

[33]In column 3 to 7 we control for pre-reform income using piece-wise splines of income at $t-1$ and the log change of income between time $t-1$ and t (similar to Kopczuk, 2005). We select this specification based on the strength of the first stage. Alternative controls of pre-reform income provide similar results (Appendix C.4).

[34]The elasticity of normal hours worked by high-skilled workers across all firms is estimated to be around -0.03 (Table D.14 in the Appendix) which, at the average annual hours of 1888, implies a reduction of around

spillovers from the tax reform are relatively low, due to the fact that high-skilled hours do not change much.

The elasticity of total hours (regular and overtime) is estimated to be higher suggesting even stronger spillovers from overtime (column 6). However, the point estimate from this specification might be inflated by the low power of the instrument (F-stat of about 4).

Our framework implies stronger spillovers in firms at high degree of coordination. Ideally we would compare high and low-coordination firms. Based on the results from the previous section, however, hours worked by high-skilled in high-coordination firms were not affected by the reform. As a result, we lack the identifying variation to estimate the spillovers in these firms. Thus in column 4 and 7 of Table 8 we restrict the analysis to low-skilled workers in firms at low degree of coordination where hours of high-skilled coworkers are more elastic. Among these workers we find lower elasticities of regular and total hours than across all workers which suggests weaker spillovers in low-coordination firms.

The theory predicts stronger spillovers in firms that employ relatively more high-skilled workers. In column 1 of Table 9 we interact the average change in hours of high-skilled workers with a dummy for being in a firm in which more than half of the workers were high-skilled in 2008. Despite the imprecise estimate, the sign of the interaction is suggestive of stronger spillovers in firms with a greater share of high-skilled workers.

The significance and magnitude of the spillovers that we find is robust to the inclusion of firm and base year fixed effects capturing unobserved characteristics of a firm, or of the time period over which the reform occurred (columns 2 and 3 in Table 9). In addition, the spillovers from high-skilled workers remain of similar magnitude and significance when we control for the average change in hours among coworkers in the residual group (column 4). Consistent with the fact that hours in the residual group are unaffected by the reform, we do not find significant spillovers from this group on low-skilled coworkers (column 4).

The existence of spillovers has two main implications. First, it implies extra tax efficiency costs. Specifically, taking spillovers into account we estimate an increase in the marginal excess burden from the tax reform of around 15% (Appendix A.6.1). Second, with spillovers the

10 yearly hours worked as an effect of the reform.

use of untargeted workers as a control group to estimate the labor supply elasticity provides downwards biased estimates. This is yet another reason that may explain the low elasticity estimated by some of the existing studies (e.g. Eissa, 1995; Eissa and Hoynes, 2004; Blundell et al., 1998; Kreiner et al., 2016).

Recent studies find evidence of excess mass in the distribution of taxable income at kinks of the tax schedule (bunching) among a minority of workers who do not face these kinks (Chetty et al., 2011, Best, 2014). This is interpreted as evidence that firms and unions offer bundles of hours and wages that reflect the preferences of the majority of workers. Differently from existing studies, we use new firm-level data on hours and the variation deriving from an actual tax rate change. Leveraging on these aspects we are able to bring new evidence on coordination as a firm-level mechanism through which changes in preferences over hours spillover to other coworkers. Furthermore, the effects that we find go beyond bunching and can be shown to affect a larger share of workers. In fact, excluding taxpayers close to the major kinks of the Danish tax schedule, the spillovers remain significant and of similar magnitude suggesting that most of the action that we find is among workers who do not bunch (column 5 of Table 9).

In Appendix C.4 we check the robustness of the baseline specifications to flexible controls of pre-reform income. Overall we find that the effects are not extremely sensitive to these controls. In addition, in the appendix we present a set of additional results and robustness checks that include the estimation of attenuating and spillover effects based on an alternative database on hours worked, the use of other measures of coordination and the estimation of specifications that separate the uncompensated elasticity from the income elasticity (Appendix C.5).

6 Conclusions

This paper explores how the coordination of hours affects the firm-component of wages. Our findings indicate that coordination strongly correlates with wage differentials across firms. Moving forward, future work might investigate how coordination is associated to other dimensions that are linked to firm wage inequality such as, for instance, the gender gap (Card et al., 2016a).

We also find attenuated responses to tax changes in high-coordination firms and spillovers on the supply of hours of coworkers not targeted by a tax reform. These suggest that the labor supply elasticity of the workers directly targeted by a tax reform captures only a part of the efficiency costs of a tax change. Therefore, future research and policy evaluations should take these effects into account when assessing the excess burden associated to a tax reform.

Finally, the implications of our results go beyond tax reforms and apply to any policy intervention that affects the preferences over hours of one group of workers in a firm. For instance, policies that target the supply of hours of older workers might indirectly affect the supply of hours of younger coworkers. Similarly, policies that directly affect workers with children may have spillovers on other coworkers. It would be interesting to evaluate, in these other settings, the effects of coordination of hours among workers with similar skills and incomes.

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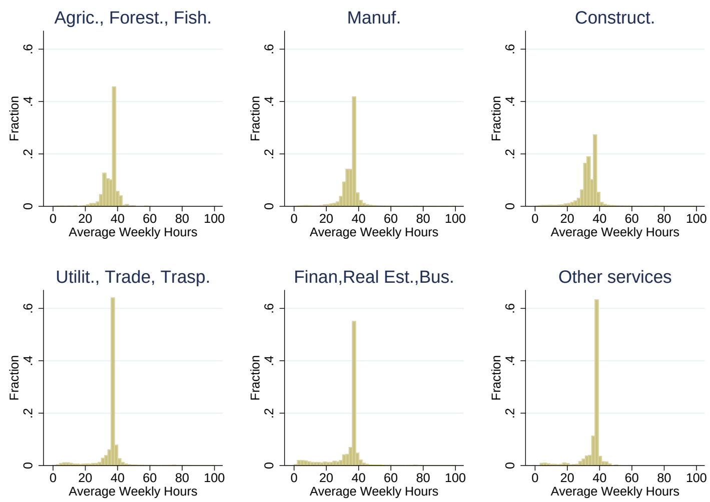
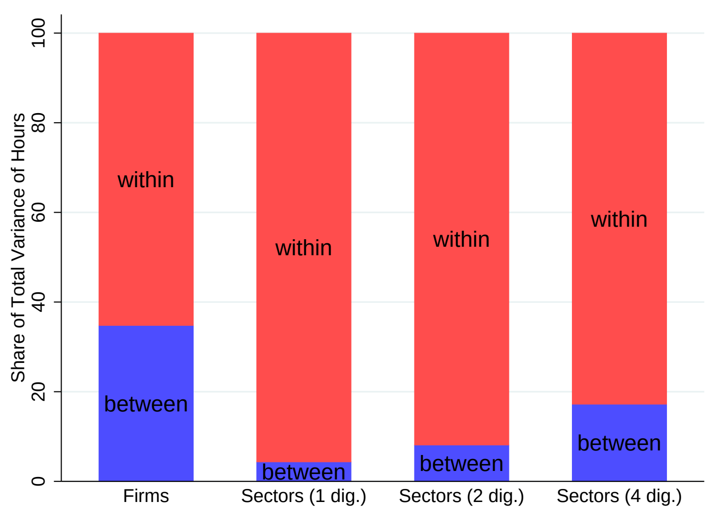
Figures and Tables

Figure 1: The distribution of hours across sectors in Denmark



Notes: The figure shows histograms of weekly total (regular and overtime) hours worked in the six major sectors in Denmark over the years 2003-2011. Weekly hours are obtained dividing annualized hours by 52. Observations are grouped in bins of 2 hours. Figures are based on a total of 875,078 individual-year observations that include fulltime and part-time workers in firms where hours are available on least 95% of the workforce. From the top left to the bottom right we have the following sectors: Agriculture, forestry, fishing, mining and quarrying; Manufacturing; Construction; Utilities, trade and transport; Financial, insurance, real estate and other businesses; Other services.

Figure 2: Variance of hours decomposition: between and within component



Notes: The figure shows the decomposition of the variance of hours worked in between and within components (footnote 8). We consider total annualized hours (including overtime) of fulltime workers. The figure is based on the 787,683 individual-year observations in our final sample (Table 1). The first bar shows the decomposition in between and within firm components. The second, third and fourth bar show respectively the within-between decomposition for 1, 2 and 4-digit sector. Industries are defined using the classification NACE rev. 2.

Figure 3: Wage rates and hours worked

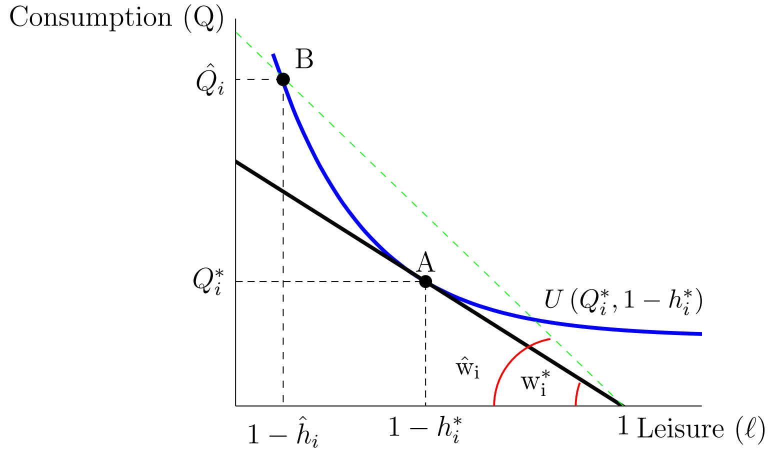
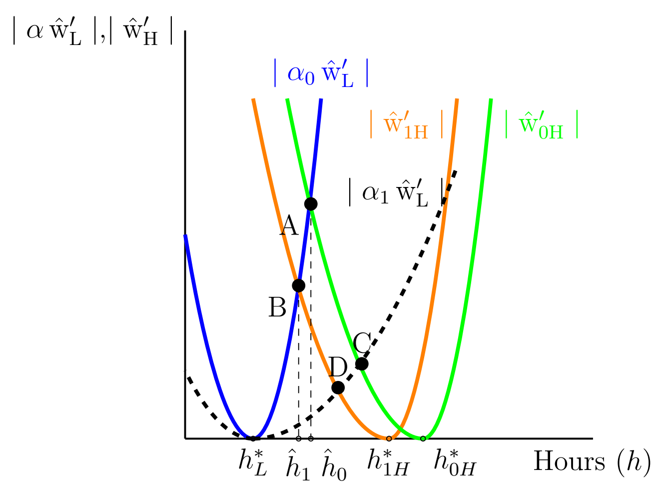
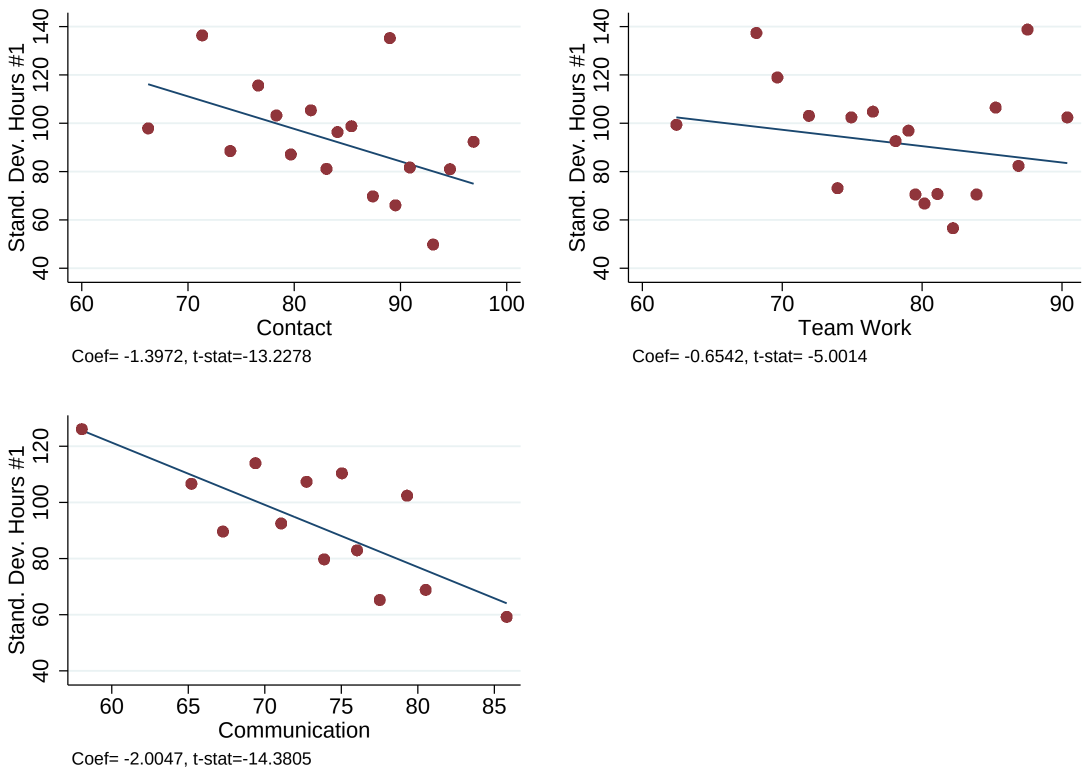


Figure 4: The effects of a tax rate change on wages



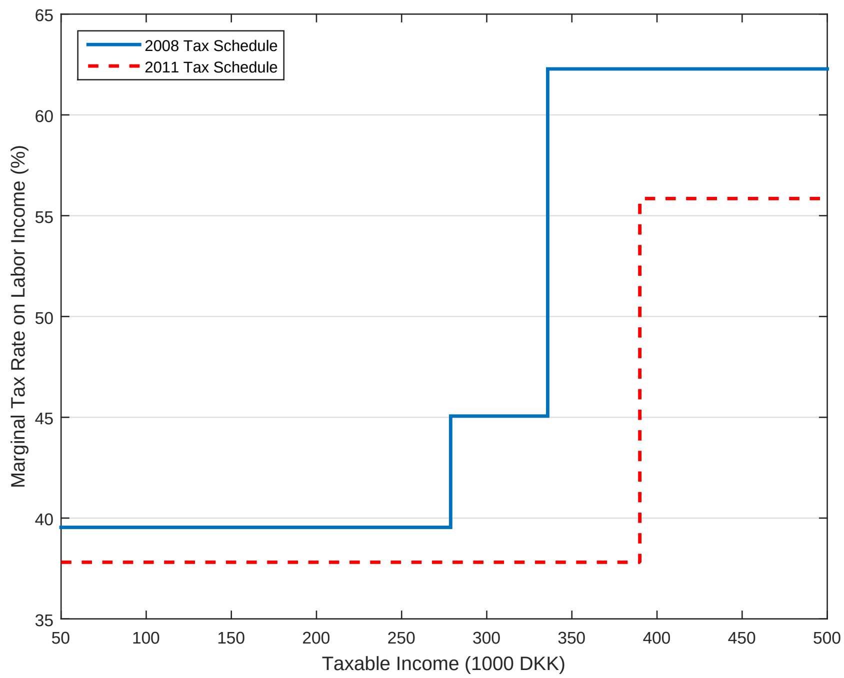
Notes: The figure shows on the y-axis the absolute value of the first derivative of the wage hours function in coordinated firms for high-skilled ($\hat{\mathrm{w}}'_{\mathrm{H}}$) and low-skilled workers ($\hat{\mathrm{w}}'_{\mathrm{L}}$). $\alpha = \hat{n}_L \div \hat{n}_H$ is the ratio between the number of low and high-skilled workers in coordinated firms. At the optimum $\hat{\mathrm{w}}'_{\mathrm{H}} + \alpha \hat{\mathrm{w}}'_{\mathrm{L}} = 0$. Therefore we plot the absolute value of $\hat{\mathrm{w}}'_{\mathrm{H}}$ and $\hat{\mathrm{w}}'_{\mathrm{L}}$ to have them on the same quadrant. The shift from point A to B represent the change in optimal hours and wage rates in coordinated firms when the tax rate goes down and the income effect prevails so that desired hours of high-skilled move down from h_{0H}^* to h_{1H}^*. The shift from C to D represents the change in wages and hours in coordinated firms obtained from the same change in desired hours of high-skilled from h_{0H}^* to h_{1H}^* assuming a lower α ($\alpha_1 < \alpha_0$).

Figure 5: Validation: Standard Deviation of Hours vs Coordination in O*NET



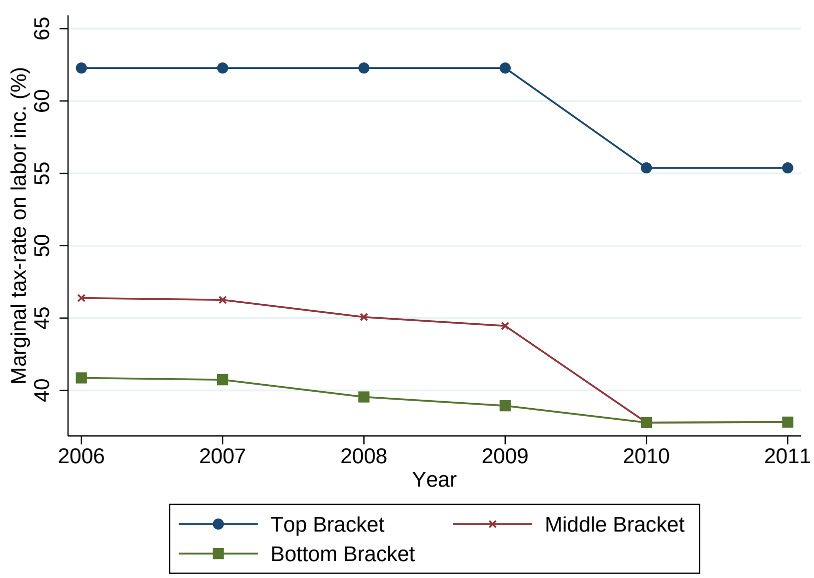
Notes: The figure shows on the y-axis the standard deviation of hours across skill groups within firms (Section 4.3) and on the x-axis 3 measures of firm-level coordination based on O*Net: Contact, Team Work and Communication. These variables are measured on a scale of importance from 0 to 100. For each firm we take the median importance of Contact, Team Work and Communication across workers. Firms are grouped into 20 bins each one containing the same number of firms. We plot mean values within each bin. At the bottom of each graph we show the coefficient and the associated t-stat from a regression of the y on the x variable.

Figure 6: The Danish Tax Schedule



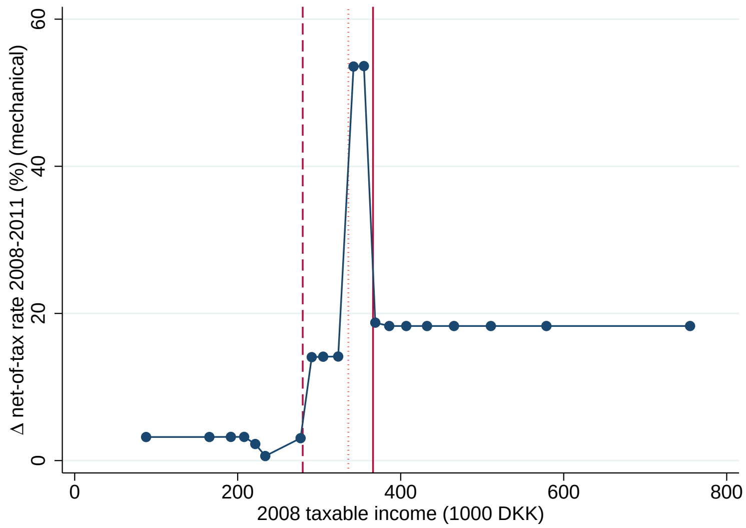
Notes: The figure plots the marginal tax rate on labor income over taxable income in 1000 DKK (1 DKK $\simeq$ 5 USD). Taxable income is in nominal terms. The solid line plots the tax schedule prior to the tax reform (2008). The dashed line plots the tax schedule after the tax reform (2011). The figure is based on Table D.13. Marginal tax rates on labor income in the bottom and middle bracket are obtained as: Statutory Marginal Tax rate * (1-Labor Market contribution) +Labor Market contribution - EITC; in the top bracket they are obtained as Marginal Tax Ceiling*(1-Labor Market contribution) +Labor Market contribution.

Figure 7: The evolution of the marginal tax rate on labor income



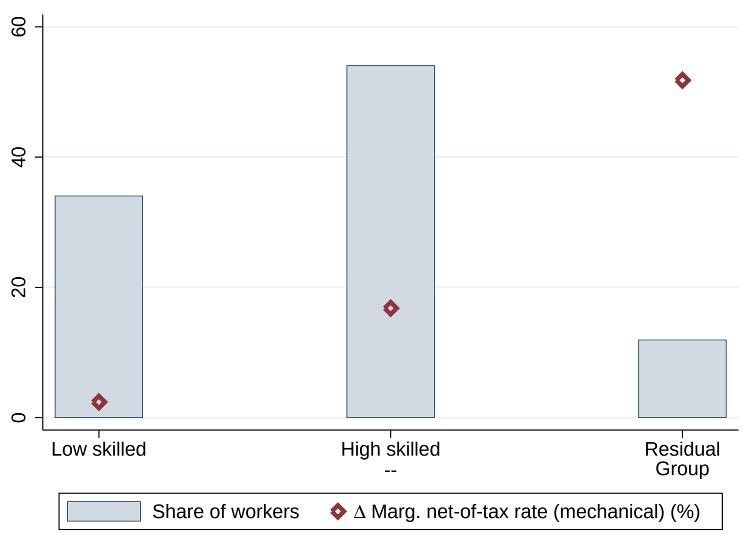
Notes: The figure shows the evolution of the marginal tax rate on labor income between 2006 and 2011. The figure is based on Table D.13. Marginal tax rates on labor income in the bottom and middle bracket are obtained as: Statutory Marginal Tax rate * (1-Labor Market contribution) +Labor Market contribution - EITC; in the top bracket they are obtained as Marginal Tax Ceiling*(1-Labor Market contribution) +Labor Market contribution.

Figure 8: Mechanical marginal net-of-tax rate change across taxable income



Notes: This figure plots the mechanical change in marginal net-of-tax rates on labor income between 2008 and 2011 over 2008 taxable income for each individual who is in our sample in 2008 and 2011. Taxable income is expressed in 1000 DKK (1 DKK $\simeq$ 5 USD). Mechanical marginal tax rates in 2011 are based on 2008 income adjusted by inflation. Each bin contains the same number of workers. The graph plots within beans median values. The dashed line delimits the bottom tax bracket in 2008 (279,800 DKK). The dotted line is the low boundary of the top tax bracket in 2008 (335,800 DKK, see Table D.13). The solid line is the low boundary of the top tax bracket in 2011 expressed in 2008 DKK (nominal 389,900 DKK discounted by 1.06 CPI, see Table D.13).

Figure 9: Average (mechanical) marginal net-of-tax rate change across groups



Notes: This figure plots the share of workers in each skill group and the average mechanical change in marginal net-of-tax rates on labor income between 2008 and 2011 in each group. Mechanical marginal tax rates in 2011 are based on 2008 income adjusted by inflation. Low-skilled are defined as tax exempt or in the bottom tax bracket in 2008. Workers in the residual group were in the top tax bracket in 2008 and,based on their 2008 income adjusted by inflation, are predicted to be in the bottom tax bracket in 2011. High-skilled are all workers who are neither in the residual group nor low-skilled.

Table 1: Descriptive Statistics

	IDA Sample		IDA -Firmstat-LON sample		Final sample	
	(1)	(1)	(2)	(2)	(3)	(3)
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Workers Characteristics						
Mean Age	39.82	12.87	41.11	11.09	42.05	10.91
Fraction < 30 years old	0.27	0.44	0.19	0.39	0.16	0.37
Fraction > 50 years old	0.27	0.44	0.25	0.43	0.27	0.45
Fraction Males	0.50	0.50	0.66	0.47	0.70	0.46
Fraction Unionized	0.70	0.46	0.73	0.44	0.77	0.15
Fraction Hourly	0.17	0.37	0.24	0.42	0.28	0.45
Fraction Primary Educ.	0.33	0.47	0.28	0.45	0.29	0.45
Fraction Secondary Educ.	0.40	0.49	0.52	0.50	0.51	0.50
Fraction Tertiary Educ.	0.27	0.43	0.20	0.39	0.20	0.39
Hourly wage (in DKK)			187.07	141.14	183.65	124.37
Annual Labor Income (in 1000 DKK)	267.00	448.30	357.93	288.35	349.36	248.68
Total Annual Hours			1907.99	213.01	1896.19	197.24
Overtime Annual Hours			27.82	95.55	27.62	87.60
Workers by sector (% of total)						
Agriculture, forestry and fishing, mining and quarrying	2.52		0.37	6.05	0.16	4.00
Manufacturing	26.60		32.48	46.83	35.73	47.92
Construction	10.35		8.67	28.15	9.43	29.23
Electricity, gas, steam and air conditioning supply, Trade and transport	30.14		43.46	49.57	40.82	49.15
Financial and insurance, Real estate, Other business	22.95		14.82	35.53	13.71	34.39
Other services	7.44		0.2	4.46	0.15	3.92
Firms Characteristics						
Mean Firm Size			51.42	328.24	43.37	302.3649
Mean Capital per employee (1000 DKK)			423.49	7339.72	963.66	43505.13
Mean Value Added per employee (1000 DKK)			436.30	3040.25	504.30	1773.43
Mean Revenues per employee (1000 DKK)			1687.35	6511.18	2132.89	8693.84
Exporters (%)			39.40	48.86	39.96	48.98
Number of observations	22,379,298		4,466,676		787,683	
Number of individuals	3,518,236		1,205,301		400,653	
Number of firms	266,196		25,249		8,369	

Notes: The table shows the mean and the standard deviations for a set of variables on 3 groups of employees. In all 3 groups we only consider workers who are between 15 and 65 years old in the years 2003-2011. The "IDA Sample" refers to the entire Danish population. The "IDA-Firmstat-LON" sample refers to the sample of workers in IDA that can be matched to Firmstat and LON. The "Final sample" is composed of all the workers from IDA-Firmstat-LON who are employed in firms in which information on hours is available for at least 95% of the workforce. Data on employment by industry for the entire population are from Statistikbanken (Statistics Denmark) that does not provide standard errors around mean values. Annual and hourly earnings, value added, capital and sales are expressed in Danish Kroner (DKK) and deflated using the CPI index with base year 2000 (1 DKK ≃ 8 USD in 2000).

Table 2: Coordination and Firm Characteristics

	Stand. Dev. Of Total Hours		Obs.
	(1)	(2)	
V.A. /employee	-0.038***	-0.013**	17807
	(0.008)	(0.006)	
Capital/employee	-0.006	-0.005***	17807
	(0.007)	(0.001)	
Sales/employee	-0.040***	-0.014	17807
	(0.007)	(0.009)	
TFP	-0.133***	-0.080***	16212
	(0.008)	(0.012)	
Firm size	-0.032***	-0.095***	17807
	(0.007)	(0.021)	
Share of tertiary educ.	-0.178***	-0.080***	17807
	(0.007)	(0.013)	
Exporter status	-0.141***	-0.005	17807
	(0.007)	(0.009)	
Fraction of hourly work.	0.337***	0.257***	17807
	(0.007)	(0.016)	
Fraction of Unionized work.	0.084***	0.017	17807
	(0.008)	(0.012)	
Fraction of Females	-0.035***	0.035**	17807
	(0.008)	(0.015)	
Fraction of Part-Time work	0.225***	0.120***	17807
	(0.008)	(0.014)	
Mean Managerial Ability	-0.069***	-0.019*	16420
	(0.008)	(0.012)	
Negotiation	-0.310***	-0.146***	13441
	(0.009)	(0.016)	
Persuasion	-0.313***	-0.153***	13441
	(0.009)	(0.016)	
Social Perceptiveness	-0.289***	-0.116***	13441
	(0.009)	(0.015)	
Adjust Actions to others	-0.160***	-0.077***	13441
	(0.009)	(0.013)	
			13441
5 digits industry f.e.	NO	YES	

*Notes: The table shows standardized coefficients from a regression of the standard deviation of hours across skill groups (Section 4.3) on firm characteristics. Each cell in the table corresponds to a different regression. In column 2 we add 5-digit industry fixed effects to the baseline classification. We use the Danish industry classification DB07 that for the first 4-digit corresponds to NACE rev.2. Regressions are based on firm-year observations from the firms in our final sample (Table 1) over the years 2003-2011. (Cap/empl) stands for physical capital over number of full-time equivalent employees. TFP (Total Factor Productivity) is obtained following Ackerberg et al. (2015) (Appendix B.4). To avoid confusion we label the O*NET descriptor "Coordination" as "Adjust Actions to Others". Standard errors in parentheses are clustered at the firm level. * p<0.10, ** p<0.05, *** p<0.01.*

Table 3: Coordination by sector

	Stand. Dev. Of Total Hours		Unionization rate
Coordination by Industry (2003-2011)			
	Mean	Std. Dev.	
Agriculture, forestry and fishing, mining and quarrying	118.69	90.47	0.71
Manufacturing	104.08	86.92	0.77
Constructions	140.70	104.12	0.72
Utilities,Trade and Transport	76.04	88.49	0.64
Financial and insurance, Real estate, Other business services	84.72	84.09	0.63
Other services	65.20	57.37	0.71
Overall sectors	95.59	94.00	0.68
Observations	8182		

Notes: The first 2 columns of the table show the mean and standard deviation of the standard deviation of hours across skill groups (Section 4.3) in each of the 6 major sectors of the Danish economy. The last column shows the average share of workers unionized in each sector. For each firm in the sample (8182 total) and in each year (2003-2011) we compute the share of workers unionized and the standard deviation of hours across skill groups within that firm-year. Then we take the average (and standard deviations) within each sector.

Table 4: Coordination and wage premiums

	(1) Firm f.e.	(2) Firm f.e.	(3) Firm f.e.	(4) Firm f.e.	(5) Firm f.e.	(6) Firm f.e.
Stand. Dev.	-0.075***	-0.053***	-0.066***	-0.090***		-0.041**
	(0.016)	(0.016)	(0.018)	(0.018)		(0.015)
Stand. Dev. Normal Hours					-0.070***	
					(0.016)	
Firm size		0.014*	0.010	0.033***	0.010	0.011
		(0.007)	(0.007)	(0.010)	(0.007)	(0.007)
Exporter status		0.061***	0.059***	0.054**	0.059***	0.049***
		(0.015)	(0.016)	(0.021)	(0.016)	(0.013)
Union. Rate		-0.002	0.031	0.035	0.030	0.062**
		(0.027)	(0.024)	(0.031)	(0.024)	(0.027)
Female Share		-0.055	-0.109**	-0.126***	-0.106**	-0.086***
		(0.045)	(0.043)	(0.041)	(0.043)	(0.022)
Average Hours		0.004	0.004	0.015	0.004	-0.041
		(0.025)	(0.026)	(0.024)	(0.025)	(0.028)
log(Cap/empl)		0.039***	0.024*	0.049***	0.024*	0.032***
		(0.012)	(0.013)	(0.014)	(0.013)	(0.012)
Negotiation						0.348***
						(0.105)
Persuasion						-0.259***
						(0.093)
Social Perceptiveness						0.008
						(0.036)
Adjust Actions to others						0.017
						(0.017)
Region F.E.	NO	YES	YES	YES	YES	YES
Compos. cntr	NO	NO	YES	YES	YES	YES
Ability Measures	NO	NO	YES	YES	YES	YES
Av. Hours b/w 36.5 and 37.5	YES	YES	YES	NO	YES	YES
Part. R-sq SD Hours	0.008	0.003	0.006	0.008	0.007	0.002
Part. R-sq VA and TFP	0.022	0.010	0.032	0.038	0.032	0.020
Coordination Share	0.349	0.321	0.200	0.196	0.233	0.097
R-sq	0.008	0.033	0.106	0.126	0.108	0.135
N	7312	7312	7312	4415	7299	6089

*Notes: In this table we show the results of estimating equation (7). The dependent variable is the firm fixed effect from the AKM model (8). Hours coordination is measured using the standard deviation of the average total (regular and overtime) hours worked across skill groups within a firm (labelled as "Stand. Dev.", see also Section 4.3). The "Stand. Dev. Normal hours" is the standard deviation of the average regular hours worked across skill groups within a firm. Skill groups are defined as deciles of the distribution of $\alpha_i + \beta X_{ijt}$ from the AKM model (8). All regressions show standardized coefficients. The exporter dummy is defined as the modal exporter status between 2003 and 2011. (Cap/empl) stands for physical capital over number of full-time equivalent employees. "Compos. cntr" refers to a vector of controls for the share of workers in each skill group. "Ability Measures" indicate a vector containing the average value of the individual fixed effects α_i in each quartile of the distribution of α_i within a firm. The dependent variable (firm f.e.) in column (5) is based wage rates from regular hours only. To avoid confusion we label the O*NET descriptor "Coordination" as "Adjust Actions to Others". Coordination Share is derived as the ratio of "Part. R-sq SD Hours" and "Part. R-sq VA and TFP" (Section 4.1). "Part. R-sq VA and TFP" is from Table D.10. Standard errors are clustered at the 2-digit industry level. *, ** and *** are 10, 5 and 1 percent significance levels.*

Table 5: Coordination and wage differentials within sectors

	(1) Firm f.e.	(2) Firm f.e.	(3) Firm f.e.	(4) Firm f.e.	(5) Firm f.e.	(6) Firm f.e.	(7) Firm f.e.	(8) Firm f.e.
Stand. Dev.	-0.060***	-0.031*	-0.028*				-0.064***	-0.018
	(0.018)	(0.016)	(0.016)				(0.019)	(0.017)
Median Abs. Dev.				-0.075***	-0.045***	-0.040**		
				(0.014)	(0.014)	(0.015)		
Firm size	0.009	0.006	0.017*	0.010	0.006	0.018*	0.011	0.010*
	(0.006)	(0.005)	(0.009)	(0.007)	(0.005)	(0.009)	(0.008)	(0.005)
Exporter status	0.065***	0.030**	0.021	0.062***	0.029**	0.020	0.063***	0.032**
	(0.018)	(0.013)	(0.013)	(0.018)	(0.013)	(0.013)	(0.015)	(0.014)
Union. Rate	0.040	0.039	0.039	0.042	0.040	0.040	0.032	0.051**
	(0.025)	(0.029)	(0.030)	(0.025)	(0.029)	(0.030)	(0.024)	(0.022)
Female Share	-0.140***	-0.069**	-0.057*	-0.140***	-0.069**	-0.057*	-0.113***	-0.120***
	(0.040)	(0.027)	(0.029)	(0.038)	(0.026)	(0.028)	(0.042)	(0.034)
Average Hours	-0.006	-0.033	-0.039*	-0.018	-0.038*	-0.043**	0.001	-0.034
	(0.022)	(0.023)	(0.023)	(0.021)	(0.021)	(0.021)	(0.026)	(0.022)
log(Cap/empl)	0.028**	0.031***	0.035***	0.028**	0.030***	0.035***	0.022*	-0.089***
	(0.013)	(0.010)	(0.010)	(0.013)	(0.010)	(0.010)	(0.013)	(0.023)
log(VA/empl)								0.381***
								(0.070)
1 digit Sector f.e.	YES	NO	NO	YES	NO	NO	NO	NO
2 digits Sector f.e.	NO	YES	NO	NO	YES	NO	YES	YES
3 digits Sector f.e.	NO	NO	YES	NO	NO	YES	YES	YES
Part. R-sq SD Hours	0.004	0.001	0.001	0.006	0.002	0.001	0.009	
Part. R-sq VA and TFP	0.033	0.016	0.014	0.033	0.016	0.014		
Coordination Share	0.113	0.049	0.042	0.181	0.113	0.095		
R-sq	0.113	0.155	0.162	0.115	0.156	0.162	0.112	0.104
N	7306	7306	7306	7306	7306	7306	7060	7060

Notes: In this table we show the results of estimating equation (7). The dependent variable is the firm fixed effect from the AKM model (8). "Stand. Dev." in the table is the standard deviation of the average total (regular and overtime) hours worked across skill groups within a firm (Section 4.3). The "Median Abs. Dev." is the the median absolute deviation of median hours across skill groups within a firm. Skill groups are defined as deciles of the distribution of $\alpha_i + \beta X_{ijt}$ *from the AKM model (8). All regressions show standardized coefficients. The exporter dummy is defined as the modal exporter status between 2003 and 2011. (Cap/empl) stands for physical capital over number of full-time equivalent employees. "Compos. cntr" refers to a vector of controls for the share of workers in each skill group. "Ability Measures" indicate a vector containing the average value of the individual fixed effects* α_i *in each quartile of the distribution of* α_i *within a firm. In column (8) TFP is used as an instrument for valued added per employee (log(V.A./empl)). TFP is obtained as in Ackerberg et al. (2015) (Appendix B.4). Coordination Share is derived as the ratio of "Part. R-sq SD Hours" and "Part. R-sq VA and TFP" (Section 4.1). "Part. R-sq VA and TFP" is from Table D.11. Standard errors are clustered at the 2-digit industry level. *, ** and *** are 10, 5 and 1 percent significance levels.*

Table 6: The elasticity of hours of high-skilled workers

	(1)	(2)	(3)	(4) High Coord.	(5) Low Coord.	(6) High Coord.	(7) Low Coord.
Dependent Variable	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$
$\Delta log\,(1-\tau^H)$	-0.067***	-0.069***	-0.047***	-0.017	-0.097***	-0.008	-0.062**
	(0.008)	(0.018)	(0.014)	(0.016)	(0.025)	(0.013)	(0.025)
Log base-year income			-0.008***	-0.002	-0.023***	-0.002*	-0.022***
			(0.003)	(0.003)	(0.006)	(0.001)	(0.006)
IV	NO	YES	YES	YES	YES	YES	YES
Overtime Hours	YES	YES	YES	YES	YES	NO	NO
Mean Hours	1924.47	1924.47	1924.47	1928.33	1914.91	1900.34	1858.41
Pvalue High=Low				0.01		0.06	
F-stat Excl. Inst.		1355.19	754.51	1293.74	192.94	1293.74	192.94
P-value Excl. Inst.		0.00	0.00	0.00	0.00	0.00	0.00
N Firms	1167	1167	1167	584	583	584	583
N	26488	26488	26488	18875	7613	18875	7613

Notes: This table reports the results from estimating equation (10). It shows the elasticity of high-skilled hours to the net-of-tax rate (1-τ^H). In columns 4 to 7 we distinguish between high and low-coordination firms. High-coordination firms are in the bottom half of the distribution of the standard deviation of hours across skill groups in 2008, and conversely low-coordination firms are in the top half. Specifications in columns 2 to 7 use mechanical changes of the net-of-tax rate on labor income as an instrument for observed changes of 1-τ^H (Section 5.5). First Stage Regressions in Table D.22. Each regression contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects, firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). "P-value High=Low" refers to the p-value of the null hypothesis that the coefficient attached to $\Delta log\,(1-\tau^H)$ in low and high-coordination firms is equal. We only consider high-skilled workers who are at the same firm between 2008 and 2011, and in firms that employ at least 1 low-skilled worker. We estimate this regression on 3 years changes between 2008 and 2011. Observations are weighted by labor income. Standard errors in parentheses are clustered at the firm level. $p<0.10$, ** $p<0.05$, *** $p<0.01$.*

Table 7: Elasticity of high-skilled hours: additional specifications

	(1) High Coord. Top 25%	(2) Low Coord. Bottom 25%	(3) High Coord.	(4) Low Coord.	(5) High Coord.	(6) Low Coord.
Dependent Variable	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$
$\Delta log\,(1-\tau^H)$	0.003	-0.147***	-0.027	-0.075***	-0.011	-0.050*
	(0.018)	(0.055)	(0.017)	(0.026)	(0.014)	(0.027)
Log base-year income	-0.001	-0.038*	-0.006*	-0.019***	-0.003	-0.016***
	(0.003)	(0.022)	(0.004)	(0.004)	(0.002)	(0.004)
Overtime hours	NO	NO	YES	YES	NO	NO
Firm F.E.	NO	NO	YES	YES	YES	YES
Base-year F.E.	NO	NO	YES	YES	YES	YES
Mean Hours	1917.40	1870.33	1935.47	1922.85	1901.60	1864.17
Pvalue High=Low	0.01		0.02		0.06	
F-stat Excl. Inst.	566.19	133.53	1542.40	353.25	1542.40	353.25
P-value Excl. Inst.	0.00	0.00	0.00	0.00	0.00	0.00
N Firms	293	291	785	675	785	675
N	8307	2371	26497	10267	26497	10267

*Notes: This table reports the results from estimating equation (10). It shows the elasticity of high-skilled hours to the net-of-tax rate (1-τ^H). In columns 1 and 2 we only consider respectively firms in the bottom 25% and top 25% of the distribution of the standard deviation of hours across skill groups in 2008. In the other columns we distinguish between high and low-coordination firms based on whether the firm in respectively in the bottom or top half of the distribution of the standard deviation of hours across skill groups in 2008. All specifications use mechanical changes of the net-of-tax rate on labor income as an instrument for observed changes of 1-τ^H (Section 5.5). First Stage Regressions are in Table D.23. Each regression contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects, firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). "P-value High=Low" refers to the p-value of the null hypothesis that the coefficient attached to $\Delta log\,(1-\tau^H)$ in low and high-coordination firms is equal. We only consider high-skilled workers who are at the same firm between 2008 and 2011, and in firms that employ at least 1 low-skilled worker. In column 1 and 2 we consider 3 years changes between 2008 and 2011. In columns 3 to 6 we consider 3 years changes over the period 2006-2011. Observations are weighted by labor income. Standard errors in parentheses are clustered at the firm level. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.*

Table 8: The spillover effects on hours worked by low-skilled

	(1)	(2)	(3)	(4)	(5) Low Coord.	(6)	(7) Low Coord.
Dependent Variable	$\Delta log\, h^L$	$\Delta log\, h^L$	$\Delta log\, h^L$	$\Delta log\, h^L$	$\Delta log\, h^L$	$\Delta log\, h^L$	$\Delta log\, h^L$
$\Delta log\, \overline{h^H_{normal}}$	0.540***	0.899***	0.878***	0.894**	0.624**		
	(0.112)	(0.304)	(0.301)	(0.373)	(0.297)		
$\Delta log\, \overline{h^H_{total}}$						1.375**	0.706**
						(0.612)	(0.345)
$\Delta log\,(1-\tau^L)$	-0.005	0.023	0.051	0.053	-0.060	0.056	-0.053
	(0.009)	(0.088)	(0.114)	(0.126)	(0.115)	(0.138)	(0.115)
IV	NO	YES	YES	YES	YES	YES	YES
Region F.E.	YES	YES	YES	YES	YES	YES	YES
Splines of log t-1 Inc. and Δlog inc. t-1-t	NO	NO	YES	YES	YES	YES	YES
Log Mean Inc. High Sk.	NO	NO	NO	YES	NO	NO	NO
Overtime Hours	NO	NO	NO	NO	NO	YES	YES
F-stat Excl. Inst.		13.09, 160.40	15.45,76.76	4.66, 55.84	11.90, 48.55	4.43, 76.72	8.39, 50.92
P-value Excl. Inst.		0.00, 0.00	0.00, 0.00	0.03,0.00	0.00, 0.00	0.04, 0.00	0.00, 0.00
Mean Hours Low Sk.	1812.51	1812.51	1812.51	1812.51	1742.05	1828.87	1760.74
Mean Hours High Sk.	1875.00	1875.00	1875.00	1875.00	1846.56	1905.60	1879.90
N Firms	968	968	968	968	484	968	484
N	10091	10091	10091	10091	4100	10091	4100

Notes: This table reports the results from estimating equation (11). It shows the elasticity of low-skilled hours to the average hours worked by high-skilled coworkers. We consider both regular (normal) hours (columns 1 to 5) and total (regular and overtime) hours (columns 6 and 7). Specifications in columns 2 to 7 use mechanical changes of the average net-of-tax rate among high-skilled in a firm as an instrument for the average change in hours, and the mechanical change of the net-of-tax rate of low-skilled as an instrument for observed changes of 1-τ^L (Section 5.5). First Stage results are in Table D.24. Low-coordination firms (columns 5 and 7) are defined as being in the top half of the distribution of the standard deviation of hours across skill groups in 2008. Each regression contains the following controls measured in the base year: work experience,work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects, firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). "Splines" refer to a flexible piecewise linear functional form with 5 components. We only consider low-skilled workers who are at the same firm between 2008 and 2011. We estimate this regression on 3 years changes between 2008 and 2011. Observations are weighted by labor income. Standard errors in parentheses are clustered at the firm level. $p<0.10$, ** $p<0.05$, *** $p<0.01$.*

Table 9: The spillover effects on low-skilled hours: additional specifications

	(1) $\Delta log\, h^L$	(2) $\Delta log\, h^L$	(3) $\Delta log\, h^L$	(4) $\Delta log\, h^L$	(5) $\Delta log\, h^L$
$\Delta log\, \overline{h}^H_{normal}$	0.958	0.888***		0.983**	0.893***
	(0.997)	(0.333)		(0.445)	(0.303)
$\Delta log\, \overline{h^H}$ × (Share High Sk.>50)	0.083				
	(1.126)				
$\Delta log\, \overline{h}^H_{total}$			1.217**		
			(0.576)		
$\Delta log\, \overline{h}^{Residual}_{normal}$				-0.179	
				(0.567)	
Share High Sk.>50	-0.005				
	(0.009)				
$\Delta log\, (1-\tau^L)$	0.020	0.163*	0.151	0.026	0.064
	(0.115)	(0.088)	(0.094)	(0.069)	(0.116)
Overtime hours	NO	NO	YES	NO	NO
Firm f.e.	NO	YES	YES	NO	NO
Base-year f.e.	NO	YES	YES	NO	NO
Workers at kinks	YES	YES	YES	YES	NO
Mean Hours Low Sk.	1813.05	1815.25	1833.23	1811.60	1811.95
Mean Hours High Sk.	1875.14	1873.63	1906.57	1877.83	1874.93
F-stat Excl. Inst.	1.20,71.31,37.34	6.23, 24.55	2.45, 25.57	122.94, 12.16, 4.41	13.97, 77.48
P-value Excl. Inst.	0.27,0.00,0.00	0.01, 0.00	0.12, 0.00	0.00, 0.00, 0.04	0.00,0.00
N Firms	977	835	835	799	958
N	10196	15985	15985	9606	9979

Notes: This table reports the results from estimating variants of equation (11). We consider both regular (normal) hours (columns 1, 2, 4 and 5) and total hours (column 3). In column 1 we interact the average change of high-skilled regular hours with a dummy if a firm has a share of high-skilled greater than 50% in 2008. All specifications use mechanical changes of the average net-of-tax rate among high-skilled in a firm as an instrument for the average change in hours, and the mechanical change of the net-of-tax rate of low-skilled as an instrument for observed changes of 1-τ^L (Section 5.5). First Stage results are in Table D.25 and Table D.26. In column 4 we also consider change in average hours among workers in the residual group within the same firm. We instrument for the average change in hours in this group using the average mechanical change of the net-of-tax rate among workers in the residual group. Each regression contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects, firm size, exporter status, share of high and low-skilled workers in the firm and 5 components splines of income at t-1 and income change between t-1 and t. Workers close to the kink points (column 5) are defined as having taxable income within 5,000 DKK of the top kink or 2,000 DKK of the bottom kink (Kleven and Schultz, 2014). In evaluating the closeness of workers to kinks, base year income is measured in 2005 DKK (1DKK $\simeq$ 6 USD in 2005). Observations are weighted by labor income. Standard errors in parentheses are clustered at the firm level. $p<0.10$, ** $p<0.05$, *** $p<0.01$.*

Online Appendix to:
Coordination of Hours within the Firm

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Abstract

Teamwork has become increasingly important in many firms, yet little is known about how coordination of hours among heterogeneous coworkers affects pay, productivity and labor supply. In this paper we propose a framework where differently productive firms choose whether or not to coordinate hours in exchange for productivity gains. In this framework, we show that more productive firms select into coordinating hours and pay compensating wage differentials, leading to attenuated labor supply responses and spillovers from tax changes. Next, we bring the model predictions to the data using linked employer-employee registers in Denmark. We first document evidence of positive correlations between wages, productivity and the degree of hours coordination - measured as the dispersion of hours - within firms. We estimate that hours coordination can explain around 4% of the variance of firm-level wages. We then estimate labor supply elasticities using changes to the personal income tax schedule in 2010 which affected high-wage earners differently. We find evidence of higher labor supply elasticity in firms with lower hours coordination. Furthermore, we find evidence of spillover effects on hours worked by coworkers not directly affected by the reform that are consistent with our model of firm level coordination of hours.

JEL Codes: J31, H20, J20

A Appendix: Supplementary derivations

A.1 The optimal demand of consumption and leisure

Workers with skill i maximize utility (1) given an hourly wage rate w_i and an income tax rate t_i, facing the budget constraint

$$E_i \equiv \int_{\omega \in \boldsymbol{\Omega}} p(\omega) q_i(\omega)\, \mathrm{d}\omega \;\leq\; h_i \mathrm{w}_i (1 - t_i) + T + \bar{\pi} \;\equiv Y_i, \tag{1}$$

where E_i is expenditure, Y_i is after-tax income under a lump-sum transfer T that balances the government's budget (there are no other government expenditures), and $\bar{\pi} \equiv \int_{\omega \in \boldsymbol{\Omega}} \pi(\omega) \mathrm{d}\omega / (n_H + n_L)$ represents the equal distribution of firm profits as dividends. A worker i's optimal product demand then is

$$q_i^*(\omega) = \left[\frac{p(\omega)}{P} \right]^{-\sigma} Q_i, \tag{2}$$

and labor supply is implicitly given by

$$\eta\, v'\,(\ell^*\,) = \frac{\mathrm{w}_\mathrm{i}^*\,(1 - t_i)}{P\,Q}, \tag{3}$$

for the (exponentiated) price index $P^{\sigma-1} \equiv \int_{\omega \in \boldsymbol{\Omega}} p(\omega)^{-(\sigma-1)}\, \mathrm{d}\omega$. Finally note that, in optimum, $E_i = PQ_i$.

A.2 Wage-hours function and optimal hours: the case of an additive separable utility function

Since the indifference condition (2) implicitly defines the wage rate as a function of the hours worked, it can be used to express $\hat{\mathrm{w}}'(\hat{h})$ in term of marginal utilities. Thus starting from:

$$\Phi(\hat{\mathrm{w}}_\mathrm{i}, \hat{h}) = U\left(\mathrm{P}^{-1} \hat{\mathrm{w}}_\mathrm{i}\,(1 - t_i)\,\hat{h} + P^{-1}(T\bar{\pi}), 1 - \hat{h}\right) - U\left(\mathrm{w}_\mathrm{i}^*\,(1 - t_i) h_i^* + +P^{-1}(T\bar{\pi}), 1 - h_i^*\right) = 0, \tag{4}$$

we have:

$$\hat{\mathrm{w}}_i'(\hat{h}) = -\left(\frac{\partial \Phi(\hat{\mathrm{w}}_\mathrm{i},\, \hat{h})}{\partial \hat{h}} \right) \left(\frac{\partial \Phi(\hat{\mathrm{w}}_\mathrm{i},\, \hat{h})}{\partial \hat{\mathrm{w}}_\mathrm{i}} \right)^{-1} = -\frac{[P^{-1} U_C \hat{\mathrm{w}}_\mathrm{i}(1 - t_i) - U_\ell]}{P^{-1} U_C \hat{h} (1 - t_i)}. \tag{5}$$

Under decreasing marginal rates of substitution

$$\hat{\mathrm{w}}_i'(\hat{h}) = -\frac{[P^{-1}U_C\hat{\mathrm{w}}_{\mathrm{i}}(1-t_i) - U_\ell]}{P^{-1}U_C\hat{h}(1-t_i)} \begin{cases} < 0 & \text{if } \hat{h} < h_i^* \\ = 0 & \text{if } \hat{h} = h_i^* \\ > 0 & \text{if } \hat{h} > h_i^* \end{cases}. \tag{6}$$

Assuming that the utility function is additive separable as in (1), the second derivative of the wage rate with respect to hours is:

$$\hat{\mathrm{w}}_i''(\hat{h}) = -\left[\frac{\hat{\mathrm{w}}_i'\,\hat{h} - \hat{\mathrm{w}}_i}{\hat{h}^2}\right] - \left[\frac{P}{\hat{h}^2(1-t_i)}\right]\frac{U_\ell}{U_C} - \frac{U_C U_{ll} + U_{CC}U_\ell\left[P^{-1}\hat{\mathrm{w}}_i'\,\hat{h}\,(1-t_i) + P^{-1}\hat{\mathrm{w}}_{\mathrm{i}}(1-t_i)\right]}{P^{-1}U_C^2(1-t_i)\,\hat{h}}. \tag{7}$$

Thus rearranging the terms in (7) we have[1]:

$$\hat{\mathrm{w}}_i''(\hat{h}) = -\frac{2}{\hat{h}}\,\hat{\mathrm{w}}_i' - \frac{U_C U_{ll} + U_{CC}U_\ell\left[P^{-1}\hat{\mathrm{w}}_i'\,\hat{h}\,(1-t_i) + P^{-1}\hat{\mathrm{w}}_i\,(1-t_i)\right]}{P^{-1}U_C^2\,(1-t_i)\,\hat{h}}. \tag{8}$$

In (8) we notice that:

$$\left[P^{-1}\hat{\mathrm{w}}_i'\,\hat{h}\,(1-t_i) + P^{-1}\hat{\mathrm{w}}_i\,(1-t_i)\right] = \frac{-P^{-1}U_C\hat{\mathrm{w}}_{\mathrm{i}}(1-t_i) + U_\ell + P^{-1}U_C\hat{\mathrm{w}}_{\mathrm{i}}(1-t_i)}{U_C} = \frac{U_\ell}{U_C} > 0. \tag{9}$$

Assuming $U_C > 0$, $U_\ell > 0$, $U_{CC} < 0$ and $U_{ll} < 0$, it follows that the second term in (8):

$$-\frac{U_C U_{ll} + \frac{U_{CC}U_\ell^2}{U_C}}{P^{-1}U_C^2(1-t_i)\,\hat{h}} > 0. \tag{10}$$

(10) captures the loss in terms of marginal utilities from working one extra hour. This loss requires wage rates to increase at an increasing rate when hours go up. Combining (10) and (8) we have:

$$\hat{\mathrm{w}}_i''(\hat{h}) = -\frac{2}{\hat{h}}\,\hat{\mathrm{w}}_i' - \frac{U_C U_{ll} + \frac{U_{CC}U_\ell^2}{U_C}}{P^{-1}U_C^2(1-t_i)\,\hat{h}}. \tag{11}$$

If $\hat{h} = h^*$ since $\hat{\mathrm{w}}_i'(\hat{h}) = 0$ then $\hat{\mathrm{w}}_i''(\hat{h}) > 0$. If $\hat{h} < h_i^*$ then $\hat{\mathrm{w}}_i'(\hat{h}) < 0$ and $\hat{\mathrm{w}}_i''(\hat{h}) > 0$. Finally, if $\hat{h} > h_i^*$ then $\hat{\mathrm{w}}_i'(\hat{h}) > 0$ and the sign of $\hat{\mathrm{w}}_i''(\hat{h})$ is ambiguous. Using (5) to rearrange (11) $\hat{\mathrm{w}}_i'' > 0$ implies:

$$2\frac{\hat{\mathrm{w}}_i(1-t_i)}{P} > \frac{U_\ell}{U_C} + \frac{U_{\ell\ell}}{U_C} - \frac{U_{CC}U^2}{U_C^2}. \tag{12}$$

[1] The rearrangement here consists in substituting (5) into the first term on the right hand side of (7). Then we take the sum of the first two terms. To gain a more transparent intuition of the results, I then express the sum of the first two terms in (7) in terms of w'(h).

This is the case when P is particularly small and/or $U_{\ell\ell}$ particularly high.

A.3 Optimal hours worked in coordinated firms: derivations

The first order condition relative to the minimization problem of section 2.3.2 are:

$$\hat{\mathrm{w}}'_{\mathrm{L}}\hat{h}\hat{n}_L + \mathrm{w}_{\mathrm{L}}\hat{n}_L + \hat{\mathrm{w}}'_{\mathrm{H}}\hat{h}\hat{n}_H + \hat{\mathrm{w}}_{\mathrm{H}}\hat{n}_H = G_H\hat{n}_H + G_L\hat{n}_L, \tag{13}$$

$$G_H = \hat{\mathrm{w}}_{\mathrm{H}}(\hat{h}), \tag{14}$$

$$G_L = \hat{\mathrm{w}}_{\mathrm{L}}(\hat{h}), \tag{15}$$

$$\hat{\gamma}\phi\, G(\hat{n}_L\, \hat{h},\, \hat{n}_H\, \hat{h}) = \hat{q}(\omega). \tag{16}$$

Replacing G_H from (14) and G_L from (15) into (13) we obtain

$$\hat{\mathrm{w}}'_{\mathrm{H}}(\hat{h})\hat{n}_H\hat{h} + \hat{\mathrm{w}}'_{\mathrm{L}}\hat{n}_L\hat{h} = 0, \tag{17}$$

dividing by $\hat{h}$ we obtain condition (4).

The optimality condition (4) implicitly defines optimal hours in coordinated firms as a function of the marginal tax rate faced by high-skilled workers. Thus it can be used to obtain the derivative of $\hat{h}$ with respect the tax rate t_H. Defining the implicit function:

$$\Phi_{t_H}(h, t_H) = \hat{\mathrm{w}}'_{\mathrm{H}}(\hat{h}) + \alpha\hat{\mathrm{w}}'_{\mathrm{L}} = 0. \tag{18}$$

We have:

$$\frac{d\hat{h}}{dt_H} = -\left(\frac{\partial\Phi_{t_H}}{\partial t_H}\right)\left(\frac{\partial\Phi_{t_H}}{\partial\hat{h}}\right)^{-1}, \tag{19}$$

using (5) in solving for the numerator in (19) gives equation (6).

A.4 The product market: prices, revenues and profits

A firm producing variety ω maximizes its profits by setting the variety-specific price $p(\omega)$ given total demand. Summing the demand indexes Q_i^* and $\hat{Q}_i$ over all consumers, of different skills and with employment in different labor markets, we arrive at aggregate consumption Q, which firms take as given under monopolistic competition. However, in the product market for their individual variety ω, firms are monopoly price setters, taking demand for their variety into account:

$$q(\omega) = [p(\omega)/P]^{-\sigma} Q,$$

after summing (2) over all consumer groups.[2] The generic profit maximization problem is

$$\pi(\omega) \equiv \max_{p(\omega)} p(\omega)\, q(\omega) - \frac{\mu}{\gamma\phi}\, q(\omega) - F \qquad \text{s.t.} \quad q(\omega) = \left[\frac{p(\omega)}{P}\right]^{-\sigma} Q, \tag{20}$$

where the constant μ is the marginal production cost (given constant returns to scale). Note that $F = 0$, $\gamma = 1$ and $\mu = \mu^*$ in the non-coordinated market, whereas $F = \hat{F}$, $\gamma = \hat{\gamma} > 1$ and $\mu = \hat{\mu}$ for firms that enter the coordinated market. Applying Euler's rule to constant-returns-to-scale production (with homogeneity of degree one in production factors), the minimized cost function in uncoordinated firms takes the form

$$C^*(\omega) = \frac{\mu^*}{\phi}\, q^*(\omega) \qquad \text{with} \quad \mu^* \equiv \mu(\mathrm{w}^*_H, \mathrm{w}^*_L, h^*_H, h^*_L),$$

where μ^* is the Lagrange multiplier of the constrained minimization problem (3), and $q^*(\omega) = \phi\, G(n^*_H h^*_H, n^*_L h^*_L)$, whereas the function $\mu(\cdot)$ also depends on the parameters of the production function. In coordinated firms the minimized costs function takes the form:

$$\hat{C}(\omega) = \frac{\hat{\mu}}{\hat{\gamma}\phi}\, \hat{q}(\omega) \qquad \text{with} \quad \hat{\mu} \equiv \mu(\hat{\mathrm{w}}_H, \hat{\mathrm{w}}_L; \hat{h}(\eta, P, t_H, t_L; \phi)),$$

where $\hat{\mu}$ is the Lagrange multiplier of the constrained minimization problem in Section 2.3.2 and $\hat{q}(\omega) = \hat{\gamma}\, \phi\, \hat{h}\, G(\hat{n}_H, \hat{n}_L)$. The optimal prices resulting from (20) are

$$p^*(\omega) = \frac{\sigma}{\sigma - 1} \frac{\mu^*}{\phi} \qquad \text{and} \qquad \hat{p}(\omega) = \frac{\sigma}{\sigma - 1} \frac{\hat{\mu}}{\hat{\gamma}\phi}. \tag{21}$$

By profit maximization (20), firms with the same ϕ choose the same optimal price–over-cost markups, production and revenue, regardless of their specific product variety ω. We therefore adopt the simplifying notation that optimal prices are $p(\phi)$, optimal production is $q(\phi)$, and optimal revenues are $p(\phi)q(\phi)$. Summing (2) over all consumer groups, total demand for a firm's output can be written $q(\phi) = [p(\phi)/P]^{-\sigma} Q$ and the firm's equilibrium revenues are

$$p(\phi)q(\phi) = [p(\phi)/P]^{-(\sigma-1)} PQ = [p(\phi)/P]^{-(\sigma-1)} E,$$

where $E = PQ$ is economy-wide expenditure, aggregated over all consumer groups. By (20),

[2] Concretely, aggregate demand is $Q \equiv \sum_{i=H,L} N^*_i Q^*_i + \hat{N}_i \hat{Q}_i$, where $Q^*_i = E^*_i/P$ and $\hat{Q}_i = \hat{E}_i/P$ with $E^*_i = h^*_i w^*_i (1 - t_i) + T$ and $\hat{E}_i = \hat{h} \hat{w}_i (1 - t_i) + T$.

profits of a firm with productivity ϕ are

$$\pi(\phi) = \frac{p(\phi)q(\phi)}{\sigma} - F = \left[\frac{p(\phi)}{P}\right]^{-(\sigma-1)} \frac{E}{\sigma} - F.$$

Using optimal prices (21) for non-coordinated and coordinated firms in this profit relationship, we can state a firm ϕ's prospective profits in the two labor market segments as in Section 2.3.3.

A.5 Tax changes and wage rates with coordination

In the setting described in Section 2, a tax change that affects coordinated hours also affects wage rates through the wage-hours function. The sign of the effect on wages depends on whether the income or the substitution effect prevails and on whether high-skilled desire to work more or less than low-skilled workers. Figure 4 shows the case in which the tax rate goes down, the income effect prevails and high-skilled desire to work more (i.e. $h^*_H > h^*_L$). In this case a drop of the tax rate moves the equilibrium from A to B. At the new equilibrium both $\mid \mathrm{w}'_{\mathrm{H}} \mid$ and $\mid \mathrm{w}'_{\mathrm{L}} \mid$ are lower implying lower wage rates for both high and low-skilled workers. Intuitively, the lower supply of hours induced by the tax drop moves low-skilled workers (who work more than desired at the original equilibrium) closer to the optimum. This results in lower wage premiums for low-skilled workers. Turning to high-skilled workers, the reform drives down both their actual and desired hours worked. Actual hours however, decrease less than the desired one, thus shrinking the gap between the optimum and the actual hours. This results in lower wage rates. The other possible cases can be derived following a similar reasoning and they lead to the conclusion that wage rates and hours move together if, in equilibrium, low-skilled prefer to work less than high-skilled, while hours and wages move in opposite directions if low-skilled prefer to work more.

From an empirical point of view however, we do not find significant effects on wages. This may be due to the fact that hours changed too little to trigger a change in wages. It may also be however that wages are stickier than hours and since data after 2011 are not available, we might be unable to capture the variation in wages.

A.6 A framework for the empirical model of taxation with spillovers

Similar to Gruber and Saez (2002), we assume that type i workers maximize an utility function that depends on consumption (c) and labor income (z). For simplicity we assume that labor income is given as the product of wage rates and hours worked so that the utility function takes the following form: $U_i\left(c_i,\, h_i \mathrm{w_i}\right)$. Following Kleven and Schultz (2014), we define $c_i = z_i - T_i\left(z\right) = z_i\left(1-\tau_i\right) + y_i$, where $T_i\left(z\right)$ is tax liability, $\tau_i = T_i'()$ and virtual income is defined as $y_i = z_i\tau_i - T_i\left(z\right)$. In uncoordinated firms the wage rate is exogenously set by the market at $\mathrm{w_i} = \mathrm{w_i^*}$. The optimal choice of hours is then a function of the marginal net-of-tax rate, virtual income and the exogenous wage rate: $h_i = h\ \left(1-\tau_i\,, y_i\,, \mathrm{w_i^*}\right)$. In this framework, changes in τ_i and y_i affect the supply of hours as follows:

$$dh_i = -\frac{\partial h}{\partial\left(1-\tau_i\right)}\, d\tau_i + \frac{\partial h}{\partial y_i}\, dy_i \tag{22}$$

Defining the uncompensated elasticity of hours with respect to the net-of-tax rate as $\alpha_2 = \left[\left(1-\tau_i\right)\,/h_i\right]\left[\partial h\,/\partial\left(1-\tau_i\right)\right]$ and the income elasticity as $\alpha_3 = \left(1-\tau_i\right)\ \left[\partial h\,/\partial y_i\right]$, then the terms in equation (22) can be rearranged as:

$$\frac{dh_i}{h_i} = -\alpha_2\,\frac{d\tau_i}{\left(1-\tau_i\right)} + \alpha_3\,\frac{dy_i}{h_i\left(1-\tau_i\right)} \tag{23}$$

Using a log-log specification, equation (23) can be estimated as:

$$\Delta log(h_i) = \alpha_0 + \alpha_2\,\Delta log\left(1-\tau_i\right) + \alpha_3\,\Delta log(y_i) + \varepsilon_i \tag{24}$$

The compensated elasticity of hours to a net-of-tax rate change can be obtained from α_2 and α_3 using the Slutsky equation: $\zeta^c = \alpha_2 - \alpha_3$.

In case firms coordinate hours among workers then the supply of hours by type i workers in a firm will also depend on the hours worked by other types of workers in the same firm. Hours worked by other types will in turn depend on the net-of-tax rate, the virtual income and the market wage rate that the other types face. We assume there is one type of other workers only that this is indexed as $-i$. Hours worked by type i workers can then be expressed as: $h_i = h\ \left(1-\tau_i\,, y_i\,, h_{-i}\,, \mathrm{w_i^*}\right)$, where $h_{-i} = h\ \left(1-\tau_{-i}\,, y_{-i}\,, \mathrm{w_{-i}^*}\right)$. In defining h_{-i}, we assume that hours worked by type $-i$ workers are independent of the tax rate and virtual income faced by type i workers. This assumption, while restrictive, fits well our empirical setting where tax changes experienced by low-skilled workers (type i) are of small magnitude and do not affect hours worked by high-skilled (type $-i$) in a significant way. We assume that the assignment of workers to a type does not change when the tax rate changes. This is consistent with our framework where workers are defined as high or low-skilled based on the marginal tax rate that they face prior to the reform and the mechanical marginal tax rates that they face after the reform.

In this framework, changes in τ_i, y_i, τ_{-i} and y_{-i} affect the supply of hours of type i workers as follows:

$$\frac{dh_i}{h_i} = -\alpha_2 \frac{d\tau_i}{(1-\tau_i)} + \alpha_3 \frac{dy_i}{h_i\,(1-\tau_i)} + \frac{\partial h}{\partial h_{-i}} \frac{1}{h_i} \left[-\beta_2 \frac{h_{-i}\, d\tau_{-i}}{(1-\tau_{-i})} + \beta_3 \frac{dy_{-i}}{(1-\tau_{-i})} + \right] \tag{25}$$

In a log-log specification, (25) can be estimated using the following empirical model:

$$\Delta log(h_i) = \alpha_0 + \alpha_1 \Delta\widehat{log\,(h_{-i})} + \alpha_2 \Delta log\,(1-\tau_i) + \alpha_3 \Delta log(y_i) + \varepsilon_i \tag{26}$$

Where $\Delta\widehat{log\,(h_{-i})}$ is predicted using using $\Delta log\,(1-\tau_{-i})$ and $\Delta log(y_{-i})$ as instruments.

A.6.1 Marginal excess burden with hours coordination

We measure the marginal excess burden (MEB) as the ratio of the change in tax revenues due to behavioural responses (dB) to total changes in tax revenues (dR). Abstracting from spillovers we have:

$$MEB = \frac{dB}{dR} = \frac{dB_H + dB_L}{dM_H + dM_L + dB_H + dB_L}$$

where the change in tax revenues due to behavioural responses for a worker type i is defined as $dB_i = (\, e_i \cdot h_i \cdot w_i \cdot \frac{\tau_i}{1-\tau_i} d\tau_i) \times N_i$, and e_i, h_i, w_i, τ_i, N_i are respectively the elasticity of type i hours, average hours, average wage rates, average marginal tax rates and number of type i workers in our sample. $d\tau_i$ measures the average change in marginal tax rates on labor income due to the reform among type i workers. The mechanical change in tax revenues is defined as $dM_i = d\tau_i \cdot h_i \cdot w_i$ and captures losses (gains) in revenues due to changes of the tax schedule absent behavioural changes.

In our setting, e_L is insignificant so that dB_L can be ignored. In comparing MEB with coordination relative to the one that would be implied by low-coordination, we first estimate MEB assuming $e_H = -0.05$. This is the elasticity across all firms. Then we compute MEB under $e_H = -0.1$ that is the elasticity in low-coordination firms (Table 6).

Including spillovers we have:

$$MEB^{Spillover} = \frac{dB^{Spillover}}{dR} = \frac{dB_L^{Spillover} + dB_H + dB_L}{dB_L^{Spillover} + dM_H + dM_L + dB_H + dB_L}$$

where $dB_L^{Spillover} = e_L^{Spillover} \cdot (dh_H/h_H) \cdot w_L \cdot h_L \cdot \tau_L$. Here $e_L^{Spillover}$ is the elasticity of low-skilled hours to the hours of high-skilled coworkers, and dh_H is the change in hours of high-skilled due to the reform. In practice, we consider spillovers from normal hours only because these have better power in first stage regressions (Table 8).

B Appendix: Extra details on institutions and data

B.1 The overtime regulation in Denmark

Overtime work is defined in the large majority of collective agreements as the number of weekly hours worked beyond the normal hours set in the employment contract.[3] In order to remunerate overtime work there are two options: i) an hour of paid leave for each hour of overtime work or ii) an increase in the hourly wage according to the rates set in the collective agreements.[4] Many agreements for example set the overtime premium to 50% for the first three hours of overtime and to 100% for overtime over three hours. Work on Sundays and during public holidays is also considered overtime work and it is usually rewarded with a 100% increase in the hourly rate. Collective agreements generally establish a cap on overtime hours per week, unless explicitly agreed upon differently by the employer and the union representatives at company level.[5]

Moreover overtime work is also indirectly affected by two laws regarding working time. The first one states that every worker is entitled to rest at least 11 hours per day on average and at least one day per week (Health and Safety Act, passed in 1996).[6] The daily rest period of 11

[3]For a large number of hourly wage employees the number of hours set in the contract is around 37.

[4]This is not the case for salaried workers who are not entitled to overtime pay.

[5]In the manufacturing sector the cap on overtime work is currently of 8 hours and it can be increased to 12 hours in relation to reparation of machines (*Industriens Overenskomst 2014-2017*). In the transport sector the same cap is set to 3 hours per week (*Industriens Overenskomst 2014-2017*). In the financial sector there is not an explicit limit on overtime work (*Standardoverenskomst 2014- Finansforbundet*) but there is a reference to the rule on maximum weekly working hours.

[6] *Arbejdsmiljloven (2010)*

hours can be reduced by a local agreement, even though not below 8 hours per day on average.

The second one is the rule that sets the maximum weekly working hours,including overtime work, to an average of 48 hours per week over a reference period (Directive on working time, passed in 2002).[7] The reference period, however, can vary substantially from sector to sector. For instance, both in the manufacturing and in the public sector the 48-hours maximum is always determined over a reference period of 4 months, unless a shorter or longer period of maximum 12 months is negotiated at the company level. In the service sector the picture is more blurred. The reference period is 4 months for employees working in shops, but those employees working in offices and warehouses have a reference period of 6 months.[8] However, deviations from the 4 or 6 months period can be specified at sector level. Finally, employees in transportation have stricter limitations on maximum weekly hours that should not exceed the 42 hours.

B.2 Construction of the data on hours and earnings

In equation (8) we use hourly wages derived as the ratio of labor earnings gross of taxes and total working hours. We use hours and earnings relative to the highest paying job in the spell of November. This is the only spell that can be matched to employers data through *FIDA*. For workers whose November spell lasts less than 1 entire year, we annualize hours and earnings multiplying by the inverse of the share of the year that they stayed in the spell. We exclude from the analysis as outliers the workers with annualize earnings lower than 2000$ (13000 DKK) or those having annual hours greater than 5,616 ($18 \times 6 \times 52$). This results in the exclusion of around 10,000 observations over the years 2003-2011 (Table D.1).

We use the gross labor earnings variable called *joblon* contained in *IDA* that is based on yearly labor earning records and that includes all forms of labor compensation excluding pension contributions.[9] *IDA* also contains two alternative measures of earnings. The first is *lonind* and

[7] *Bekendtgrelse af lov om gennemfrelse af dele af arbejdstidsdirektivet (2004)*

[8] In the financial sector the reference period is set to 13 weeks (*Standardoverenskomst 2014- Finansforbundet*).

[9] In Denmark, workers save for their old age in a number of ways. One is through the Additional Pension from the Labour Market, called ATP. Employers make contributions for each employee to a pension fund and they increase with hours worked. Additionally there are additional pension contributions administered by the employer, which are measured by the variables *arbpen10-arbpen15* and private pension contributions measured by the variables *pripen10-pripen15*. Additional details about how the gross annual earnings are measured can be

it measures the gross annual labor earnings for the whole year and not just for the spell of November. The second one is *timelon* and it measures hourly wages. This variable however is missing for around 20,000 observations in our final sample so we prefer not to use it in the main analysis. As in Kleven and Schultz (2014), in the tax simulator we use information on labor and total earnings stemming from the income register (*INDK*).[10] As a deflator for the income variables we use the Consumer Price Index with base year 2000 from Statistics Denmark.[11]

Normal working hours are from *Lønstatistikken* and they are inclusive of vacation, weekends, legal holidays or lunch breaks, whereas unpaid leave and overtime hours are excluded. *Lønstatistikken* also repots information on overtime hours (i.e. *overtid*) that takes value zero for around 70% of our final sample. Among the salaried workers this share goes up to 81%, while among hourly workers this share is around 42%. All the information contained in *Lønstatistikken* originates from employers, specifically data in *Lønstatistikken* are collected for the public companies from the administrative salary system (*Arbejdstidsregnskabet*). For most private companies (with the equivalent of at least 10 full time employees) the data are collected by the Danish employers confederation (*Dansk Arbejdsgiverforening and Finanssektorens Arbejdsgiverforening*). Over the years 2003-2011 only about 55% of the observations in IDA can be matched in LON. Attrition can be partially explained by the fact that data on about 15% of the firms surveyed are judged of low quality by Statistics Denmark and they are not released in LON. Data on hours are also available in 2002 when, however, only 30% of the observations in IDA can be matched in LON. For this reason, we exclude 2002 from the analysis.

With the introduction of the e-income registry (*E-indkomst*) the Danish tax authorities obtained information on hour worked by all employees over the age of 14, including employees in smaller enterprises, on a monthly basis.[12] This database is only available in the years 2008-2011. For this reason we use *E-indkomst* as a secondary source of data to check the robustness of our baseline results. We make hours in *E-indkomst* comparable to those in LON by aggregating monthly hours into annual hours and we exclude observations to which hours are imputed.

found at: `http://www.dst.dk/da/TilSalg/Forskningsservice/Dokumentation/hoejkvalitetsvariable/loenforhold-der-vedroerer-ida-ansaettelser-/joblon`

[10] In this register the variable capturing labor earnings is *qlontmp2*.

[11] This can be accessed at `http://www.statistikbanken.dk/PRIS6`

[12] The hours variable that we use is called *ajoloentimer*.

B.3 Accounting Data

As far as firms variables are concerned, capital stock (MAAT) is measured as the value of land, buildings, machines, equipment and inventory is from the Accounting Statistics register (Regnskabsstatistik).[13] We obtain total sales (OMS) from the same register. The definition of value added is the one suggested by Statistics Denmark. This changes over the sample period to account for changes in accounting standards. Specifically from 2002 to 2003, the value added is calculated as:

$$(OMS + AUER + ADR + DLG) -$$
$$(KRH + KENE + KLOE + UDHL + UASI + UDVB + ULOL + EKUD + SEUD)$$

where AUER is the value of work performed for own purposes and capitalized as part of fixed assets, ADR represents other non-operating income (such as interest rates payments), DLG measures inventories, KRH consists of purchases of raw materials , finished goods and packaging (excluding electricity) , KENE are energy purchases, KLOE are labor costs, UDHL measures rents, UASI losses on small inventories, UDVB are the costs of hiring workers from other companies (such as temporary agency employment), ULOL are the leasing costs, EKUD represents other external costs (a part from secondary costs) and SEUD measures secondary costs.

From 2004 to 2012, the valued added is calculated as:

$$(OMS + AUER + ADR + DLG) -$$
$$(KVV + KRHE + KENE + KLOE + UASI + UDHL + UDVB + ULOL + EKUD + SEUD)$$

where KVV is the purchase of goods for resale while KRHE measures consists of purchases of raw materials , finished goods and packaging (excluding electricity). Finally the number of full-time equivalent workers (FANSH) is from Firmstatistik.

B.4 Total Factor Productivity

Total Factor Productivity (TFP) is obtained from a Cobb-Douglas production function:

$$y_{it} = \beta_0 + \beta_l \, \ell_{it} + \beta_k \, k_{it} + v_{it} + \varepsilon_{it} \tag{27}$$

[13] http://www.dst.dk/da/Statistik/dokumentation/Times/regnskabsstatistik-for-firmaer/

where y is log value added, ℓ is the log number of full time employees and k is the log of physical capital in firm i at time t. We assume that the error component ε_{it} cannot be observed or predicted by firms, while the productivity shock v_{it} is assumed to follow a Markov process so that $p\left(v_{it+1} \mid I_{it}\right) = p\left(v_{it+1} \mid v_{it}\right)$, where I_{it} - the information held by a firm at time t- includes realization of v_i up to t (Olley and Pakes, 1996). This assumption implies that:

$$v_{it} = g(v_{it-1}) + \xi_{it} \tag{28}$$

where $E\left[\xi_{it} \mid I_{it}\right] = 0$ by construction. We assume that capital at t is a function of capital and investments at $t-1$: $k_{it} = \kappa\left(k_{it-1}, i_{it-1}\right)$, while labor is chosen after $t-1$. Furthermore, following Ackerberg et al. (2015) (henceforth ACF) we assume that labor is part of the demand of intermediate inputs (m_{it}):

$$m_{it} = f(k_{it}, v_{it}, \ell_{it}) \tag{29}$$

As in other studies we assume that $f()$ is strictly increasing in v_{it} so that:

$$v_{it} = f^{-1}(k_{it}, m_{it}, \ell_{it}) \tag{30}$$

and replacing this in (27) we have:

$$y_{ijt} = \beta_0 + \beta_l\, \ell_{it} + \beta_k\, k_{it} + f^{-1}(k_{it}, m_{it}, \ell_{it}) + \varepsilon_{it} = \Phi_{it}(k_{it},\, \ell_{it}, m_{it}) + \varepsilon_{it} \tag{31}$$

As in ACF we use the following moment condition to obtain an estimate of Φ_{it} ($\hat{\Phi}_{it}$) through GMM:

$$E\left[\varepsilon_{it} \mid I_{it}\right] = E\left[y_{it} - \Phi_{it}(k_{it},\, \ell_{it}, m_{it}) \mid I_{it}\right] = 0 \tag{32}$$

Then we estimate of β_0, β_l and β_k through GMM from the following moment condition:

$$\begin{aligned} &E\left[\varepsilon_{it} + \xi_{it} \mid I_{it-1}\right] = \\ &\quad E\left[y_{it} - \beta_0 - \beta_l\, \ell_{it} - \beta_k\, k_{it} - g\left(\Phi_{it}(k_{it-1},\, \ell_{it-1}, m_{it-1}) - \beta_0 - \beta_l\, \ell_{it-1} - \beta_k\, k_{it-1}\right) \mid I_{it-1}\right] = 0 \end{aligned} \tag{33}$$

Finally TFP is derived as:

$$TFP_{it} = \hat{\Phi}_{it} - \hat{\beta}_l\, \ell_{it} - \hat{\beta}_k k_{it} \tag{34}$$

In practice we proxy for $f^{-1}()$ using a 4th order polynomial function of k, ℓ, m and a full set of interactions among these terms, while $g()$ is assumed to be a quadratic function of v_{it-1}.

B.5 The Danish Tax System

Table D.12 reports all types of income relevant to the Danish tax system.[14] The taxable income (TI) is defined as the sum of personal income (PI) and capital income (CI) minus deductions (D). Personal income is given by the sum of labor income (LI) and other sources of income such as transfers or grants. Table D.13 shows tax rates and tax bases in the years 2008-2011. The tax system consists of a flat regional tax[15], progressive national taxes, labor market and EITC contributions. Income deriving from stocks (SI) is taxed following a separate progressive schedule. The tax rates that are shown in the table are cumulative. This means that the tax rate for a taxpayer in the top tax bracket for instance, is the sum of the tax rates in the bottom, middle and top tax bracket along with the regional tax rate, the labor market contribution and the EITC contribution rates. The sum of the tax rates however, can not exceed a marginal tax rate ceiling. If it does then the ceiling is binding.

As shown in Table D.13, several changes to the tax system occurred over the years that we consider. In 2009 the income cut-off of the middle and top tax brackets were equalized, while the bottom tax rate went slightly down. The changes were particularly beneficial to taxpayer in the middle bracket for which the marginal tax rate ceiling was not binding and who had a tax base wide enough to fully exploit the change in bottom tax rates. In the following year, the 2010 Tax Reform abolished the middle tax bracket, it lowered the bottom tax rate from 5.04% to 3.67%. As an effect of those changes the marginal tax rate ceiling was also lowered from 59% to 51.5%. As a result, between 2008 and 2011, the marginal tax rate on labor income in the top tax bracket went down from 62.28% to 55.83%, while in the middle tax bracket it went from 45.06% to 37.78% (Figure 7). Finally in the bottom tax bracket the marginal tax rate on labor income went from 39.54% to 37.78%. The same reform also introduced a 40000 DKK

[14]We base Table D.12 on Table 1 in Kleven and Schultz (2014). We update the table to reflect the tax code relevant in the period that we analyze.

[15]The regional tax consists of a church, a municipality and a county tax. In the exposition that follows we show regional tax rates on the average municipality.

deduction on capital income in the top bracket while increasing the income cut-off of the top tax bracket. The lowest income amount to be considered in the top tax bracket in fact, went up in nominal term from 335,800 DKK to 389,900 DKK that corresponds to an increase of 9% in real terms that further reduced the actual marginal tax rate faced by high incomes.

C Appendix: Additional results

C.1 The conditional exogenous mobility assumption

The estimation of unbiased coefficients from equation (8) requires that the unobserved component of the hourly wage rate r_{ijt} is mean independent of individual, firm fixed effects and time varying characteristics:

$$\mathbb{E}\left(r_{ijt}|X_{ijt},\, \alpha_i,\, \psi_{j(i,t)}\right) = 0 \tag{35}$$

To gain a better understanding of the problematic cases, following Card et al. (2013) (henceforth CHK), we assume that the error component r_{ijt} is made of 3 parts:

$$r_{ijt} = \eta_{ij(i,t)} + \zeta_{it} + \varepsilon_{it} \tag{36}$$

$\eta_{ij(i,t)}$ is a match specific component that captures an idiosyncratic wage premium (or discount) earned by individual i at firm j. This is assumed to have mean zero for all i and j. ζ_{it} is a unit root component meant to capture drifts in the portable component of the individuals earnings power (e.g. health shocks, unobserved human capital accumulation etc.). This is assumed to have zero mean. Finally ε_{it} is a residual mean reverting component.

Under these assumptions, $\mathbb{E}\left(r_{ijt}\alpha_i\right) = 0$ for all i and t. Furthermore, assuming that the components of X_{ijt} are exogenous (i.e. $\mathbb{E}\left(r_{ijt}X_{ijt}\right) = 0 \;\forall\; i, t$) then condition (35) holds if the vector of firm fixed effects is exogenous to the error component (i.e. $\mathbb{E}\left(r_{ijt}\psi_{j(i,t)}\right) = 0 \;\forall\; i, t$). As it is showed in CHK, a sufficient condition for this to hold is that the assignment of workers to firms obeys a strict exogeneity condition (i.e. the ”conditional exogenous mobility”).

Following CHK, we investigate the plausibility of the ”conditional exogenous mobility” assumption considering 3 cases in which the assumption is violated. First, we consider the case of sorting based on the idiosyncratic employer-employee match component of wages $\eta_{ij(i,t)}$. This type of sorting is problematic because workers are paid differently at each firm depending on the match component. Absent any match effect, the average wage gains and losses from moving from high to low wage firms are expected to be symmetric. This is the case for both males and females. The existence of match effects however, will tend to offset the losses associated with moving to a low wage firm. In the limit if all transitions are voluntary and if selection is based only on the match component movers would experience no wage losses.

To check this we follow CHK and we construct mean log coworkers wages for each person in each year obtaining a distribution of coworkers wages in each year. Thus we assign each worker to a quartile of the coworkers wage distribution in a year based on the average log wage of his/her coworkers in that year. We then identify movers as workers who move from one firm to the other and who can be observed for two consecutive years in both the sending and the receiving firm. Thus we derive average wage rates of movers in the two years before and after the move in each quartile of the coworkers wage distribution.[16] Figure D.1 shows the wage trends of movers from the 1st (i.e. low paying) or 4th (i.e. high paying) quartile of the coworkers wage distribution. Similar to other studies, we find rather symmetric wage losses and wage gains for workers moving from high to low paying firms and the opposite. This evidence is confirmed in Table D.4 and D.5 that show the average log wage changes associated to transitions from and to each quartile of the coworker wage distribution. We also fail to find big changes in wages of workers moving across firms in the same quartile of the coworkers wage distribution. Taken together, this evidence suggests that the sorting based on a match component is likely to play a minor role in our setting.

A second case in which the exogenous conditional mobility is violated is when mobility is related to the drifts to the expected wage a person can earn at all jobs (i.e. the shocks at the unit root component of ζ_{it}). For instance, if a worker ability is revealed slowly over time and if it is valued differently at different firms, workers who turn out to be more productive than expected will experience rising wages at their initial employer and may be more likely to move to higher paying firms. The absence of any systematic trend in wages prior to a move for workers who move to high versus low paying firms (Figure D.1) suggests that this type of

[16] Since our sample period ranges between 2003 and 2011 this implies that we focus on movers who moved in the years 2005-2009.

mobility likely plays a minor role in our setting.

Finally a third problematic case might arise if mobility is related to the transitory fluctuations in the unobserved component ε_{it} of wages. This is the case for example, if workers tend to leave firms that experience negative shocks and join firms that experience positive shocks. This type of correlation would imply systematic dips in the wage of leavers and unusual growth in the wage of joiners that we fails to find in our data (Figure D.1).

Related to the particular framework discussed by this paper, mobility might be due to unobserved shocks to preferences over hours worked. An unexpected disease for instance, might induce a worker to move to a lower paying firm in exchange for a working schedule that better fits the new desired hours. If this is the case however, we would observe substantial changes in hours worked by movers. This should be especially true for workers moving from bottom to top paying firms and the opposite. Table D.6 shows the average percentage change in annual hours worked by movers in the two years prior versus the two years after the job change. Hours worked by movers are relatively stable across employers paying different wages. This is the case for males and females, independently on whether they move between the top and bottom paying firms or not.[17] This suggests that unobserved shocks to preferences over hours play a minor role in determining mobility in our sample. The sample that we consider however, is composed of full-time workers who move between firms in the private sector only. As a result we do not consider movers from full-time to part-time work and from the private to the public sector for which we might expect more variation in hours (Arizo et al., 2016).

C.2 Validation of coordination measures using survey data

C.2.1 Survey of Adult Skills (PIAAC)

The Survey of Adult Skills (PIAAC) collects, among other variables, information on a range of generic skills required of individuals in their work. The survey covers around 166,000 adults aged 16-65 who were surveyed in the following countries: Australia, Austria, Belgium (Flanders), Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy,

[17] The average wage changes by quartiles of the coworkers wage distribution in the sending firm never go above 0.5%, that is equivalent to around 9 hours on an yearly basis.

Japan, Korea, the Netherlands, Norway, Poland, the Slovak Republic, Spain, Sweden, the United Kingdom (England and Northern Ireland), the United States, Cyprus and the Russian Federation. The data collection took place from 1 August 2011 to 31 March 2012 in most participating countries.

In the analysis that follows we exclude from PIAAC workers in the public sector, self-employed and students. We focus on the following two characteristics of a job: *Sharing work related information* and *Time cooperating with coworkers* both of which can be though to imply coordination of hours. These characteristics are measured on a discrete scale ranging from 1 to 5 where 1 means that the characteristic is not important and 5 that it is extremely important. In order to merge this information to Danish Registers we first take the modal value of each characteristic within each 4-digit occupation. Then we merge with registers data based on (4-digit) occupation (ISCO-08) and we take the average value of each characteristic in a firm as a measure of the importance of that characteristic. Figure D.2 plots the standard deviation of hours across skill groups against each one of these measures in each firm-year in our sample. As expected we find a strong and negative correlation of the standard deviation with each one of the two variables. That is, in firms where these characteristics are more important hours turn out to be are more coordinated.

C.2.2 Measures of coordination in time use survey data

The Time Use Survey was conducted in 2001 and 2008 by the Danish National Institute of Social Research. Industry information however, is only available in the 2001 survey and for this reason in the following analysis we only use 2001 data. The data collection consists of a questionnaire interview that collects information on demographic and labor market characteristics and two diaries, one diary is for a weekday while the other one for a weekend day. Each diary is divided in 10 minutes intervals and stretches from 4am to 4am the day after. In each interval the respondent has to inform: i) what he/she did (the primary activity) and ii) where he/she was. The survey includes a representative sample of approximately 3,000 individuals. We restrict our analysis to full-time employees (>26 weekly hours) in the private sector or approximately

750 observations.[18]

Based on this, we construct a coordination index as follows: we group workers in two educational groups, the tertiary educated and all others. For each educational group and in each sector and hour of the day we compute the share of workers who are at work relative to the total number of workers in that educational group:

$$Share_{ehs} = \frac{N_{ehs}}{N_{es}} \tag{37}$$

where e indicates either tertiary educated (t) or other workers (o), h is hour of the day and it ranges between 4am to 4am of the day after, while s indicates sector. Due to the limited number of observations we use a 1-digit sector definition analogous to the one used in Table 3. The coordination index in a sector is computed as the correlation between the share of tertiary and other workers across the 24 hours of the day:

$$Coordination\, index_s = correlation\,(Share_{ths}\,,\, Share_{ohs}) \tag{38}$$

High correlation between the share of differently educated workers over the day can be interpreted as signaling high-coordination and viceversa.

Table D.3 show the coordination index in each sector. In line with Table 3, the index is extremely high in some of the service industries such as utilities, trade and the financial sector while it takes relatively low values in agriculture and construction. In line with Table D.3 the index is higher in manufacturing than in construction and agriculture but lower than in most of the service sectors. Differently from Table 3 the residual sector (i.e. "Public administration, education, health and arts") shows a relatively lower index relative to the other services. In our final sample however only 29 firms out of more than 8,000 are part of this sector.

C.3 Coordination and wages differentials: additional robustness checks

Hours worked might be measured with errors and this might bias the estimated correlation between coordination and wage premiums. To get a sense of the size and the direction of

[18]The variable that identifies workers in the private sector is missing for 1,073 observations out of 3,000. We also exclude from the analysis self-employed, students and those whose industry of employment is missing.

this bias, in column 1 of Table D.8 we use the average importance of the *Contact*, *Teamwork* and *Communication* in a firm (see Section 4.3) as an instrument for the standard deviation of hours in equation (7). To the extent that the importance of these factors is correlated with the coordination of hours, this IV approach allows to better separate the coordination component from the measurement error in σ_j. The coefficient from this specification is negative and greater in magnitude than in the baseline model. This suggests that measurement errors generate attenuation bias and that the division bias (Borjas, 1980) is unlikely to play a major role in our setting.[19]

In line with this, columns 2 in Table D.8 show the results obtained while using the median absolute deviation from the median hours (MAD) as an alternative measure of coordination. This measure is less sensitive to outliers. The magnitude of the standardized coefficients in this specification goes up suggesting that, if anything, outliers might drive down the correlation between wages and coordination.

Van Reenen (1996) finds that innovation in a firm causes higher wages. While we can not directly measure innovation, if we control for the stock of immaterial assets in a firm we find that the coefficient on coordination is barely affected (column 3). Moreover, coordination may be expected to be more important among workers of the same plant. In fact, when we restrict the analysis to single plant firms (80% of the sample) we find the coefficient to be greater in magnitude than in the baseline (column 4). In the last column (5) of Table D.8 we control for the number of skill groups in a firm as a way to take out any spurious correlation between high dispersion in hours and the skill diversity of the workforce in a firm. The results are robust to this control.

In the baseline specification we only focus on the firms where attrition in hours worked is low (i.e. less than 5% of the workforce in a year). Columns 1 and 2 in Table D.9 reports the coefficients estimated when we consider all firms in the largest set of connected firms. The coefficient is negative and significant and the Coordination share within 3-digit industry (column 2) is similar to the one estimated in the baseline model.

In the baseline version of equation (8) we control for firm time varying characteristics to

[19]If the first and second moments of the distributions of the errors and the actual hours are uncorrelated, then measurement error can be shown to generate downward biased estimates.

isolate the the firm fixed effect from capturing temporary fluctuations in wages due to firm specific shocks.[20] As a robustness check in columns 3 and 4 of Table D.9 we shows the results obtained while estimating equation (8) including in X_{ijt} only individual time varying controls.[21] The coefficients from these regressions are still negative and significant even if less precisely estimated possibly because the temporary variations in wages add some noise to the firm fixed effect in this specification.

Finally, in order to check whether the correlation that we find is driven by other factors specific of some years in our data we divide the overall sample period in 3 subperiods (2003-2005, 2006-2018 and 2009-2011). Then we estimate equation (8) separately on each one of these shorter panels to obtain the firm-component of the wages specific of a subperiod ($\psi^s_{j(i,t)}$). In the second step we then relate $\psi^s_{j(i,t)}$ to coordination in that subperiod σ^s_j, a set of controls and subperiod fixed effects γ^s.

$$\widehat{\psi^s_{j(i,t)}} = \delta_0 + \delta_1 \sigma^s_j + \delta_2 \bar{Z}^s_j + \gamma^s + v^s_j \tag{39}$$

While the fixed effects allow to control for factors specific of a subperiod, this panel regression is based on firm fixed effects ($\psi^s_{j(i,t)}$) estimated on shorter panels and thus on a lower number of movers. This might reflect in less accurate estimates. With this caveats in mind, column 5 in Table D.9 shows δ_1 estimated from this regression. The coefficient remains negative and significant even if less precisely estimated. The lower precision however, is likely due to outliers because when we use the median absolute deviation of hours as a measure coordination the coefficient is much more precisely estimated (column 6).

C.4 Additional robustness checks on coordination labor supply and tax changes

Table D.15 shows the labor supply elasticity of normal hours in the residual group. This is obtained through the same empirical model used to for high-skilled (equation (10)). Independently on the specific controls for base-year income, the elasticity remains positive, close to zero

[20]The time varying characteristics that we use are value added, sales per employee, exporter status and the share of salaried workers

[21]These are a set of interactions between year dummies and educational attainments and interaction terms between quadratic and cubic terms in age and educational attainments.

and insignificant (columns 2 to 5). At the point estimate however, the elasticity is twice as large among workers who are in the bottom half of the income distribution in the residual group. These are also more distant from the top tax bracket that is suggestive of weaker responses among workers who are more likely to end up in the top bracket by increasing hours.

In columns 1 and 2 of Table D.16 we examine the labor supply response of high-skilled women with children and of high-skilled in the top 10% of the income distribution in 2008 respectively. In line with other recent studies, we find stronger responses among women and top incomes. Differently from high-skilled males, we estimate a positive elasticity among women. The Gruber-Saez type of specification that we use assumes away bunching at the kink points. With significant bunching however, this may create bias. Thus in column 3 we exclude workers at the major kink points of the tax schedule. The estimated elasticity is extremely robust to this specification. Finally in column 4 we estimate the effect of the reform on labor income rather than on hours. In order to compare our results with those of other studies, we estimate this specification on all wage earners. In line with Kleven and Schultz (2014), we estimate a positive and small (0.03) elasticity of labor income. This suggests that the negative elasticity of hours that we find might be linked to the specific sample for which data on hours are available.

For the reasons discussed in Section 5.5, the instrumental variables that we use depends on income at time t. This can be problematic due to mean reversion or to the existence of other trends that unevenly affect the labor supply of workers across the distribution of income at the same time as the tax reform. To check whether the baseline results from Table 6 are sensitive to controls of base-year income, in Table D.17 we estimate equation (10) controlling for pre-reform income in a number of flexible ways. In columns 1 and 2 we control for 5-piece splines of income at time t (similar to Gruber and Saez, 2002), in columns 3 and 4 we control for a 5th order polynomial function of income at time t and an indicator function for positive base-year income (as in Dahl and Lochner, 2012), finally in column 5 and 6 we include 5-piece splines of income at $t-1$ and the change of income between $t-1$ and t (similar to Kopczuk, 2005) .[22] The results from these alternative specifications are very much in line with the baseline ones.

[22]Gruber and Saez (2002) use 10-piece splines while we use 5-piece splines of the base year income. Since we focus on a limited sample of the Danish population and since we only exploit one tax reform, we do not have in fact enough power to estimate more than 5-piece splines of income.

In particular, the labor supply in low-coordination firms is significantly more elastic than in firms at high degree of coordination in all the specifications. The magnitude of the elasticity in low-coordination firms is close in the one estimated in the baseline regressions and it ranges from -0.07 to -0.1 depending on the specification.

In Table D.18 we perform a similar set of robustness checks on the spillover effects estimated through equation (11). In these specifications we control for base-year income (column 1), 5-piece splines of income at t (column 2) and a 5th order polynomial function of income at time t (column 3). The coefficient on $\Delta log\, \overline{h^H}$ remains significant, positive and of comparable magnitude as in the baseline results.

In columns 1 to 4 in Table D.19 we present the results obtained from using the alternative measure of coordination described in Section 4.3 where skill groups are defined from the intersection of education (primary, secondary and tertiary) and occupation (blue collar, middle and top manager) groups. In column 1 and 2 we estimate equation (10) on workers in high and low-coordination firms. As in the baseline model the labor supply in low-coordination firms remains significantly more elastic and the magnitude of the coefficients is close to the baseline. Columns 3 and 4 show the results obtained from estimating equation (11) on workers in low-coordination firms. In column 3 we focus on normal hours of work while in column 4 we consider total hours inclusive of overtime. The spillovers remain significant and of similar magnitude as in the baseline regression model.

In columns 5 and 6 in Table D.19 we estimate equation (10) using data on hours worked from *E-indkomst* (called "BFL hours" in the tables). This is an alternative source of administrative data on hours worked available in the years 2008-2011 only (see Appendix B.2). We restrict the analysis to the workers included in the baseline specification that can be matched in *E-indkomst*. As in the baseline regressions we do not find significant effects on the elasticity of hours of high-skilled workers in high-coordination firms. The elasticity in low-coordination firms remains significant and of similar magnitude as in the baseline regressions. In column 7 we estimate (11). The spillovers remain significant and of comparable but greater magnitude. However, the magnitude has to be interpreted with caution because of the low power in some of the first stage regressions (F-stat lower than 2).

C.5 Income and uncompensated elasticity to tax changes

In the specifications that we discuss in the paper the labor supply elasticity is inclusive of the income effect. In the robustness section we also present separate estimates of the income effects for both high and low-skilled workers. To estimate the income effects we follow the standard model used in the taxable income literature and we modify equation (10) and equation (11) as follows:

$$log\left(\frac{h^H_{ijt+3}}{h^H_{ijt}}\right) = \theta_0 + \theta_1\, log\left(\frac{1-\tau^H_{it+3}}{1-\tau^H_{it}}\right) + \theta_2\, log\left(\frac{vy^H_{it+3}}{vy^H_{it}}\right) + \theta_3\, X_{ijt} + \upsilon_{ijt} \tag{40}$$

$$log\left(\frac{h^L_{ijt+3}}{h^L_{ijt}}\right) = \mu_0 + \mu_1\, log\left(\frac{\overline{h^H_{jt+3}}}{\overline{h^H_{jt}}}\right) + \mu_2\, log\left(\frac{1-\tau^L_{it+3}}{1-\tau^L_{it}}\right) + \mu_3\, log\left(\frac{vy^L_{it+3}}{vy^L_{it}}\right) + \mu_4\, X_{ijt} + \epsilon_{ijt} \tag{41}$$

In these models the terms $log(vy^L_{it+3}\,/\,vy^L_{it})$ and $log(vy^H_{it+3}\,/\,vy^H_{it})$ indicate the changes in virtual income of respectively low and high-skilled workers between time t and $t+3$. Due to the same endogeneity problems that we discuss in Section 5.5, we estimate these specifications using mechanical changes of the virtual incomes and net-of-tax rates as instruments for the observed changes of these variables. Mechanical changes of the virtual income are obtained from simulating the post-reform virtual income while assuming that the real income stayed constant between t and $t+3$ as described (Section 5.5).

Following Kleven and Schultz (2014), we define virtual income as $\tau z_{LAB} + \sum_{n=1}^{N} t^n z_n - T(z_{LAB}, z_1, ..z_N)$ where T() indicates total tax liabilities, τ is the marginal tax rate on labor income (z_{LAB}) and t^n is the marginal tax rate on the n^{th} component of income z_n. This characterization is a generalization of the standard virtual income definition to a situation with multiple income components. It differs from the definition used in some of the existing studies (e.g. Gruber and Saez, 2002) where virtual income is defined as after-tax income. Based on this, the coefficients θ_1 and μ_2 measure the uncompensated elasticity of hours worked to the marginal net-of-tax rates. θ_2 and μ_3 measure the elasticity of hours with respect to virtual income (see Section A.6).[23]

[23]Other studies in this literature use the after tax income rather than virtual income in estimating similar type of regressions (e.g. Gruber and Saez, 2002). In these studies, the analogue of θ_1 or μ_2 in our specification measure the compensated elasticity of hours. In our specification, θ_1 and μ_2 can be combined to respectively θ_2 and μ_3 using the Slutsky equation to obtain the compensated elasticity (Section A.6).

In columns 1 and 2 of Table D.20 we estimate equation (40) respectively in high and low-coordination firms. Unfortunately, due to the fact that the our identifying variation is based on one tax reform only we miss the power to estimate separately the income effect and the uncompensated elasticity . Even if imprecisely estimated, the point estimates show a substantial difference in both the income and the uncompensated elasticity between firms at high versus low degree of coordination. In fact, in line with the baseline results the uncompensated elasticity and the income effects are greater in magnitude in firms at low-coordination. In the last column of Table D.18 we show the spillover effects obtained from estimating equation (41). In this specification we use the mechanical change of the virtual income of low-skilled workers as an instrument for the observed change of virtual income. In the first stage regressions we also use the average virtual income of high-skilled coworkers as an additional instrument. Adding these additional controls does not have sizeable effects on the estimated spillovers that remain significant and of a similar magnitude as in the baseline model.

C.6 The effect of the 2010 Tax reform on firm characteristics

We investigate the effects of the tax reform on firm characteristics using the following regression model:

$$log\left(\frac{y_{jt+3}}{y_{jt}}\right) = \gamma_0 + \gamma_1\, log\left(\frac{\overline{1-\tau^H_{jt+3}}}{\overline{1-\tau^H_{jt}}}\right) + \gamma_2\, Z_{jt} + \varepsilon_{jt} \tag{42}$$

We estimate this model considering 4 different y variables : firm size, the share of high-skilled, the share of low-skilled workers in a firm and the amount of physical capital. The regressor of interest in this model is:

$$log\left(\frac{\overline{1-\tau^H_{jt+3}}}{\overline{1-\tau^H_{jt+3}}}\right) = log\left[\frac{H^{-1}_{jt+3}\sum_{i\in\, H_{jt+3}}(1-\tau_{ijt+3})}{H^{-1}_{jt}\sum_{i\in\, H_{jt}}(1-\tau_{ijt+3})}\right] \tag{43}$$

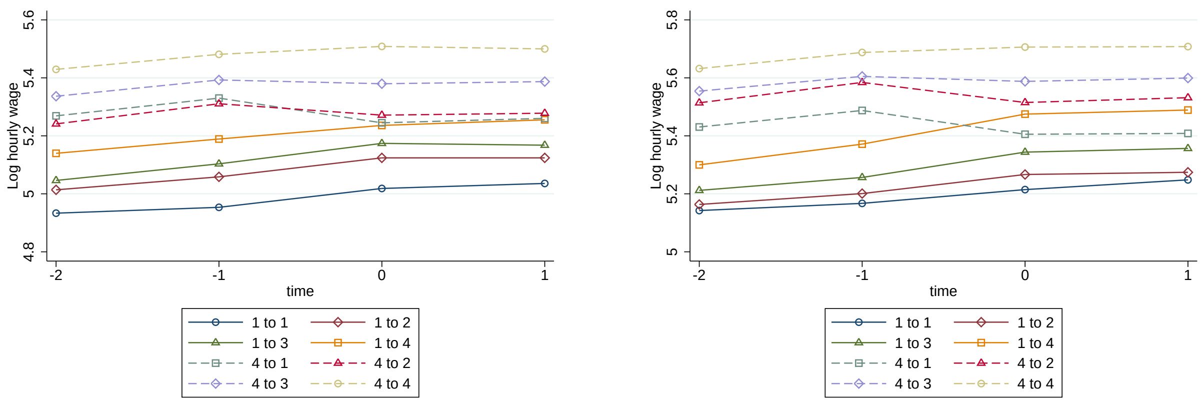
This measures the log change of the average net-of-tax-rate on labor income faced by high-skilled workers in a firm. We see this as a proxy of the intensity of the effect of the tax reform on firm j. For reasons similar to those discussed in Section 5.5, we use the mechanical change $log\left(\overline{1-\tau^H_{Mjt+3}}\right) - log\left(\overline{1-\tau^H_{jt}}\right)$ defined in equation (13) as an instrument for the actual change defined in equation (43). Z_{jt} is a vector of firm characteristics measured in the base year.

Table D.21 shows the results from this model. The coefficient of interest in these specifications is the one attached to the variable $\Delta log\,(\overline{1 - \tau^{H}})$ that corresponds to γ_1 in equation 42. Each column of the table reports the effects on a different outcome variable y. In column 1 the outcome variable is the log change in firm size, in columns 2 and 3 respectively we analyze the effects on the log change of the share of high-skilled and the share of low-skilled workers in a firms. Finally in column 4 we look at the effects on the amount of physical capital in a firm. The coefficient γ_1 estimated in these specifications remains small and insignificant across all columns. This is reassuring and it corroborates the assumptions that firms did not change their production technologies as an effect of the reform.

D Appendix: Additional Tables and Figures

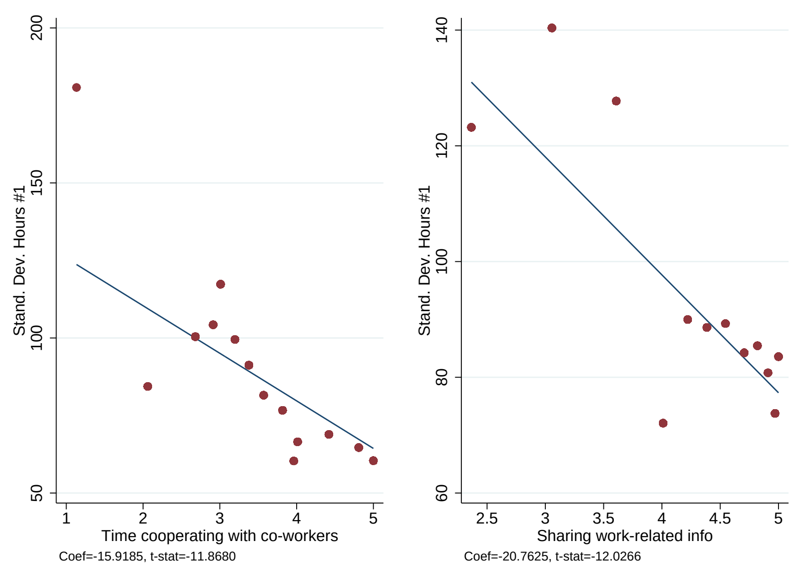
D.1 Additional graphs and tables

Figure D.1: Wage Dynamics of Movers



(a) Females (b) Males

Figure D.2: PIAAC validation exercise coordination



Note: Classification of Sharing work related information: 1-Never, 2-Less than once a month, 3-Less than once a week but at least once a month, 4-At least once a week but not every day, 5-Every day. Classification of Time cooperating with coworkers: 1-None of the time, 2-Up to a quarter of the time, 3- Up to half of the time, 4-More than half of the time, 5-All of the time. We group firms in 20 equally sized bins based on the variable on the x-axis.

Table D.1: Steps of the data preparation

	Obs.	**Workers**	**Firms**	**Obs. share tot.**	**Workers share tot.**	**Firms share tot.**
1. Entire Population	22,379,298	3,518,236	266,196	100	100	100
2. Lønstatistikken sample	12,130,358	2,649,618	39,778	54.20	75.31	14.94
3. Firms administrative data sample	5,211,149	1,485,789	29,957	23.29	42.23	11.25
4. Keep firms with more than 2 workers	5,209,536	1,485,478	29,576	23.28	42.22	11.11
5. Keep full time workers only	4,476,222	1,207,580	29,116	20.00	34.32	10.94
6. Drop Outliers in hours and income	4,466,676	1,205,301	29,111	19.96	34.26	10.94
7. Keep firms with less than 5% of obs. missing	787,683	400,653	8,293	3.52	11.39	3.12

Notes: Workers younger than 15 and older than 65 are excluded from the entire population.

Table D.2: Summary Statistics of the AKM regression

	All Sample	Largest group of connected firms
Person and estabilishment parameters		
Number of person effects	1205295	1195884
Number of firm effects	26227	26121
Summary of parameters estimates		
Std. dev. of person effects	0.962	0.960
Std. dev. of firm effects	0.141	0.137
Std. dev. Of Xb	0.829	0.828
Adjusted R-squared	0.913	
Std. dev. of log wages	0.451	0.450
Number of person-year observations	4466655	4445484

Notes:Controls in first step (AKM) regressions: year dummies interacted with education dummies, quadratic and cubic terms in age interacted with education dummies, VA per employee, capital per employee, sales per employee, exporter status, fraction of salaried workers

Table D.3: Coordination index by sector using TUS data

	Coordination index
Agriculture, forestry and fishing, mining and quarrying	0.833
Manufacturing	0.978
Construction	0.956
Electricity, gas, steam and air conditioning supply, trade and transport	0.982
Financial and insurance, Real estate, Other business	0.986
Public administration, education, health, arts	0.929
Observations	748

Table D.4: Mobility and wage changes: Males

		Log wages of movers (mean)		Log wage change	
Origin to destination quartile	Number of moves	2 years before	2 years after	Raw	Adjusted
1 to 1	2895	5.14	5.25	0.11	0.00
1 to 2	1515	5.16	5.28	0.12	0.03
1 to 3	965	5.21	5.36	0.15	0.05
1 to 4	500	5.29	5.48	0.19	0.09
2 to 1	960	5.22	5.25	0.03	-0.06
2 to 2	2443	5.29	5.35	0.06	-0.02
2 to 3	1824	5.33	5.43	0.10	0.02
2 to 4	925	5.39	5.51	0.13	0.04
3 to 1	612	5.37	5.37	0.00	-0.07
3 to 2	2110	5.39	5.43	0.05	-0.03
3 to 3	6217	5.40	5.46	0.06	0.00
3 to 4	2120	5.49	5.59	0.10	0.02
4 to 1	304	5.43	5.41	-0.02	-0.10
4 to 2	760	5.51	5.55	0.03	-0.05
4 to 3	2354	5.55	5.60	0.05	-0.02
4 to 4	6395	5.62	5.70	0.08	0.00

Notes: Entries are observed mean log real hourly wages in the period 2003-2011 for job changers with at least 2 years of wages at the old and new job. Job refers to the firm of main occupation in the year. Origin/destination quartiles are based on mean wages of coworkers in year before (origin) or year after (destination) job move. Four year wage changes in regressions-adjusted include controls for age, age squares and cubs, education dummies, and quadratic in age fully interacted with education.

Table D.5: Mobility and wage changes: Females

		Log wages of movers (mean)		Log wage change	
Origin to destination quartile	Number of moves	2 years before	2 years after	Raw	Adjusted
1 to 1	2869	4.94	5.04	0.10	0.00
1 to 2	759	5.01	5.12	0.11	0.02
1 to 3	496	5.04	5.17	0.13	0.03
1 to 4	240	5.12	5.24	0.12	0.03
2 to 1	511	5.08	5.12	0.04	-0.05
2 to 2	1128	5.11	5.18	0.07	-0.01
2 to 3	869	5.13	5.23	0.10	0.01
2 to 4	465	5.19	5.29	0.10	0.01
3 to 1	324	5.15	5.17	0.03	-0.06
3 to 2	873	5.18	5.24	0.06	-0.02
3 to 3	2934	5.24	5.30	0.06	0.00
3 to 4	1064	5.29	5.40	0.11	0.02
4 to 1	195	5.27	5.27	0.00	-0.08
4 to 2	419	5.24	5.28	0.04	-0.05
4 to 3	1371	5.34	5.39	0.05	-0.01
4 to 4	3177	5.41	5.49	0.07	-0.01

Notes: Entries are observed mean log real hourly wages in the period 2003-2011 for job changers with at least 2 years of wages at the old and new job. Job refers to the firm of main occupation in the year. Origin/destination quartiles are based on mean wages of coworkers in year before (origin) or year after (destination) job move. Four year wage changes in regressions-adjusted include controls for age, age squares and cubs, education dummies, and quadratic in age fully interacted with education.

Table D.6: Dynamics in Hours of Movers

Average change in annual hours worked by movers (%)
Breakdown by quartiles of the coworkers wage distribution

Type of origin firm	Males		Females	
	Obs.	Mean change (%)	Obs.	Mean change (%)
1st Quartile	6709	0.05	4920	-0.25
2nd Quartile	7182	0.01	3444	-0.31
3rd Quartile	12924	0.27	5952	0.06
4th Quartile	11549	0.04	5913	-0.39

Mean change (%) in annual hours worked by movers
Detailed Breakdown for movers in the 1st and 4th quartile

Sending to Receiving firm	Males		Females	
	Obs.	Mean change (%)	Obs.	Mean change (%)
1st to 1st	3284	0.02	3202	0.43
1st to 2nd	1775	0.04	853	-1.06
1st to 3rd	1084	0.08	575	-0.40
1st to 4th	566	0.24	290	0.04
4th to 1st	351	0.01	220	-0.52
4th to 2nd	995	0.00	502	-0.70
4th to 3rd	2709	0.23	1541	0.10
4th to 4th	7494	0.07	3650	-0.45
Mean Hours		1935		1930

Notes: Panel A in the table shows the average percentage change in hours worked by movers broken down the quartile of the coworkers wage distribution of the sending firm. In Panel b we then further break down the hours change within the 1st and 4th of the sending firm depending on the quartile of the coworkers wage distribution of the receiving firm. We do this in each interval 2003-2007, 2004-2008, 2005-2009, 2006-2010 and 2007-2011. In the table we show the average change across these periods.

Table D.7: Desired Hours by Skill Groups

Skills Definion 1	Average desired weekly hours	Obs.
skill $\leq$ 10th percentile	37.34	465
10th percentile$<$ skill $<$ 20th percentile	36.78	462
20th percentile$<$ skill $<$ 30th percentile	37.69	463
30th percentile$<$ skill $\leq$40th percentile	37.72	461
40th percentile$<$ skill $\leq$ 50th percentile	38.55	461
50th percentile$<$ skill $\leq$ 60th percentile	38.33	463
60th percentile$<$ skill $\leq$ 70th percentile	38.48	463
70th percentile$<$ skill $\leq$ 80th percentile	39.33	461
80th percentile$<$ skill $\leq$ 90th percentile	38.79	462
skill $>$ 90th percentile	40.42	461
Skills Definition 2	**Average desired weekly hours**	
Primary education, blue collar	37.67	963
Secondary education, blue collar	37.73	1,512
Tertiary education, blue collar	38.31	106
Primary education, middle manager	38.39	245
Secondary education, middle manager	38.25	852
Tertiary education, middle manager	39.17	693
Primary education, manager	41.55	43
Secondary education, manager	41.72	113
Tertiary education, manager	43.97	96

Notes: Information on desired hours is obtained from the 2008-2010 Danish labor force survey data. We focus on workers whose reference week is in November to better match information in the Labor Force Survey to registers data. Skills Definition 1 refers to skill groups defined as deciles of the distribution of $\alpha_i + \beta X_{ijt}$ from the AKM regression model. AKM regressions are estimated on the years 2008-2010. Skills definition 2 refers to skill groups defined at the intersection of occupational and educational category.

Table D.8: Coordination and wage differentials: Measurement error and regular hours

	(1) Firm f.e.	(2) Firm f.e.	(3) Firm f.e.	(4) Firm f.e.	(5) Firm f.e.
Stand. Dev. Tot. Hours	-0.342**		-0.069***	-0.072***	-0.061***
	(0.172)		(0.018)	(0.018)	(0.017)
Median Abs. Dev. Tot. Hours		-0.085***			
		(0.015)			
Firm size	0.003	0.010	0.009	0.148*	0.004
	(0.006)	(0.007)	(0.007)	(0.075)	(0.004)
Exporter status	0.023	0.072***	0.065***	0.059***	0.051***
	(0.029)	(0.018)	(0.016)	(0.019)	(0.015)
Union. Rate	0.068**	0.035	0.030	0.030	0.020
	(0.029)	(0.023)	(0.023)	(0.022)	(0.023)
Female Share	-0.113***	-0.108**	-0.104**	-0.087**	-0.111**
	(0.038)	(0.042)	(0.044)	(0.040)	(0.044)
Average Hours	0.024	-0.001	0.008	0.006	0.002
	(0.043)	(0.025)	(0.026)	(0.027)	(0.025)
log(Cap/empl)	0.019	0.029**	0.025*	0.038***	0.028**
	(0.015)	(0.013)	(0.013)	(0.014)	(0.013)
Numb. of skill groups					0.072***
					(0.012)
(Intang. Assets)/empl			0.019**		
			(0.009)		
O*NET IV	YES	NO	NO	NO	NO
Multi-plant firms	YES	YES	YES	NO	YES
Coordination Share		0.279	0.256	0.273	0.200
F-stat excl. instr.	8.942				
R-sq	0.020	0.118	0.101	0.101	0.105
N	6089	7374	7312	5695	7312

*Notes: The Stand. Dev. of Total hours is the standard deviation of the average hours worked across skill groups within a firm. The Median Abs. Dev. is the the median absolute deviation of median hours across each skill groups within a firm. Skill groups are defined as deciles of the distribution of $\alpha_i + \beta X_{ijt}$ from the AKM model. O*NET IV refers to a vector composed by the average importance of the Contact, Teamwork and Communication in the firm (Section 4.3). All regressions show standardized coefficients. Exporter and industry dummies are based on the median value between 2003 and 2011. (Cap/emp) stands for physical capital per employee. Intang. Assets/empl indicates Intangible assets per employee. All regression include a vector of controls for the share of workers in each skill group and for the average value of the individual fixed effects α_i in each quartile of the distribution of α_i within a firm. Coordination Share is derived as the ratio of "Part. R-sq SD Hours" and "Part. R-sq VA and Sales". Standard errors are clustered at the 2-digit industry level. *, ** and *** are 10, 5 and 1 percent significance levels.*

Table D.9: Wage differentials and coordination: additional robustness

	(1) Firm f.e.	(2) Firm f.e.	(3) Firm f.e.	(4) Firm f.e.	(5) Firm f.e.	(6) Firm f.e.
Stand. Dev. Def. 1	-0.041***	-0.021**	-0.051***		-0.030*	
	(0.011)	(0.010)	(0.018)		(0.016)	
Median Abs. Dev. Def. 1				-0.069***		-0.034***
				(0.016)		(0.012)
Firm size	0.007***	0.011***	0.010	0.011	0.009	0.010
	(0.002)	(0.002)	(0.007)	(0.008)	(0.007)	(0.008)
Exporter status	0.048***	0.022**	0.044***	0.042***	0.013	0.012
	(0.011)	(0.009)	(0.015)	(0.016)	(0.009)	(0.009)
Union. Rate	0.041***	0.040***	0.038	0.042	0.027	0.029
	(0.015)	(0.013)	(0.026)	(0.026)	(0.018)	(0.018)
Female Share	-0.150***	-0.089***	-0.131***	-0.134***	-0.055**	-0.057**
	(0.039)	(0.020)	(0.044)	(0.042)	(0.027)	(0.026)
Average Hours	-0.021**	-0.045***	-0.015	-0.028	-0.045**	-0.055**
	(0.010)	(0.010)	(0.024)	(0.022)	(0.022)	(0.021)
log(Cap/empl)	0.022*	0.036***	0.026**	0.026**	0.017	0.017
	(0.013)	(0.010)	(0.012)	(0.012)	(0.012)	(0.012)
Connected set sample	YES	YES	NO	NO	NO	NO
3 digits Sector f.e.	NO	YES	NO	NO	NO	NO
3-year sub-period f.e.	NO	NO	NO	NO	YES	YES
AKM individual controls	NO	NO	YES	YES	NO	NO
Part. R-sq SD Hours	0.002	0.001	0.003	0.003	0.001	0.001
Part. R-sq VA and Sales	0.022	0.008	0.014	0.014	0.004	0.004
Coordination Share	0.084	0.074	0.182	0.209	0.198	0.190
R-sq	0.153	0.200	0.092	0.094	0.380	0.380
N	20766	20766	7305	7305	8487	8487

*Notes: The Stand. Dev. of Total hours is the standard deviation of the average hours worked across skill groups within a firm. The Median Abs. Dev. is the the median absolute deviation of median hours across each skill groups within a firm. Skill groups are defined as deciles of the distribution of $\alpha_i + \beta X_{ijt}$ from the AKM model. All regressions show standardized coefficients. Exporter and industry dummies are based on the median value between 2003 and 2011. (Cap/empl) stands for physical capital over number of full-time equivalent employees. Specifications (7) also include quadratic and cubic terms of value added per employee. All regression include a vector of controls for the share of workers in each skill group and for the average value of the individual fixed effects α_i in each quartile of the distribution of α_i within a firm. Coordination Share is derived as the ratio of "Part. R-sq SD Hours" and "Part. R-sq VA and Sales". Standard errors are clustered at the 2-digit industry level. *, ** and *** are 10, 5 and 1 percent significance levels.*

Table D.10: Value Added, Sales and and wage premiums relative to Table 4

	(1) Firm f.e.	(2) Firm f.e.	(3) Firm f.e.	(4) Firm f.e.	(5) Firm f.e.	(6) Firm f.e.
log(VA/empl)	0.122***	0.095***	0.168***	0.168***	0.166***	0.157***
	(0.020)	(0.019)	(0.020)	(0.025)	(0.021)	(0.022)
TFP	0.049	0.031	0.097***	0.113***	0.096***	0.059**
	(0.034)	(0.024)	(0.029)	(0.029)	(0.029)	(0.023)
Firm size		0.016**	0.013*	0.041***	0.013*	0.013**
		(0.007)	(0.007)	(0.012)	(0.007)	(0.006)
Exporter status		0.062***	0.046***	0.047**	0.047***	0.037***
		(0.017)	(0.015)	(0.020)	(0.015)	(0.013)
Union. Rate		-0.001	0.038	0.045	0.039	0.067***
		(0.026)	(0.024)	(0.031)	(0.024)	(0.025)
Female Share		-0.058	-0.107***	-0.111***	-0.105***	-0.098***
		(0.040)	(0.035)	(0.035)	(0.035)	(0.020)
Average Hours		-0.020	-0.031	-0.030*	-0.030	-0.063***
		(0.022)	(0.021)	(0.018)	(0.021)	(0.023)
log(Cap/empl)		0.019	-0.008	0.023	-0.007	-0.007
		(0.012)	(0.013)	(0.016)	(0.013)	(0.015)
Persuasion						-0.188**
						(0.074)
Social Perceptiveness						0.025
						(0.044)
Adjust Actions to others						0.005
						(0.017)
Negotiation						0.254**
						(0.097)
Region F.E.	NO	YES	YES	YES	YES	YES
Compos. cntr	NO	NO	YES	YES	YES	YES
Ability Measures	NO	NO	YES	YES	YES	YES
Av. Hours b/w 36.5 and 37.5	YES	YES	YES	NO	YES	YES
Part. R-sq VA and Sales	0.022	0.010	0.032	0.038	0.032	0.020
R-sq	0.022	0.041	0.148	0.153	0.147	0.165
N	7117	7117	7060	4279	7047	5904

*Notes: All regressions show standardized coefficients. Exporter and industry dummies are based on the median value between 2003 and 2011. (Cap/empl) stands for physical capital over number of full-time equivalent employees. All specifications control for quadratic and cubic functions of value added per employee and TFP. TFP is obtained from as described in Appendix B.4. "Compos. cntr" refers to a vector of controls for the share of workers in each skill group. "Ability Measures" indicate a vector containing the average value of the individual fixed effects α_i in each quartile of the distribution of α_i within a firm. Coordination Share is derived as the ratio of "Part. R-sq SD Hours" and "Part. R-sq VA and Sales". Standard errors are clustered at the 2-digit industry level. *, ** and *** are 10, 5 and 1 percent significance levels.*

Table D.11: Value Added, Sales and and wage premiums relative to Table 5

	(1) Firm f.e.	(2) Firm f.e.	(3) Firm f.e.
log(VA/empl)	0.159***	0.148***	0.142***
	(0.019)	(0.020)	(0.019)
TFP	0.122***	0.083***	0.084***
	(0.029)	(0.021)	(0.021)
Firm size	0.012**	0.007*	0.018*
	(0.005)	(0.004)	(0.010)
Exporter status	0.034**	0.018	0.010
	(0.013)	(0.012)	(0.012)
Union. Rate	0.044*	0.042	0.043
	(0.026)	(0.028)	(0.028)
Female Share	-0.136***	-0.083***	-0.066***
	(0.030)	(0.023)	(0.025)
Average Hours	-0.041**	-0.052***	-0.057***
	(0.017)	(0.018)	(0.017)
log(Cap/empl)	-0.005	-0.001	0.006
	(0.013)	(0.013)	(0.011)
Region f.e.	YES	YES	YES
Compos. and Ability cntr.	YES	YES	YES
1 digit Sector f.e.	YES	NO	NO
2 digits Sector f.e.	NO	YES	NO
3 digits Sector f.e.	NO	NO	YES
Part. R-sq VA and Sales	0.033	0.016	0.014
R-sq	0.156	0.183	0.188
N	7055	7055	7055

*Notes: Notes: All regressions show standardized coefficients. Exporter and industry dummies are based on the median value between 2003 and 2011. All specifications control for quadratic and cubic functions of value added per employee and TFP. TFP is obtained as described in Appendix B.4. "Compos. cntr" refers to a vector of controls for the share of workers in each skill group. "Ability Measures" indicate a vector containing the average value of the individual fixed effects α_i in each quartile of the distribution of α_i within a firm. Coordination Share is derived as the ratio of "Part. R-sq SD Hours" and "Part. R-sq VA and Sales". Standard errors are clustered at the 2-digit industry level. *, ** and *** are 10, 5 and 1 percent significance levels.*

Table D.12: Income Types in the Danish Tax System

Acronym	**Income Type**	**Main Intems Included**
LI	Labor income	Salary, wages, honoraria, fees, bonuses, fringe benefits, business earnings
PI	Personal income	LI+ transfers, grants, awards, gifts, received alimony -Labor market contribution, certain pension contributions
CI	Capital income	Interest income, rental income, business capital income -interest on debt (mortgage, bank loan, credit cards, student loans)
D	Deductions	Commuting costs, union fees, UI contribution, other work expenditures, charity, paid alimony
PCP		Private capital pension contribution
ECP		Employer paid capital pension contribution
TI	Taxable income	PI+CI-D
SI	Stock Income	Dividends and realized capital gains from shares

Table D.13: Personal Income Tax System in Denmark

	2008			2009		
Tax type	**Base**	**Rate**	**Tax Bracket (DKK)**	**Base**	**Rate**	**Tax Bracket (DKK)**
Regional tax*	TI	33.16		TI	33.21	
National taxes						
Bottom tax	PI+CI(>0)	5.48	0 - 279799	PI+CI(>0)	5.04	0 - 347199
Middle tax	PI +CI(>0)	6.0	279800 - 335799	PI +CI(>0)	6.0	>347200
Top tax	PI+CI(>0)+PCP+ECP	15.0	335800	PI +CI(>0)+PCP+ECP	15.0	>347200
Labor market contribution	LI	8.0		LI	8.0	
EITC	LI	4.0		LI	4.25	
Tax on stock income	SI	28.0, 43.0, 45.0		SI	28.0, 43.0. 45.0	
Marginal tax ceiling	PI/CI/TI	59.0		PI/CI/TI	59.0	

	2010			2011		
Tax type	**Base**	**Rate**	**Tax Bracket (DKK)**	**Base**	**Rate**	**Tax Bracket (DKK)**
Regional tax*	TI	33.32		TI	33.38	
National taxes						
Bottom tax	PI+CI(>0)	3.67	0 - 389899	PI+CI(>0)	3.64	0 - 389899
Middle tax	-	-		-	-	
Top tax	PI +CI(>40000)+PCP+ECP	15.0	>389900	PI +CI(>40000)+PCP+ECP	15.0	>389900
Labor market contribution	LI	8.0		LI	8.0	
EITC	LI	4.25		LI	4.25	
Tax on stock income	SI	28.0, 42.0		SI	28.0, 42.0	
Marginal tax ceiling	PI/CI/TI	51.5		PI/CI/TI	51.5	

Notes: Acronyms are explained in Table D.12. The regional tax includes municipal, county and church taxes. The Regional Tax Rate in the table is the average across municipalities. Tax rates are cumulative. For example, the marginal tax rate in the top bracket (in the average municipality) in 2008 is equal to 33.16 + 5.48 + 6 + 15 = 59.64 percent. Since this exceeds the marginal tax ceiling (59 percent) however, the ceiling is binding. For labor income, there is a labor market contribution of 8 percent on top of the tax ceiling, but at the same time labor income enters all the other tax bases net of the labor market contribution. The effective tax ceiling on labor income in 2008 is therefore equal to 8.0 + (1 0.08) 59.0 = 62.3 percent. The sum of regional and National taxes (with the exclusion of the stock income tax) can not exceed the Marginal Tax ceiling.

Table D.14: Elasticity of high-skilled hours: normal hours worked

	(1) $\Delta log\, h^H$	(2) $\Delta log\, h^H$	(3) $\Delta log\, h^H$
$\Delta log\,(1-\tau^H)$	-0.022***	-0.050***	-0.028**
	(0.007)	(0.016)	(0.013)
Log base-year income			-0.008***
			(0.002)
IV	NO	YES	YES
Region F.E.	YES	YES	YES
Overtime Hours	NO	NO	NO
Mean Hours	1888.27	1888.27	1888.27
F-stat Excl. Inst.		1355.00	754.53
P-value Excl. Inst.		0.00	0.00
N Firms	1166	1166	1166
N	26489	26489	26489

*Notes: Each regression contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects,firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). We only consider regular hours worked. Observations are weighted by labor income. Standard errors in parentheses are clustered at the firm level. First Stage Regressions are available from the authors upon request. * p<0.10, ** p<0.05, *** p<0.01.*

Table D.15: Elasticity of hours of workers in the residual group

	(1) $\Delta log\, h^H$	(2) $\Delta log\, h^H$	(3) $\Delta log\, h^H$	(4) $\Delta log\, h^H$	(5) $\Delta log\, h^H$	(6) $\Delta log\, h^H$
$\Delta log\,(1-\tau^{Residual})$	-0.014**	0.007	0.007	0.011		0.017
	(0.006)	(0.020)	(0.019)	(0.020)		(0.026)
$\Delta log\,(1-\tau^{Residual}_{5th})$					0.011	
					(0.024)	
IV	NO	YES	YES	YES	YES	YES
Splines of inc. at t	NO	NO	YES	NO	NO	YES
Splines of log t-1 inc. and Δ log inc. t-1-t	NO	NO	NO	YES	NO	NO
5th ord. polynomial inc. t	NO	NO	NO	NO	YES	NO
Base-year inc. above median only	NO	NO	NO	NO	NO	YES
Mean Hours	1876.15	1876.15	1876.15	1879.48	1870.05	1878.65
F-stat Excl. Inst.		407.80	476.59	348.64	377.72	291.47
P-value Excl. Inst.		0.00	0.00	0.00	0.00	0.00
N Firms	932	932	932	792	965	742
N	6246	6246	6246	4962	4958	3123

*Notes: Each regression contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects,firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). We only consider regular hours worked. Observations are weighted by labor income. Standard errors in parentheses are clustered at the firm level. First Stage Regressions are available from the authors on request. * p<0.10, ** p<0.05, *** p<0.01.*

Table D.16: Elasticity of hours and labor income: extra specifications

	(1) $\Delta log h^H$	(2) $\Delta log h^H$	(3) $\Delta log h^H$	(4) $\Delta log(\, Labor\, income^H)$
$\Delta log(1-\tau^H)$	0.071**	-0.063*	-0.045***	0.0336***
	(0.035)	(0.037)	(0.015)	(0.0087)
Log base-year income	-0.012	-0.003	-0.008***	-0.1988***
	(0.012)	(0.005)	(0.003)	(0.0063)
Women with kids only	YES	NO	NO	NO
Workers at kinks	YES	YES	NO	YES
Top 10\% income only	NO	YES	NO	NO
Mean Hours	1888.72	1951.85	1927.68	
F-stat Excl. Inst.	189.17	14.46	678.35	5.66e+04
P-value Excl. Inst.	0.00	0.00	0.00	0.00
N	2998	2648	24736	1865067

*Notes: Regression in columns 1 to 3 contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects,firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). We consider both regular and overtime hours worked. In column 4 to be consistent with Kleven and Schultz (2014) we include the following controls: labor market experience, experience, squared, age, gender, marital status, number of kids aged 018 years, educational degree, industry, municipality, local unemployment rate, and base-year fixed effects. Observations are weighted by labor income. Standard errors in parentheses are clustered at the firm level. First Stage Regressions are available from the authors on request. * p<0.10, ** p<0.05, *** p<0.01.*

Table D.17: Elasticity of high-skilled hours: income controls

	(1) High Coord. Top 50%	(2) Low Coord. Bottom 50%	(3) High Coord. Top 50%	(4) Low Coord. Bottom 50%	(5) High Coord. Top 50%	(6) Low Coord. Bottom 50%
Dependent Variable	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^H$
$\Delta log\,(1-\,\tau^H)$	-0.020	-0.082***			-0.024**	-0.072**
	(0.014)	(0.027)			(0.012)	(0.029)
$\Delta log\,(1-\,\tau\_5th^H)$			-0.023	-0.115***		
			(0.022)	(0.031)		
IV	YES	YES	YES	YES	YES	YES
Region F.E.	YES	YES	YES	YES	YES	YES
Splines of inc. at t	YES	YES	NO	NO	NO	NO
5th ord. polynomial inc. t	NO	NO	YES	YES	NO	NO
Splines of log t-1 inc. and Δ log inc. t-1-t	NO	NO	NO	NO	YES	YES
Pvalue High=Low	0.05		0.02		0.02	
Mean Hours	1904.10	1847.66	1904.29	1850.89	1907.00	1853.11
F-stat Excl. Inst.	1298.25	461.91	307.72	79.46	857.62	250.09
P-value Excl. Inst.	0.00	0.00	0.00	0.00	0.00	0.00
N Firms	584	583	584	581	537	519
N	19067	7421	17852	6814	15619	5649

*Notes: Each regression contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects,firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). "Splines" refer to a flexible piecewise linear functional form with 5 components. τ_{5th} refers to marginal tax rates obtained as in Dahl and Lochner (2012). "P-value High=Low" refers to the p-value of the null hypothesis that the coefficient attached to $\Delta log\,(1-\,\tau^H)$ in low and high-coordination firms is equal. Observations are weighted by labor income. Coordination is measured using Std. Dev. Definion 1. Standard errors in parentheses are clustered at the firm level. First Stage Regressions are available from the authors on request. * p<0.10, ** p<0.05, *** p<0.01.*

Table D.18: Spillover effects: income controls

	(1) $\Delta log\, h^L$	(2) $\Delta log\, h^L$	(3) $\Delta log\, h^L$
$\Delta log\, \overline{h^H}$	1.152***	1.160***	1.115**
	(0.373)	(0.365)	(0.464)
$\Delta log\, (1-\tau^L)$	0.050	0.044	
	(0.105)	(0.123)	
$\Delta log\, (1-\tau^L_{5th})$			0.030**
			(0.015)
Log base-year income	YES	NO	NO
Splines of inc. at t	NO	YES	NO
5th ord. polynomial inc. t	NO	NO	YES
F-stat Excl. Inst. 13.65, 105.11	17.17, 62.25	3.91, 459.04	
P-value Excl. Inst.	0.00, 0.00	0.00, 0.00	0.05, 0.00
Mean Hours Low Sk.	1809.02	1809.02	1809.49
Mean Hours High Sk.	1877.51	1877.51	1877.50
N Firms	1157	1157	1151
N	14402	14402	13654

*Notes: Each regression contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects, firm size, exporter status, share of high and low-skilled workers in the firm. "Splines" refer to a flexible piecewise linear functional form with 5 components. τ_{5th} refers to marginal tax rates obtained as in Dahl and Lochner (2012). Observations are weighted by labor income. First Stage Regressions are available from the authors on request. Standard errors in parentheses are clustered at the firm level. * p<0.10, ** p<0.05, *** p<0.01.*

Table D.19: Elasticity of high-skilled hours: alternative definitions of coordination and data on hours

	(1) High Coord. Top 50% Def. 2	(2) Low Coord. Bottom 50% Def. 2	(3) Low Coord. Bottom 50% Def. 2	(4) Low Coord. Bottom 50% Def. 2	(5) High Coord. Top 50% BFL Hours	(6) Low Coord. Bottom 50% BFL Hours	(7) BFL Hours
Dependent variable	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^L$	$\Delta log\, h^L$	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^L$
$\Delta log\,(1-\tau^H)$	-0.001	-0.092***			-0.008	-0.091**	
	(0.012)	(0.022)			(0.041)	(0.042)	
$\Delta log\,\overline{h^H_{normal}}$			0.684**				
			(0.307)				
$\Delta log\,\overline{h^H_{total}}$				0.760**			
				(0.319)			
$\Delta log\,\overline{h^H_{blf}}$							1.015**
							(0.400)
$\Delta log\,(1-\tau^L)$			-0.016	-0.077			0.187
			(0.107)	(0.113)			(0.291)
Log base-year income	-0.001	-0.022***			-0.022**	-0.010	
	(0.002)	(0.007)			(0.009)	(0.010)	
Overtime hours	YES	YES	NO	YES	NO	NO	NO
BFL hours	NO	NO	NO	NO	YES	YES	YES
Mean Hours	1905.27	1863.52	1760.44	1783.84	1901.01	1854.16	1851.93
Pvalue High=Low	0.00				0.15		
F-stat Excl. Inst.	1034.04	282.28	5.43,35.78	9.88,35.78	962.85	179.52	1.37,33.69
P-value Excl. Inst.	0.00	0.00	0.00,0.00	0.00,0.00	0.00	0.00	0.26,33.69
N Firms	583	583	489	489	477	521	802
N	15701	10788	4749	4749	15521	6330	8562

*Notes: Each regression contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects, firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). Column 3, 4 and 7 contain controls for flexible piecewise linear functions with 5 components of income at t-1 and the change in income between t-1 and t. BFL hours refer to hours from E-indkomst. Total hours refer to the sum of normal and overtime hours. Coordination is measured using the St. Dev definition 2 in columns 1 to 4 and the St. Dev. definition 1 in columns 5 to 7. Observations are weighted by labor income. Standard errors in parentheses are clustered at the firm level. First Stage Regressions are available from the authors on request. * p<0.10, ** p<0.05, *** p<0.01.*

Table D.20: Uncompensated elasticity and virtual income

	(1) High Coord. Top 50%	(2) Low Coord. Bottom 50%	(3)
Dependent variable	$\Delta log\, h^H$	$\Delta log\, h^H$	$\Delta log\, h^L$
$\Delta log\,(1-\tau^H)$	-0.028**	-0.552	
	(0.014)	(6.212)	
$\Delta log\, vy^H$	-0.013	-1.154	
	(0.017)	(15.801)	
$\Delta log\, \overline{h^H}$			0.957***
			(0.283)
$\Delta log\,(1-\tau^L)$			-0.008
			(0.065)
$\Delta log\, vy^L$			-0.008
			(0.020)
Log base-year income	0.002	0.429	0.010
	(0.007)	(6.200)	(0.013)
Overtime hours	YES	YES	NO
Mean Hours	1924.91	1907.33	1812.58
Pvalue $\Delta log\,(1-\tau^H)$ High=Low	0.98		
Pvalue $\Delta log\, vy^H$ High=Low	0.98		
F-stat Excl. Inst.	2049,43.8	0.65,0.01	23.84,5,78,29.7
N Firms	583	584	968
N	18824	7618	10066

*Notes: Each regression contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects,firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). In column 3 we only consider regular hours worked. Observations are weighted by labor income. "P-value $\Delta log\,(1-\tau^H)$ High=Low" refers to the p-value of the null hypothesis that the coefficient attached to $\Delta log\,(1-\tau^H)$ in low and high-coordination firms is equal. "P-value $\Delta log\,(1-vy^H)$ High=Low" refers to the p-value of the null hypothesis that the coefficient attached to $\Delta log\,(1-vy^H)$ in low and high-coordination firms is equal. First Stage Regressions are available from the authors on request. Standard errors in parentheses are clustered at the firm level. * p<0.10, ** p<0.05, *** p<0.01.*

Table D.21: The effects of the tax reform on firm characteristics

	(1)	(2)	(3)	(4)
	$\Delta log\,(FirmSize)$	$\Delta log\,(ShareHighSk.)$	$\Delta log\,(ShareLowSk.)$	$\Delta log\,(PhysicalCapital)$
$\Delta log\,(\overline{1-\tau^H})$	-0.204	0.161	-0.466	0.063
	(0.398)	(0.349)	(0.357)	(1.481)
Firm Size	-0.000	0.000	-0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Ind. Exp.	-0.055***	0.034**	-0.071***	0.251**
	(0.020)	(0.016)	(0.022)	(0.101)
Ind. Mupltiplant	-0.036*	-0.011	0.025	0.003
	(0.021)	(0.014)	(0.020)	(0.106)
Share of Low Sk.	0.053	-0.527***	-0.214	-0.599
	(0.100)	(0.089)	(0.141)	(0.567)
Share of High Sk.	0.042	-0.128	-0.800***	-0.315
	(0.095)	(0.081)	(0.125)	(0.542)
Mean Log base year (t) income	-0.047	-0.011	0.243**	0.299
	(0.116)	(0.068)	(0.111)	(0.455)
IV	YES	YES	YES	YES
Region F.E.	YES	YES	YES	YES
F-stat Excl. Inst.	116.04	116.04	116.04	117.07
P-value Excl. Inst.	0.00	0.00	0.00	0.00
N Firms	968	968	968	963

*Notes: Each regression contains the following additional controls measured in the base year: average work experience, average work experience squared, share of males, share of married workers, average workers age, average number of children per worker, local unemployment (firm municipality), share of primary, secondary and tertiary educated workers region fixed effects. "Mech." stands for mechanical change. First Stage Regressions are available from the authors on request. F-stat Excl. Inst. refers to the Angrist-Pischke F-statistic. Standard errors in parentheses are clustered at the firm level. * p<0.10, ** p<0.05, *** p<0.01.*

Table D.22: First Stage regression relative to Table 6

	(2)	(3)	(4) High Coord. Top 50%	(5) Low Coord. Bottom 50%	(6) High Coord. Top 50%	(7) Low Coord. Bottom 50%
Dependent variable	$\Delta log\,(1-\tau^H)$	$\Delta log\,(1-\tau^H)$	$\Delta log\,(1-\tau^H)$	$\Delta log\,(1-\tau^H)$	$\Delta log\,(1-\tau^H)$	$\Delta log\,(1-\tau^H)$
$\Delta log\,(1-\tau^H)$ Mech.	1.935***	2.086***	1.942***	2.429***	1.942***	2.429***
	(0.053)	(0.076)	(0.054)	(0.175)	(0.054)	(0.175)
Log base-year income		-0.030***	-0.016***	-0.056***	-0.016***	-0.056***
		(0.007)	(0.004)	(0.016)	(0.004)	(0.016)
Overtime Hours	YES	YES	YES	YES	NO	NO
F-stat	1.36e+03	7.55e+02	1.29e+03	1.93e+02	1.29e+03	1.93e+02
p-value	0.00	0.00	0.00	0.00	0.00	0.00
N Firms	1167	1167	584	583	584	583
N	26488	26488	18858	7630	18858	7630

*Notes: Each regression contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects, firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). The abbreviation "Mech." stands for mechanical changes. Observations are weighted by labor income. Coordination is measured using Std. Dev. Definion 1. F-stat Excl. Inst. refers to the Angrist-Pischke F-statistic. Standard errors in parentheses are clustered at the firm level. * p<0.10, ** p<0.05, *** p<0.01.*

Table D.23: First Stage regression relative to Table 7

	(1) High Coord. Top 25%	(2) Low Coord. Bottom 25%	(3) High Coord. Top 50%	(4) Low Coord. Bottom 50%	(5) High Coord. Top 50%	(6) Low Coord. Bottom 50%
Dependent variable	$\Delta log\,(1-\tau^H)$	$\Delta log\,(1-\tau^H)$	$\Delta log\,(1-\tau^H)$	$\Delta log\,(1-\tau^H)$	$\Delta log\,(1-\tau^H)$	$\Delta log\,(1-\tau^H)$
$\Delta log\,(1-\tau^H)$ Mech.	1.952***	2.499***	1.835***	2.182***	1.835***	2.182***
	(0.082)	(0.216)	(0.047)	(0.116)	(0.047)	(0.116)
Log base-year income	-0.010	-0.057***	-0.012***	-0.038***	-0.012***	-0.038***
	(0.006)	(0.014)	(0.004)	(0.008)	(0.004)	(0.008)
Overtime hours	NO	NO	YES	YES	NO	NO
Region f.e.	YES	YES	YES	YES	YES	YES
Firm F.E.	NO	NO	YES	YES	YES	YES
Base-year F.E.	NO	NO	YES	YES	YES	YES
F-stat	566.19	133.53	1542.40	353.25	1542.40	353.25
p-value	0.00	0.00	0.00	0.00	0.00	0.00
N Firms	293	291	785	675	785	675
N	8307	2371	26497	10267	26497	10267

*Notes:Each regression contains the following controls measured in the base year: work experience, work experience squared, sex, age, number of children, marital status, education, local unemployment (municipality),region fixed effects, firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). "Mech." stands for mechanical changes. Observations are weighted by labor income. F-stat Excl. Inst. refers to the Angrist-Pischke F-statistic. Standard errors in parentheses are clustered at the firm level. * p<0.10, ** p<0.05, *** p<0.01*

Table D.24: First Stage regression relative to Table 8

	(1) $\Delta log\,\overline{h^H}$	(2) $\Delta log\,(1-\tau^L)$	(3) $\Delta log\,\overline{h^H}$	(4) $\Delta log\,(1-\tau^L)$	(5) $\Delta log\,\overline{h^H}$	(6) $\Delta log\,(1-\tau^L)$	(7) $\Delta log\,\overline{h^H}$	(8) $\Delta log\,(1-\tau^L)$	(9) $\Delta log\,\overline{h^H_{total}}$	(10) $\Delta log\,(1-\tau^L)$	(11) $\Delta log\,\overline{h^H_{total}}$	(12) $\Delta log\,(1-\tau^L)$
$\Delta log\,(\overline{1-\tau^H})$ Mech.	-0.432***	-0.185*	-0.432***	-0.178*	-0.438**	0.139	-0.545***	-0.187	-0.277	-0.178*	-0.495**	-0.187
	(0.163)	(0.111)	(0.163)	(0.097)	(0.193)	(0.118)	(0.192)	(0.152)	(0.178)	(0.097)	(0.194)	(0.152)
$\Delta log\,(1-\tau^L)$	-0.063*	0.649***	-0.061	0.492***	-0.061	0.478***	-0.143**	0.858***	-0.038	0.492***	-0.107*	0.858***
	(0.036)	(0.051)	(0.037)	(0.060)	(0.037)	(0.059)	(0.056)	(0.113)	(0.037)	(0.060)	(0.061)	(0.113)
Region F.E.	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Splines of log t-1 Inc. and Δlog inc. t-1-t	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Log Mean Inc. High Sk.	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO
Overtime Hours	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
F-stat Excl. Inst.	13.09	160.40	15.45	76.76	4.66	55.84	11.90	48.55	4.43	76.72	8.39	50.92
P-value Excl. Inst.	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.04	0.00	0.00	0.00
N Firms	968	968	968	968	968	968	484	484	968	968	484	484
N	10091	10091	10091	10091	10091	10091	4100	4100	10091	10091	4100	4100

*Notes: Each regression contains the following controls measured in the base year: work experience, work experience squared,sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects, firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted). Observations are weighted by labor income. "Mech." stands for mechanical change. F-stat Excl. Inst. refers to the Angrist-Pischke F-statistic. Standard errors in parentheses are clustered at the firm level. * p<0.10, ** p<0.05, *** p<0.01 .*

Table D.25: First Stage regression relative to Table 9 columns 1-2

	(1) $\Delta log\,\overline{h}^H_{normal}$	(2) $\Delta log\,(1-\tau^L)$	(3) $\Delta log\,\overline{h}^H \times$ (Share High Sk.>50)	(4) $\Delta log\,\overline{h}^H_{normal}$	(5) $\Delta log\,(1-\tau^L)$
$\Delta log\,(\overline{1-\tau^H})$ Mech.	-0.165	-0.273**	-0.015	-0.441**	-0.017
	(0.241)	(0.135)	(0.025)	(0.194)	(0.092)
$\Delta log\,(1-\tau^L)$	-0.076*	0.892***	0.015	0.007	0.444***
	(0.043)	(0.078)	(0.020)	(0.012)	(0.090)
$\Delta log\,(\overline{1-\tau^H})\,Me. \times$(Share HS>50)	-0.622	-0.757**	-0.794***		
	(0.387)	(0.310)	(0.291)		
Overtime hours	NO	NO	NO	NO	NO
Firm F.E.	NO	NO	NO	YES	YES
Base-year F.E.	NO	NO	NO	YES	YES
F-stat Excl. Inst.	1.20	71.31	37.34	6.23	24.55
P-value Excl. Inst.	0.27	0.00	0.00	0.01	0.00
N Firms	977	977	977	835	835
N	10196	10196	10196	15985	15985

*Notes: Each regression contains the following controls measured in the base year: work experience, work experience squared,sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects, firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted) and 5 components splines of income at t-1 and income change between t-1 and t. "Share HS" indicates share of high-skilled. Observations are weighted by labor income. F-stat Excl. Inst. refers to the Angrist-Pischke F-statistic. Standard errors in parentheses are clustered at the firm level. * p<0.10, ** p<0.05, *** p<0.01*

Table D.26: First Stage regression relative to Table 9 columns 3-5

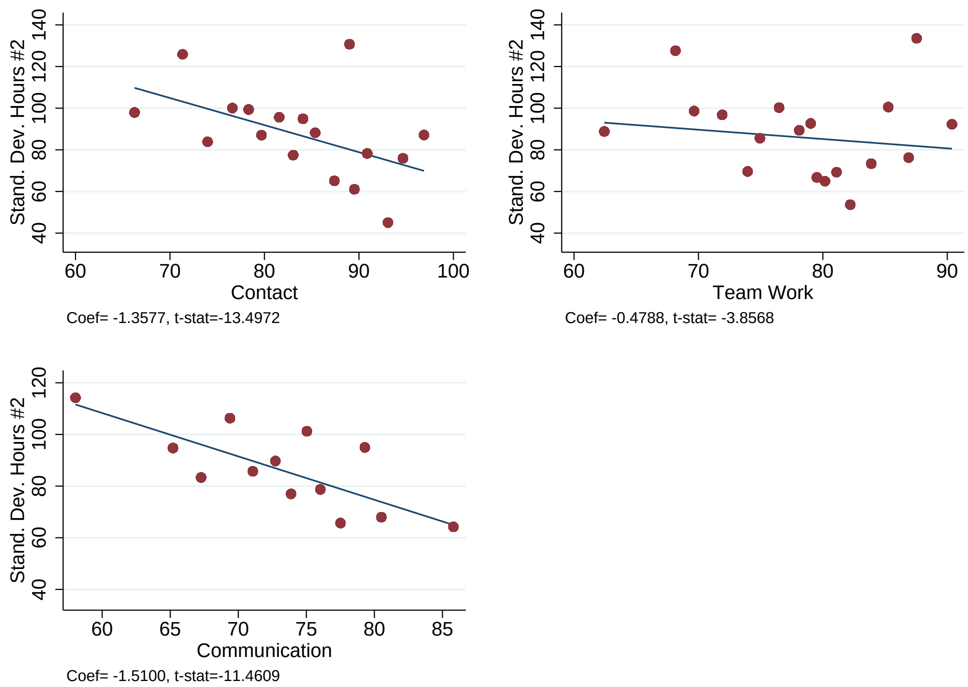
	(1) $\Delta log\,\overline{h}^H_{total}$	(2) $\Delta log\,(1-\tau^L)$	(3) $\Delta log\,(1-\tau^L)$	(4) $\Delta log\,\overline{h}^H_{normal}$	(5) $\Delta log\,\overline{h}^{Residual}_{normal}$	(6) $\Delta log\,\overline{h}^H_{normal}$	(7) $\Delta log\,(1-\tau^L)$
$\Delta log\,(\overline{1-\tau^H})$ Mech.	-0.357	-0.017	-0.541***	-0.346*	0.007	-0.437***	-0.149
	(0.266)	(0.092)	(0.150)	(0.192)	(0.203)	(0.165)	(0.092)
$\Delta log\,(\overline{1-\tau}^{Residual})$ Mech.			0.006	0.105	0.149**		
			(0.069)	(0.071)	(0.065)		
$\Delta log\,(1-\tau^L)$	0.025*	0.444***	0.883***	-0.066	-0.064	-0.063*	0.487***
	(0.015)	(0.090)	(0.079)	(0.041)	(0.044)	(0.038)	(0.059)
Overtime hours	YES	YES	NO	NO	NO	NO	NO
Firm F.E.	YES	YES	NO	NO	NO	NO	NO
Base-year F.E.	YES	YES	NO	NO	NO	NO	NO
Workers at kinks	YES	YES	YES	YES	YES	NO	NO
F-stat Excl. Inst.	2.45	25.57	122.94	12.16	4.41	13.97	77.48
P-value Excl. Inst.	0.12	0.00	0.00	0.00	0.04	0.00	0.00
N Firms	835	835	799	799	799	958	958
N	15985	15985	9606	9606	9606	9979	9979

*Notes: Each regression contains the following controls measured in the base year: work experience, work experience squared,sex, age, number of children, marital status, education, local unemployment (municipality), region fixed effects, firm size, exporter status, share of high and low-skilled workers in the firm (the residual group is omitted) and 5 components splines of income at t-1 and income change between t-1 and t. First stage regression on column 4 and 5 of Table 9 are not shown and available upon request from the authors. "Mech." stands for mechanical change. Observations are weighted by labor income. F-stat Excl. Inst. refers to the Angrist-Pischke F-statistic. Standard errors in parentheses are clustered at the firm level. * p<0.10, ** p<0.05, *** p<0.01*

D.2 Standard Deviation of hours Definition 2: tables and graphs

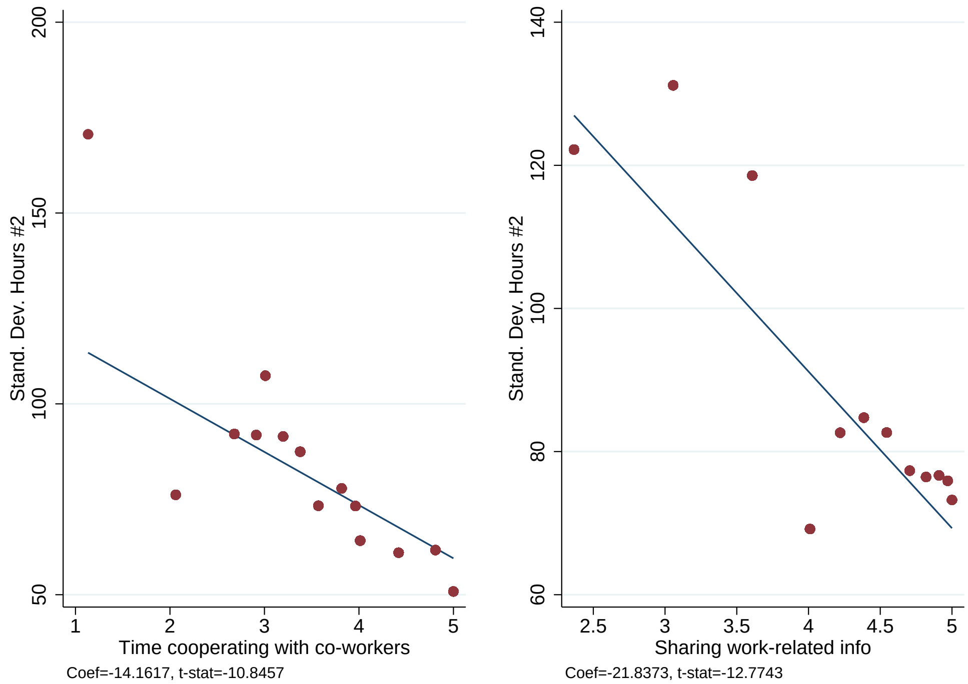
In this section we present the results of a parallel analysis performed using the standard deviation of hours across skills groups, where skill groups are defined at the the intersection of 3 educational groups (i.e. primary, secondary and tertiary education) and 3 broad occupational categories (i.e. manager, middle manager and blue collar) (Section 4.3).

Figure D.3: Tasks and Coordination of hours (Def. 2 Education-Occupation)



Note: We group firms in 20 equally sized bins based on the variable on the x-axis.

Figure D.4: PIAAC validation exercise coordination (Def. 2)



Note: We group firms in 20 equally sized bins based on the variable on the x-axis.

Table D.27: Coordination by sector (def. 2)

	Std. Dev. hours Def. 2 (education occupation)	
Coordination by Industry (2003-2011)		
	Mean	Std. Dev.
Agriculture, forestry and fishing, mining and quarrying	112.25	101.70
Manufacturing	98.55	80.31
Constructions	129.04	96.06
Electricity, gas, steam and air conditioning supply, Trade and transport	68.15	86.97
Financial and insurance, Real estate, Other business	79.00	80.38
Public administration, education, health, arts, entertainment and other services	67.41	65.92
Overall sectors	87.79	89.60
Observations	8182	

Notes: The table shows average values over the period 2003-2011.

Table D.28: Coordination and Firm Characteristics (Def 2)

	Stand. Dev. Def. 2 (education-occupation)		**Obs.**
	(1)	(2)	
V.A. /employee	-0.037***	-0.014*	17714
	(0.008)	(0.007)	
Capital/employee	-0.006	-0.005***	17714
	(0.007)	(0.001)	
Sales/employee	-0.042***	-0.004	17714
	(0.009)	(0.020)	
TFP	-0.112***	-0.061***	16148
	(0.008)	(0.013)	
Firm size	-0.018**	-0.050***	17714
	(0.007)	(0.015)	
Share of tertiary educ.	-0.139***	-0.061***	17714
	(0.008)	(0.014)	
Number of plants	-0.022***	-0.027	17714
	(0.007)	(0.017)	
Exporter status	-0.133***	-0.009	17714
	(0.007)	(0.010)	
Fraction of hourly work.	0.317***	0.235***	17714
	(0.007)	(0.017)	
Fraction of Unionized work.	0.095***	0.025**	17714
	(0.008)	(0.012)	
Fraction of Females	-0.019**	0.061***	17714
	(0.008)	(0.016)	
Fraction of Part-Time work	0.207***	0.121***	17714
	(0.008)	(0.014)	
Mean Managerial Ability	-0.055***	-0.022**	17714
	(0.008)	(0.011)	
Negotiation	-0.291***	-0.128***	16401
	(0.009)	(0.015)	
Persuasion	-0.298***	-0.134***	13353
	(0.009)	(0.015)	
Social Perceptiveness	-0.277***	-0.099***	13353
	(0.009)	(0.015)	
Adjust Actions to others	-0.146***	-0.063***	13353
	(0.009)	(0.013)	
5 digits industry f.e.	NO	YES	

*Notes: The table shows standardized coefficients from a regression of the standard deviation of hours across skill groups on firm characteristics. Each cell is a different regression. TFP is obtained from the procedure described in Appendix B.4. To avoid confusion we label the O*NET descriptor "Coordination" as "Adjust Actions to Others". Standard errors in parentheses are clustered at the firm level. * p<0.10, ** p<0.05, *** p<0.01.*

Table D.29: Coordination and wage premiums

	(1) Firm f.e.	(2) Firm f.e.	(3) Firm f.e.	(4) Firm f.e.	(5) Firm f.e.	(6) Firm f.e.
Stand. Dev. Def. 2	-0.070***	-0.047**	-0.042**	-0.077***		-0.038**
	(0.019)	(0.018)	(0.018)	(0.016)		(0.016)
Stand. Dev. Normal Hours					-0.044**	
					(0.019)	
Firm size		0.015*	0.014**	0.038***	0.014**	0.012**
		(0.007)	(0.006)	(0.014)	(0.007)	(0.005)
Exporter status		0.069***	0.083***	0.085***	0.084***	0.081***
		(0.015)	(0.017)	(0.025)	(0.018)	(0.016)
Union. Rate		-0.003	0.047*	0.038	0.046*	0.053**
		(0.025)	(0.026)	(0.029)	(0.026)	(0.025)
Female Share		-0.055	-0.070**	-0.077***	-0.067*	-0.049**
		(0.045)	(0.034)	(0.028)	(0.035)	(0.019)
Average Hours		0.003	-0.011	0.002	-0.012	-0.039
		(0.025)	(0.025)	(0.023)	(0.025)	(0.026)
log(Cap/empl)		0.038***	0.067***	0.083***	0.067***	0.064***
		(0.012)	(0.013)	(0.017)	(0.013)	(0.014)
Negotiation						0.201
						(0.123)
Persuasion						-0.151***
						(0.056)
Social Perceptiveness						0.017
						(0.068)
Adjust Actions to others						-0.034*
						(0.017)
Region F.E.	NO	YES	YES	YES	NO	YES
Compos. cntr	NO	NO	YES	YES	NO	YES
Ability Measures	NO	NO	YES	YES		YES
Av. Hours b/w 36.5 and 37.5	YES	YES	YES	NO	NO	YES
Part. R-sq SD Hours	0.006	0.002	0.002	0.002	0.002	0.001
Part. R-sq VA and Sales	0.022	0.010	0.006	0.006	0.008	0.005
Coordination Share	0.276	0.251	0.280	0.260	0.255	0.227
R-sq	0.006	0.031	0.072	0.073	0.072	0.079
N	7285	7285	7285	4392	7271	6067

*Notes: The "Stand. Dev." is the standard deviation of the average total hours worked across skill groups within a firm. The Stand. Dev. of Normal hours is the standard deviation of the average normal hours worked across skill groups within a firm. Skill groups are defined as deciles of the distribution of $\alpha_i + \beta X_{ijt}$ from the AKM model. All regressions show standardized coefficients. The exporter dummy is derived as the modal exporter status between 2003 and 2011. (Cap/empl) stands for physical capital over number of full-time equivalent employees. "Compos. cntr" refers to a vector of controls for the share of workers in each skill group. "Ability Measures" indicate a vector containing the average value of the individual fixed effects α_i in each quartile of the distribution of α_i within a firm. The dependent variable (firm f.e.) in column (5) is based on the wage rate from normal hours. To avoid confusion we label the O*NET descriptor "Coordination" as "Adjust Actions to Others" Coordination Share is derived as the ratio of "Part. R-sq SD Hours" and "Part. R-sq VA and TFP". "Part. R-sq VA and Sales" is from Table D.10. Standard errors are clustered at the 2-digit industry level. *, ** and *** are 10, 5 and 1 percent significance levels.*

Table D.30: Coordination and wage differentials within sectors

	(1) Firm f.e.	(2) Firm f.e.	(3) Firm f.e.	(4) Firm f.e.	(5) Firm f.e.	(6) Firm f.e.	(7) Firm f.e.	(8) Firm f.e.
Stand. Dev. Def. 2	-0.038**	-0.031*	-0.028				-0.038**	-0.032*
	(0.016)	(0.017)	(0.017)				(0.019)	(0.019)
Median Abs. Dev. Def. 2				-0.049***	-0.037**	-0.034**		
				(0.015)	(0.015)	(0.015)		
Firm size	0.013**	0.009*	0.021*	0.013**	0.009*	0.020*	0.015**	0.014**
	(0.006)	(0.005)	(0.011)	(0.005)	(0.005)	(0.010)	(0.007)	(0.006)
Exporter status	0.058***	0.039***	0.031**	0.054***	0.037***	0.029**	0.086***	0.077***
	(0.017)	(0.013)	(0.013)	(0.017)	(0.013)	(0.013)	(0.017)	(0.018)
Union. Rate	0.038	0.035	0.033	0.038	0.035	0.033	0.050**	0.058***
	(0.028)	(0.031)	(0.031)	(0.029)	(0.032)	(0.032)	(0.025)	(0.022)
Female Share	-0.085**	-0.037	-0.016	-0.085**	-0.037	-0.017	-0.078**	-0.063**
	(0.036)	(0.024)	(0.021)	(0.036)	(0.025)	(0.023)	(0.033)	(0.025)
Average Hours	-0.019	-0.030	-0.036	-0.022	-0.033	-0.038*	-0.013	-0.019
	(0.023)	(0.024)	(0.023)	(0.021)	(0.022)	(0.021)	(0.025)	(0.025)
log(Cap/empl)	0.057***	0.043***	0.044***	0.058***	0.045***	0.047***	0.067***	0.021
	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)	(0.011)	(0.013)	(0.029)
log(VA/empl)								0.145**
								(0.071)
Region f.e.	YES	YES	YES	YES	YES	YES	YES	YES
Compos. and Ability cntr.	YES	YES	YES	YES	YES	YES	YES	YES
1 digit Sector f.e.	YES	NO	NO	YES	NO	NO	NO	NO
2 digits Sector f.e.	NO	YES	NO	NO	YES	NO	NO	NO
3 digits Sector f.e.	NO	NO	YES	NO	NO	YES	YES	YES
Part. R-sq SD Hours	0.001	0.001	0.001	0.002	0.001	0.001	0.002	
Part. R-sq VA and Sales	0.009	0.005	0.004	0.009	0.005	0.004		
Coordination Share	0.163	0.171	0.150	0.113	0.276	0.237		
R-sq	0.065	0.087	0.091	0.066	0.088	0.092	0.076	0.083
N	7240	7240	7240	7306	7306	7306	7035	7035

*Notes: The "Stand. Dev." is the standard deviation of the average total hours worked across skill groups within a firm. The Median Abs. Dev. is the the median absolute deviation of median hours across each skill groups within a firm. Skill groups are defined as deciles of the distribution of $\alpha_i + \beta X_{ijt}$ from the AKM model. All regressions show standardized coefficients. Exporter and industry dummies are based on the median value between 2003 and 2011. (Cap/empl) stands for physical capital over number of full-time equivalent employees. In column (8) TFP is used as an instrument for valued added per employee (log(V.A./empl)). TFP is obtained as described in Appendix B.4. "Compos. cntr" refers to a vector of controls for the share of workers in each skill group. "Ability Measures" indicate a vector containing the average value of the individual fixed effects α_i in each quartile of the distribution of α_i within a firm. Coordination Share is derived as the ratio of "Part. R-sq SD Hours" and "Part. R-sq VA and TFP". "Part. R-sq VA and Sales" is from Table D.11. Standard errors are clustered at the 2-digit industry level. *, ** and *** are 10, 5 and 1 percent significance levels.*

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