Wage drift and the relevance of centralized wage setting: “Evidence from the Netherlands”

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List of Symbols

Symbol	Meaning
π	Profits
V	Trade union' utility
A	Productivity index
$\frac{y}{L}$	Productivity per hour worked
u	Unemployment rate
v	Vacancy rate (Amount of vacancies per 1000 workers)
B	Unemployment benefits
θ	Labor market tightness (amount of vacancies/amount of unemployed workers)
L	Number of employed trade union members
N	Number of trade union members
W_c	Contractual wage
w	Real wage
λ	Union bargaining power
Ω	Weighted average gains from bargaining by trade union and firm
K	Capital
L^D	Labor demand
W^{max}	Wage for which a firm is indifferent between hiring a worker or looking for another worker.
$W^{reservation}$	Reservation wage

Abstract:

In the Netherlands wage determination takes place in two stages. First trade unions negotiate a contractual wage. In the second stage employees and employers may negotiate a higher wage. The employee may be extremely talented or the employer may want to attract more qualified personnel. Therefore the final wage may be higher than the contractual wage. The additional increase in the wage of a worker is known as the wage drift. In this thesis I provide evidence for a (strong) negative relationship between the wage drift and the contractual wage. This indicates that if the contractual wage goes up the wage drift will go down and vice versa. This has important implications for centralized wage setting. Trade unions may negotiate a relatively low contractual wage to induce firms to open more vacancies. This creates more opportunities for unemployed workers. However if the wage drift goes up when the contractual wage goes down firms will not be induced to open additional vacancies. If trade unions want a high wage the wage drift also diminishes the possibilities to get one, since the higher contractual wage leads to a lower wage drift. Therefore the effectiveness of centralized wage negotiations is diminished by the wage drift.

1. Introduction

In the Netherlands wage determination takes place in two stages. In the first stage trade unions negotiate with employers' associations about changes in the contractual wage on industry level or firm level. In the second stage individual employers and employees may negotiate with their employees additional benefits specific for their relation. The employee may be extremely talented or the employer may start offering higher wages to attract more qualified personnel. When a worker is talented he may make a promotion or receive an additional bonus. The difference between the changes of the actual and contractual wages is called the wage drift. The share of the wage drift in the market sector was about 25% of the total wage increase between 1995 and 2013[1].

This leaves an important role in wage determination for the wage drift. However since the wage drift plays such a large role in wage determination some researchers doubt whether the wage set by trade unions, the contractual wage, even plays a role. Some studies find that an increase in the contractual wage is (partly) offset by a decrease in the wage drift (e.g. Lever(1993) or Holmlund and Skedinger (1988)), whereas the wage drift is attributed to labor market conditions, firm characteristics and personal characteristics (e.g. Novella and Sissoko (2013) or Holden (1998)) in other studies. However, in those studies no relationship between the wage drift and contractual wage is found.

Knowledge of the wage drift is limited and economic literature on the wage drift is inconclusive[2]. In this thesis I will try to add to the literature by finding an explanation for the existence of the wage drift. Studying the wage drift is very relevant since it tells us something about the relevance of the centralized wage setting. If an increase in the contractual wage is completely offset by a decrease in the wage drift, the increase contractual wage does not lead to a higher actual wage.

[1] The wage drift in the government sector and health care sector was respectively 23,2% and 16,5%. Statistics on the wage drift are provided by Statistics Netherlands.
[2] Some studies found a negative relationship between the wage drift and contractual wage whereas others do not find any relationship.

To find an explanation for the wage drift it is necessary to study the economic literature. There are four main theories that explain the wage drift.

A traditional explanation of the wage drift stresses the role of market forces. Those theories use the *neoclassical supply and demand framework* or *search model theory* to explain the wage drift. Holmlund (1986) and Oswald (1982) for example explain the wage drift with the neoclassical supply and demand framework and attribute the wage drift mainly to a corrective mechanism for excess demand for labor.

Some researchers explain the wage drift with search models (e.g. Pissarides (1990) or Mortensen (2005)). In search models there are labor market frictions. Because of these frictions finding workers to fill vacancies is a time consuming process. The longer this process takes the higher are forgone profits. When a firm raises its wage, relative to other firms, more workers will be attracted to that particular firm and the time it will take to find a worker will be shorter. Rational workers will switch from jobs with a low wage to jobs with a high wage[3] (Mortensen, 2005). In those models it is not possible for all firms to offer the same wage since raising the wage slightly will attract more workers[4] (thereby strongly reducing forgone profits). Because firms offer different wages workers look for jobs that offer a higher wage and have the possibility to make a promotion, which is a form of wage drift.

Holden (1998) and Moene et al (1991) use *bargaining models* to explain the wage drift. Those are based on the Nordic countries. In Nordic countries the wage drift is established in negotiations with local unions. Those local unions can induce all workers to exert only the minimum level of effort. In the Netherlands however the wage drift is negotiated at an individual level so bargaining models are not useful to explain the wage drift in the Netherlands.

Efficiency wage theories as Muysken and van Veen (1996) therefore seem more suitable to explain the wage drift on an individual level (than bargaining models). However these

[3] Assuming that jobs are homogenous in all respects but the wage
[4] If search costs are not too big (see section 3.3.2)

theories are difficult to implement empirically and not really developed (yet) with regard to the wage drift. Nevertheless efficiency wage theory will also be discussed in this thesis.

Based on the theory it is possible to find a number of determinants of the wage drift (e.g. the vacancy rate, unemployment rate or contractual wage). To test the relationship of these determinants of the wage drift a Labor Market Panel dataset, that consists of yearly observations on individuals between 2001 and 2009, will be used. The dataset has been supplemented with data on the contractual wage and labor market conditions. Unfortunately the dataset is split in two parts, due to an inconsistency in the measurement of the wage[5]. The main finding in this thesis, derived with Ordinary Least Squares and Instrumental Variables estimation techniques, is that an increase in the contractual wage leads to a decrease in the wage drift. However the size of this offset is not completely robust and is subject to further research. Worker characteristics are also important determinants of the wage drift and the wage drift responds to changes in the labor market tightness and productivity of firms.

The structure of this thesis is as follows. First I will discuss the relevant empirical literature on this topic in section 2. In section 3 I will discuss the theories that try to explain the wage drift. In section 3.1 I will discuss how a collectively set wage relates to the wage set in a competitive labor market. In section 3.2 efficiency wage theory will be discussed and in section 3.3 search models will be discussed. Bargaining models will not be discussed, since they are not applicable to the institutional setting in the Netherlands. In section 4 I will discuss the dataset and the methods that were used to find how the wage drift is determined. Section 5 provides the results and the implications of the results. In section 6 I will discuss the limitations of this study and possibilities for future research. Finally section 7 will conclude.

[5] The wage was measured using a labor market survey from 2001 – 2005, whereas the wage was derived from taxes between 2006-2009.

2. Empirical literature review

Empirical evidence on the wage drift is scarce and inconclusive. Most studies have been performed in Scandinavian countries. Holmlund and Skedinger (1988) analyzed the Swedish wood industry. They estimated the relationship between the contractual wage and the wage drift with different unemployment variables and region specific fixed effects. Every estimation showed a negative relationship between the contractual wage and the wage drift. Hibbs and Locking (1996) studied the same relationship with aggregate data on Sweden. They found a negative relationship between the "frame wage change" (contractual wage change) and the wage drift. They also found that central negotiators are able to predict the wage drift. This result suggests that central negotiators take the wage drift into account when they make their wage demands. Holden (1989[a] and 1998) studied the relationship between the contractual wage and the wage drift for Sweden, Norway, Denmark and Finland and he found that centrally negotiated wages increase the real wage with a coefficient that is not significantly different from unity (which means that there is no relationship between the wage drift and the contractual wage).

There is one main difference between this study and previously mentioned studies. This thesis is a study of the wage drift in the Netherlands. The institutional setting of the Netherlands is very different from the one in Scandinavian countries. In Scandinavian countries there is central bargaining and local bargaining, both are performed by trade unions. In the Netherlands there is industry level (local) bargaining and individual bargaining. The fact that there is individual bargaining instead of local bargaining might change the relationship between contractual wages and the wage drift. There has been one study of this relationship in the Netherlands. Lever (1993) studied the wage drift in the Netherlands and found that for every 1 percent decrease in the contractual wage, the wage drift increases by 0.7 percent. Another result of this study is that trade unions take the prevailing wage drift into account when they make their wage demands. The most recent study of the wage drift has been performed by Novella and Sissoko (2013). Novella and Sissoko (2013) studied the wage drift in Belgium. The institutional setting of Belgium resembles the institutional setting of the Netherlands. They found a coefficient that is not significantly different from unity for the relationship between the contractual wage and the actual wage. This indicates that

there is no offsetting effect of the wage drift with regard to the contractual wage. The results of the empirical studies are summarized in table 1.

Table 1: Empirical studies of the relationship between the contractual wage and the wage drift.[6]

Study	Sample	Independent variables	Method	Main Result(s)
Holmlund & Skedinger (1988)	Swedish wood industry, panel data from 1969-1985	Intercept, consumer prices, output prices, prices of materials in the wood industry, payroll tax, benefit level, unemployment, reference wage and contractual wage	OLS and region & time dummies	Wage drift is affected by: Wc(-), u(-), b(+), t(?), W^r(+), Pmaterials (-)
Holden (1989[a])	Norwegian manufacturing sector, annual observations, aggregate data from 1963 to 1986 and disaggregated data for 6 industries from 1970 to 1985	Intercept, vacancy rate, inventories, payroll tax, share of labor in gross product, a time trend and the contractual wage	OLS with industry & year dummies and IV estimations	Wage drift is affected by: v(+), inventories (-), t(-). There is no relationship between the wage drift and the contractual wage
Lever (1993)	Small set of weekly earnings in the private sector in the Netherlands (1972-1983). Corrected for structural changes	Intercept, CPI, unemployment, vacancy rate, reference wage rate	OLS	Wage drift is affected by: Wc(-), u(-), v(+), p(+)
Hibbs and Locking (1996)	Aggregate annual data on Sweden for 1972-1990	Intercept, contractual wage, vacancy rate, the observed wage drift (1 period lagged) and compression pushes	IV	Wage drift is affected by: Wc(-), v(+), compression push (+)
Holden (1998)	Annual aggregated data for Denmark (1961-1989), Finland (1961-1992), Norway (1961-1992) and Sweden (1961-1985)	Intercept, value added deflator, CPI, employment, tax rate, productivity, the unemployment rate and contractual wages	OLS	No relationship between the wage drift and the contractual wage.
Novella and Sissoko (2013)	Panel data on the full Belgium population of full-time workers from 1998-2006	Intercept, worker characteristics, firm characteristics,labor market conditions and contractual wages	GMM	Wage drift is affected by: Labor market conditions, firm/worker characteristics. No relationship wage drift and the contractual wage

(-), (+) or (?) indicate a negative, positive or an insignificant relationship between the wage drift and a given variable.

In the previously discussed literature researchers also studied which other factors influenced the wage drift (except for Holden (1998)). Holden (1989[a]) found that the wage drift depends on the level of inventories of a firm. If a firm has more inventories they will have a stronger bargaining position during work-to-rule measures by local unions[7]. It will take longer before reduced production will make it impossible for firms to supply their customers. All the studies that have been discussed find that labor market conditions affect the wage drift. The

[6] There is a related strand of literature that studies the wage cushion (actual wage – minimum contractual wage). Those papers are not discussed since they measure a different concept. However they offer explanations why firms pay more than a minimum set by trade unions. Examples of those papers are Jung and Schnabel (2011), Cardoso and Portugal (2005) and Bastos et al (2008). Older literature also uses the term "wage drift" (e.g. Ordine (1995) or Gould (1967)), whereas they study the wage cushion and not the wage drift.
[7] Work-to-rule means that workers only produce the minimum level required by their contract.

vacancy rate and unemployment rate are important determinants of the wage drift in the literature. This could indicate that the wage drift is an instrument to overcome pressure on the labor market. Novella and Sissoko (2013) found that age is a factor that affects the wage drift. According to this study the wage drift decreases with age. The determinants of the wage drift that were found in the literature are also summarized in table 1.

3. Theoretical Framework

The theoretical framework is divided in 3 parts. In section 3.1 classical models of trade union behavior will be discussed to gain some insights in the behavior of trade unions. The (contractual) wage that trade unions set/negotiate will be compared to the competitive setting. If the wage that trade unions set is lower than the equilibrium wage in a competitive setting, competitive forces would drive up the wage and thus cause wage drift. In this situation the contractual wage would not effectively lead to a higher actual wage. In section 3.2 efficiency wage models will be discussed and the interaction between the wage drift and the contractual wage in those models. Finally in section 3.3 friction models will be discussed. Friction models give a reason why workers would switch jobs and make promotion. And why some firms pay more than other firms. In a competitive model all firms pay the same[8]. These models are very important since promotion is likely to be the most important component of wage drift.

3.1 Trade union behavior and the competitive outcome

Throughout the literature there are four main models of trade union behavior[9], namely the "monopoly union" model (Dunlop, 1944), the "right-to-manage" model (Leontief, 1946), the "efficient bargaining" model (Mcdonald and Solow, 1981) and the median voter model (see e.g. Booth (1991)). Those models can be used to derive the contractual wage and its determinants. The efficient bargaining model and median voter model however will not be discussed due to lower empirical relevance. In the efficient bargaining model wages and employment are set at the same time, which leads to an efficient solution. However simultaneous bargaining over wages and employment is hardly ever observed in practice (Heijdra and van der Ploeg, 2002). In the median voter model employers are assumed to first hire trade union workers and afterward non-union workers. This does not correspond with

[8] If there is any wage differential all workers will move to the firm that pays more, in that case the firm(s) with the low wage either needs to start paying more to attract workers or the firm with the high wage can start paying less since there are more than enough workers for that firm. This makes it impossible for different firms to offer a different wage for workers that are of an equal skill level.
[9] See e.g. Booth (1991), Heijdra and van der Ploeg (2002) and Layard et al. (1991).

reality. To explain the outcome of the monopoly union model and right-to-manage model it is first necessary to explain the basic behavior of trade unions.

Consider a representative trade union and a representative firm. Suppose that a representative trade union has a utility function V(w, L) with the following form ((Booth, 1995) and (Heijdra and van der Ploeg, 2002)):

$$V(w,L) = \left(\frac{L}{N}\right)u(w) + \left[1 - \left(\frac{L}{N}\right)\right]u(B) \qquad (1)$$

where N is the number of union members, L is the number of employed union members, w is the real wage rate, B is the level of unemployment benefits and u(.) is the indirect utility function of a representative union member. The number of union members is fixed. The objective of the trade union is to maximize its utility function.

Firms try to maximize their profits. Consider a representative firm with a production function of Y = AF(L, K), where Y is output, K is the fixed capital stock, A is the productivity index and F(., .) features constant returns to scale and positive but diminishing marginal productivity of labor (Heijdra and van der Ploeg, 2002). The (short-run) profit function can then be defined as:

$$\pi(w,L) = AF(L,K) - wL \qquad (2)$$

From this equation it can easily be derived (by taking the first derivative with regard to employment) that the demand function of firms is downward sloping with regard to the wage and upward sloping with regard to productivity and capital:

$$\pi_L = AF_L(L,K) - w \;\leftrightarrow L^D = L^D\big(w(-), A(+), K(+)\big) \qquad (3)$$

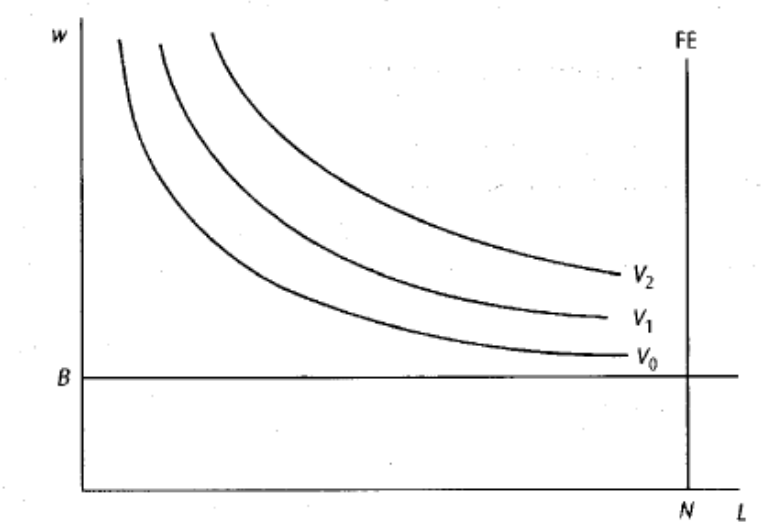
To find the resulting wage in the different union settings it is necessary to find the trade unions' indifference curves. The trade unions' indifference curves (combination of wage and

employment levels for which the trade unions' utility remains equal) can be determined as follows (Heijdra and van der Ploeg, 2002):

$$
\begin{aligned}
dV = V_w dw + V_L dL = 0 \\
\rightarrow \left(\frac{L}{N}\right) u_w dw + \frac{1}{N}[u(w) - u(B)]dL = 0 \\
\rightarrow \left(\frac{dw}{dL}\right)_{dV=0} = -\left(\frac{u(w) - u(B)}{L u_w}\right) < 0
\end{aligned}
\qquad (4)
$$

This means that the unions' indifference curves are downward sloping. Intuitively this makes sense. When the wage goes down the union wants higher employment to stay indifferent. The unions' indifference curves are illustrated in figure 1. Since the union will never set a wage lower than B[10], the level of unemployment benefits, and employment can never be higher than N, the number of union members. Therefore there are two restrictions in the figure, namely the FE line and the B line.

Figure 1: Indifference curves of the union (Heijdra and van der Ploeg, 2002)



It is now possible to describe trade union behavior in the monopoly union model and the right-to-manage model.

[10] otherwise the union will be better off if everyone is unemployed

3.1.1 Monopoly union

The monopoly union is the oldest trade union model that will be discussed. It was developed by Dunlop (1944). In this model trade unions set a wage and firms respond by setting a level of employment. The model can be criticized because it is somewhat simplistic. For example, Layard et al (1991: 96) wrote "the union never gets everything it wants, it bargains". Still the model has been widely used in the literature and is a special case of the right-to-manage model, which will be discussed next.

The problem that the trade union faces in this setting is as follows (Heijdra and van der Ploeg, 2002):

$$\max_{w} V(w, L) \ \ subject\ to\ \pi_E(w, A, L, K) = 0 \qquad (5)$$

Labor demand acts as a "budget restriction" for the trade union. The problem can be rephrased as (Heijdra and van der Ploeg, 2002):

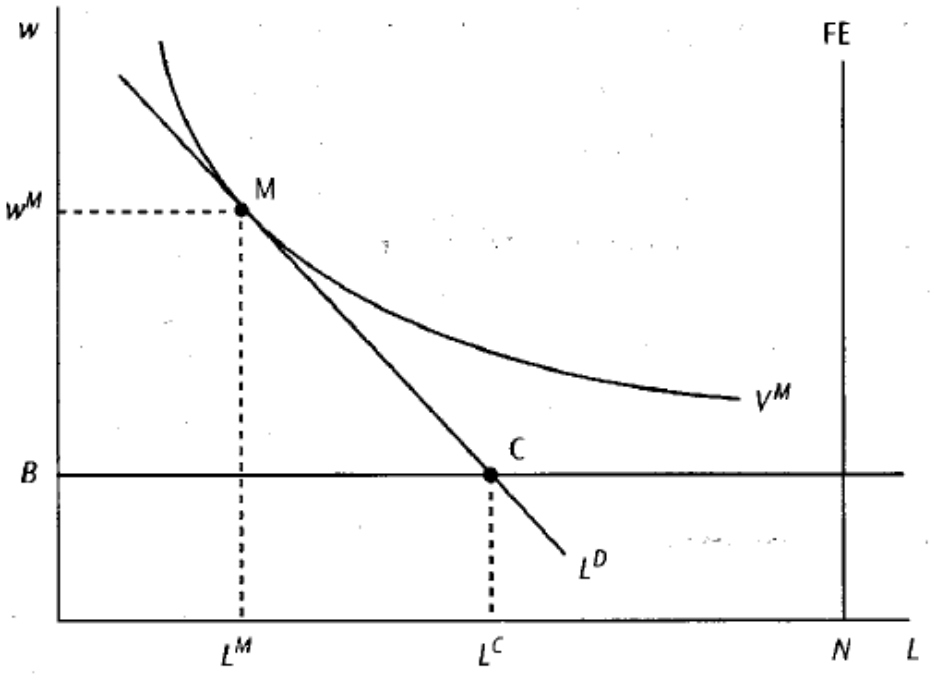
$$\max_{w} V\left[w, L^D(w, A, K)\right] \qquad (6)$$

The first order condition will be:

$$\frac{dV}{dw} = 0 : V_w + V_L L_w^D = 0 \qquad (7)$$

This implies that $V_w/V_L = -L_w^D$. Meaning that the slope of the trade unions' indifference curves should be equal to the slope of demand for labor. The solution is illustrated in figure 2. The wage that is set by the monopoly union is equal to w^M, the utility level that is attained by the union is equal to V^M and employment is L^M (unemployment is $(N- L^M)$).

Figure 2: Wage setting by a monopoly union (Heijdra and van der Ploeg, 2002)



In Booth (1995) and Heijdra and van der Ploeg (2002) the outcome of the monopoly union model is compared to the outcome in a perfectly competitive market. The equilibrium wage in the perfectly competitive market is equal to the level of unemployment benefits (Heijdra and van der Ploeg, 2002). Trade unions have no incentive to set a wage lower than the perfectly competitive outcome, since workers would then be better off if they were unemployed. In the perfectly competitive equilibrium the utility of being employed equals the utility of being unemployed. Raising the wage above the equilibrium outcome increases the utility of employment, while it does not affect the utility of those who lose their jobs. So even though some workers will become unemployed, total utility will go up. The union will set the wage at a level where the increase in utility for the employed is equal to the decrease in utility for the workers that lose their jobs. This will always result in a wage above the perfectly competitive outcome and therefore the union will cause unemployment.

In the next section the outcome of the right-to-manage model will be discussed.

3.1.2 The right-to-manage model

In reality trade unions have to negotiate a wage and cannot simply set one. Leontief (1946) was the first to propose the right-to-manage model as an alternative to the monopoly union model. In this model the trade union still sets the employment level, however trade unions and firms bargain about the centralized set wage. The real wage in this model is derived by Nash-bargaining (see e.g. Booth(1991, pp 150-151)). The real wage that is chosen after bargaining maximizes "the symmetrically weighted average of the gains of the two parties" (Heijdra and van der Ploeg, 2002). In logarithmic terms this means:

$$\max_{w} \Omega \equiv \lambda \log[V(w,L) - \bar{V}] + (1-\lambda)\log[\pi(w,L) - \bar{\pi}] \; s.t. \; \pi_L(w,A,L,K) = 0 \quad (8)$$

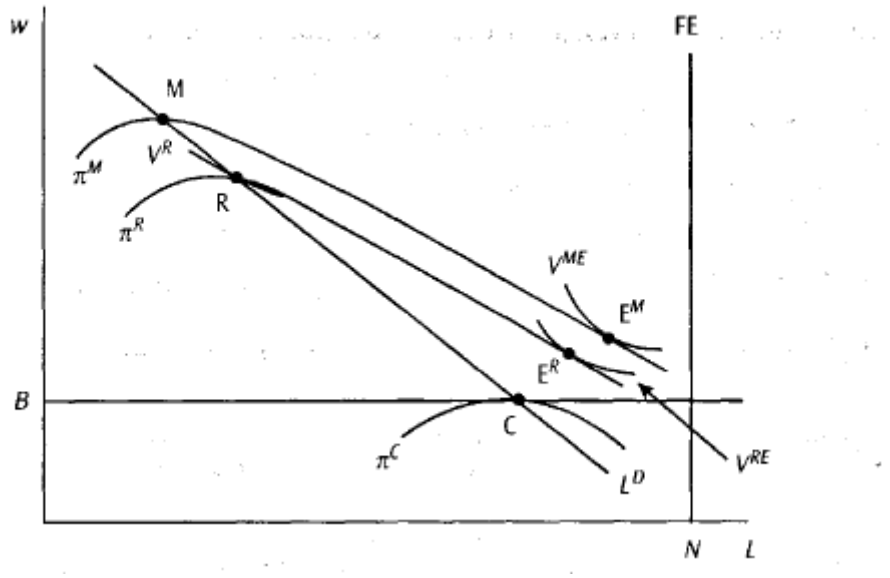
where $\bar{V}$ is the fall-back position of the union. This is equal to the utility derived from the competitive wage, since this wage will prevail if the trade union does not set any wage (or if the trade union sets a wage lower than the competitive wage). $\bar{\pi}$ can be seen as the fall-back position of the firm. This is the level of profits for which the profits of the firm are minimal[11]. λ represents the relative bargaining strength of the union ($0 \leq \lambda \leq 1$). At $\lambda = 1$ the right-to-manage model is exactly the same as the monopoly union model. For any $\lambda<1$ the wage markup however is smaller than in the monopoly union model[12]. For $\lambda=0$ there will not be a wage markup and the competitive equilibrium will prevail. The situation in the right-to-manage model is illustrated in figure 3, where R indicates the right-to-manage outcome, M the monopoly union outcome and C the perfectly competitive outcome.

As long as the bargaining strength of the union is larger than zero the workers will receive a positive wage markup over the perfectly competitive wage.

[11] The minimum level of profits is slightly positive, because otherwise firms cannot pay their fixed costs (Heijdra and van der Ploeg, 2002)

[12] For a formal proof see (Heijdra and van der Ploeg, 2002: 190-193) equation (8.9) and (8.15, 8.16)

Figure 3: Wage setting in the right-to-manage model (Heijdra and van der Ploeg, 2002)



In the next section I will discuss how different determinants will affect the contractual wage in the monopoly union or right-to-manage setting.

3.1.3 Determinants of the contractual wage

Based on the utility function (1) of the trade union it is possible to determine how several variables affect the contractual wage. The basic intuition is that if the marginal utility of employment falls, it becomes more attractive to have higher employment at the cost of a lower wage, and vice versa. The following variables will then affect the wage set by trade unions[13]:

Unemployment benefits

When unemployment benefits go up the utility of unemployed workers will also go up. This means that the utility loss of a higher wage, through lower employment, falls. Therefore the union will start demanding higher wages (or start negotiating for higher wages). This results in a higher contractual wage.

[13] Note that those are not all variables that affect the wage drift, however they are likely to be most relevant in determining the contractual wage.

Trade union membership

Union power depends fundamentally on the ability of trade unions to reduce labor supply (Booth, 1995). Trade unions can induce their members to go on a strike. Non-union members are much less likely to go on a strike, since they do not receive any compensation when they do so. Therefore higher trade union membership is likely to lead to a higher bargaining power, which leads to a higher contractual wage in the right-to-manage model.

Tax rate

An increase in the marginal tax rate makes employment more attractive for trade unions, since it reduces the marginal utility of employment (Bovenberg and van der Ploeg, 1994). If average tax rates go up it leads to higher wages, since unemployment becomes more attractive especially if unemployment benefits escape the increase in average tax rate (Bovenberg and van der Ploeg, 1994).

Changes in labor demand elasticity

Labor demand is an important variable when determining the contractual wage. Trade unions maximize their utility function respecting labor demand. If labor demand elasticity is high it means that raising the wage will lead to higher unemployment. This implies loss of earnings for more workers (that lose their job) than if labor demand elasticity is relatively low. Therefore trade unions will set a lower contractual wage if labor demand elasticity is relatively high.

Changes in labor demand

When labor demand goes up more workers will be employed given a certain contractual wage. This increases the marginal utility of a wage raise (since more workers benefit than before). Therefore a higher contractual wage will be set if labor demand is higher.

3.1.4 Relationship contractual wage and wage drift in a competitive market

Suppose a trade union sets a contractual wage in a market that was perfectly competitive (before the contractual wage was set). In figure 2 and 3 the wage from a perfectly competitive setting is compared to the wage that a trade union sets or negotiates. If a trade union is able to set a contractual wage that cannot be undercut, the contractual wage will lead to a higher wage (and unemployment). Therefore the wage drift will not completely offset changes in the contractual wage.

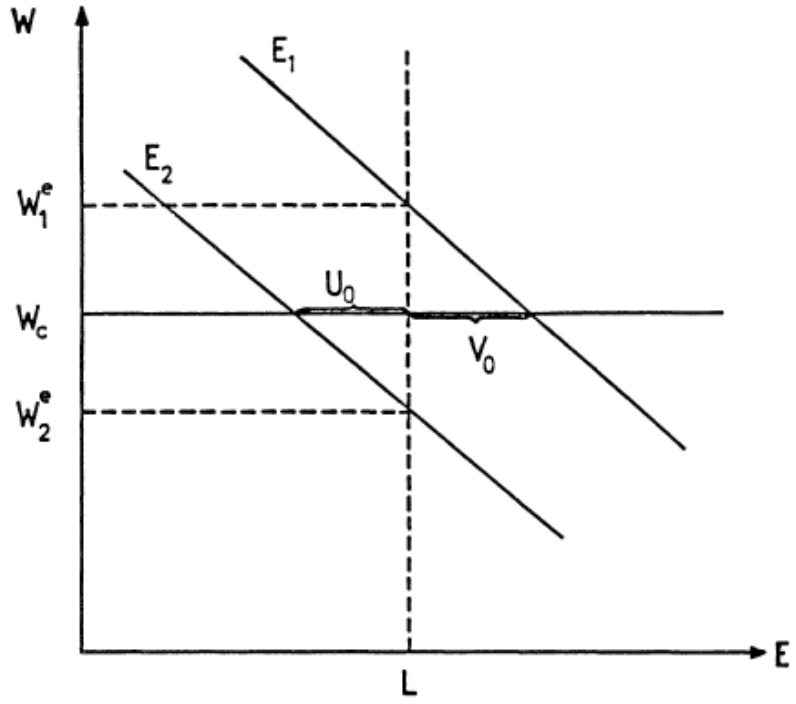
However this model is too simple to capture the relationship between the wage drift and the contractual wage. First of all unemployed workers are likely to enjoy utility of leisure as well. This leads to a wage above the level of unemployment benefits (see e.g. Borjas (2008)). In this setting a union, with a utility function given in (1), may not set a wage above the equilibrium wage (because people who lose their jobs will lose utility, whereas they did not in the perfectly competitive case). Still setting a wage lower than the equilibrium wage would not make sense, since a higher wage leads to more people working at a higher wage (at a wage lower than the equilibrium wage some people do not work because the cost of working (less leisure) is higher than the benefits of working (wage)).

Workers are likely to be heterogeneous with respect to their productivity instead of homogeneous. This leads to higher wages for more productive workers (see e.g. Heijdra and van der Ploeg (2002)). If the trade union would set a contractual wage that increases the wage for all workers, there will be high unemployment for less productive workers (Bastos et al, 2008). Therefore it is unlikely that trade unions set a contractual wage that increases the wage for all workers. The wage drift may then increase the wage for more productive workers because of competition for those workers. This means that a centrally set wage may affect less productive workers, but not the highly productive workers.

Holmlund (1986) also studied the case in which the trade union does not exactly know labor demand. If the trade union does not know labor demand it may set a contractual wage that only causes unemployment in the case of low labor demand (because setting a higher wage than the wage that results from high demand may cause high unemployment in case there

will be low demand) and is therefore lower than the equilibrium wage if there is high labor demand. The situation is illustrated in figure 4, where E1 depicts the situation with high labor demand and E2 depicts the situation with low labor demand. L depicts the (fixed) equilibrium employment rate. There may be a positive wage drift in case of high labor demand because of competition for the few workers that are available. This will drive up the wage rate. In this situation the contractual wage does not lead to a higher actual wage.

Figure 4: Unionized labor market with different states of demand (Holmlund, 1986)



Finally a large part of the wage drift can be attributed to the fact that different jobs have a different wage and people switch between those jobs. However in the competitive setting all firms pay the same wage, even if one is more productive than another. In equilibrium the marginal productivity of labor will be the same for all firms (if one firm would be better off by offering a higher wage all firms would have to offer a higher wage, otherwise they will not be able to attract labor anymore). Therefore I will discuss a theory that is able to explain promotions in section 3.3. However in the next section I will first discuss efficiency wage models that try to explain the relationship of contractual wages and wage drift.

3.2 Trade unionism under efficiency wages

There are some efficiency wage models in which the relationship between the wage drift and contractual wage has been incorporated, namely Muysken and van Veen (1996) and Moene et al (1991). Those models are quite similar to bargaining models, such as Holden (1998) and Moene (1988), that try to explain the relationship between the wage drift and contractual wage. Wage drift exists in those models because local trade unions are able to reduce worker productivity if firms do not offer a higher wage increase. This gives firms an incentive to increase the wage. In an efficiency wage model (individual) workers reduce their effort if firms do not offer a higher wage increase than solely the contractual wage. Therefore firms may be willing to pay a higher wage increase.

In a non-competitive market firms set a wage above the market-clearing wage (Bovenberg and van der Ploeg, 1994). They set the wage above the market-clearing wage because the wage positively affects worker productivity and therefore revenues. There are a number of reasons why a higher wage would lead to higher worker productivity. It could be to motivate workers and prevent shirking (Akerlof, 1982; Shapiro and Stiglitz, 1984), to retain workers (e.g. Salop, 1979) or to recruit better workers (Weiss, 1980).

When firms have the possibility to set the wage[14] they will offer a wage that maximizes their profits. If this wage is higher than the contractual wage there will be a positive wage drift. In that case increments of the contractual wage systematically lower the wage drift the closer it gets to the wage that maximizes profits. Only if the contractual wage is higher than the optimal wage it will lead to a higher actual wage.

Since the contractual wage is exogenous it is difficult to use those models in explaining the wage drift. There is no explanation why trade unions would set a wage that is lower than the optimal wage. Therefore it is not possible to do reliable prediction of the relationship between the wage drift and contractual wage based on efficiency wage theory.

[14] Even if firms and workers have to bargain over the wage drift, the story is not much different (see Moene et al (1992)).

3.3 Search models

Promotion is one of the main components of the wage drift, and actually the only one available in the dataset that will be discussed in section 4. Therefore it is useful to discuss a theory that is able to explain these promotions. Search models with on-the-job search are able to discuss why people switch jobs and how this results into higher wages. These will be discussed in this section. In section 3.1 I will first discuss the most basic search model. This model does not feature on-the-job search yet, which is an important factor that contributes to the wage drift. However they still may be important in the discussion of the relationship between the wage drift and the contractual wage because the contractual wage puts a restriction on wage bargaining between a firm and a worker. In section 3.2, the models with on-the-job search will be discussed. In section 3.3 I will discuss how different variables affect promotions.

3.3.1 Basic search model

In my discussion of the basic search model I will follow the insights of Diamond (1982), Pissarides (1990) and Mortensen and Pissarides (1999).

In search models there are market frictions. Mortensen and Pissarides (1999) define those market frictions as "the costly delay in the process of finding partners and determining the terms of trade". This means that it will take time before a worker and a firm find one another.

In the basic model there are homogeneous workers and homogeneous firms. The workers can be either employed or unemployed. Employed workers do not look for different jobs, so there is no on-the-job search. If workers are unemployed they will search for a job[15]. The chance that they will instantaneously find a job depends on the labor market tightness (=θ)[16]. If the labor market is tighter it means there are more vacancies per unemployed

[15] The assumption is made that firms offer a wage that is at least equal to the reservation wage of workers (the reservation wage depends on the level of unemployment benefits and utility of leisure).
[16] The labor market tightness will be defined as the amount of vacancies divided by the amount of unemployed.

worker and it is easier to find a job for an unemployed worker. This means that the unemployed worker will be able to find a job faster and will have a lower forgone wage.

All firms are the same in the model. Firms want to maximize their profits and are able to open vacancies. The vacancies can be either open or filled. When the vacancy is open no production will take place and the firm will be looking for an unemployed worker to fill the vacancy. Posting a vacancy has a cost and there is freedom of entry and exit. Therefore the value of posting a vacancy will be equal to zero in equilibrium. The chance that a firm is able to fill the vacancy instantaneously depends on the labor market tightness. However in this case a tighter labor market makes it more difficult for the firm to find a worker to fill the vacancy (since the amount of unemployed workers is relatively low with respect to the amount of vacancies). Therefore it will take longer for a firm to fill its vacancies in case of a high labor market tightness.

When a worker and a firm find one another (have a match) they will have a surplus over their outside options. The outside options for the firm is to look further for a different worker and the outside option the worker has is to look further for a different job. However in this time period no production will take place and the worker will only receive unemployment benefits (and possibly utility of leisure). This means both parties (the unemployed worker and the firm) have a surplus over their outside option and want to work together. The division of the surplus between firm and worker depends on the relative bargaining strength of both parties (Heijdra and van der Ploeg, 2002). The surplus that will be bargained over can be displayed as follows:

$$Bargaining\ space = W^{max} - W^{reservation} \quad (9)$$

Where W^{max} denotes the wage that makes a firm indifferent between looking for a new worker and hiring the worker that is currently matched to the job and $W^{reservation}$ is the wage that makes the worker indifferent between accepting the job or looking for another job.

When trade unions set a contractual wage they restrict the bargaining space for the worker and the firm. Equation (8) can be modified slightly to get:

$$Bargaining\ space = W^{max} - W_c \qquad (10)$$

Where W_c denotes the contractual wage stipulated by a collective labor agreement. If W_c is higher than the reservation wage the trade union already captures part of the match surplus for the worker. This means that workers with a weak bargaining position may receive a higher wage because the trade union already captures part of the surplus for them. On the other hand workers with a strong bargaining position are able to capture a larger part of the surplus than solely the part that the trade union already captures. An increase in the contractual wage decreases the bargaining space and therefore reduces the room available for a positive wage drift. Therefore a negative relationship between the contractual wage and wage drift can be expected, although it is expected that an increase in the contractual wage leads to a higher wage for workers with a weak bargaining position.

In the next section search models with on-the-job search will be discussed.

3.3.2 On-the-job search

In practice workers often switch jobs. Rational workers move from jobs with a low wage to jobs with a high wage (Lentz and Mortensen, 2010)[17]. Search models can be extended to capture this feature, although they are somewhat different from the basic search model. Instead of (Nash) bargaining over the wage, all firms post a wage. Firms are still homogeneous with respect to their productivity.

Workers can be employed or unemployed, however when workers are employed they still look for different jobs. Workers, who look for a new job, are assumed not to have any costs of looking for a new (better) job[18] (in contrast to Burdett (1978)). Because of this assumption

[17] This statement fundamentally depends on the assumption that jobs are homogeneous. If jobs with a higher wage are, for example, less fulfilling workers may switch from jobs with a high wage to jobs with a low wage.
[18] Possible "search costs" could involve the time/effort spend looking for a job.

workers will always search for a better paid job (unless they earn the highest wage possible). Unemployed workers also accept any job offer because of this assumption, as long as the wage offered is higher than the reservation wage.

Firms maximize their profits. Finding a new worker for an open vacancy takes time. The time it takes to fill the vacancy depends on the number of workers that are willing to work for a firm. If a firm offers a very low wage they will only attract unemployed workers. If firms on the other hand offer a higher wage they are able to attract both unemployed workers and workers from firms that offer a lower wage. Therefore vacancies with a higher wage will be vacant for a shorter period of time. This reduces forgone profits. The fact that a firm offers a higher wage for its job also reduces labor turnover. Workers will stay longer at a job because there are less jobs that offer a better wage. This means that workers at a better paid job will also stay there for a longer period of time, which also reduces forgone profits.

This has important implications for the wage distribution among firms. In the basic search model all firms offer the same wage, since they are all the same and there is no on-the-job search (and all workers have the same bargaining power). However in the wage posting game firms have an incentive to offer a higher wage than the other firms since it will reduce the time that a vacancy will be open (and thus forgone profits). Mortensen (2005) shows that, in a model with on-the-job search, no search costs and homogeneous jobs, all firms offer a different wage in equilibrium. An equilibrium in which all firms offer the same wage is no longer possible. One firm could always start offering a slightly higher wage than the other firms, which would result in much lower forgone profits (due to the attraction of more workers to open vacancies). Therefore the equilibrium covers jobs that offer different wages. Some jobs offer a low wage, which have high labor turnover. And some jobs offer a high wage, with low job turnover.

A fundamental assumption within that equilibrium is that search costs are not too large. If there are search costs involved offering a slightly higher wage may not attract more workers than offering the same wage as the other firms. When profits, that would otherwise be forgone, do not make up for the higher wage anymore there is no reason for firms to set a

higher wage than other firms. In that case there would not be wage differentials when firms are homogenous even if there are market frictions and there is on-the-job search.

With the knowledge of on-the-job search models it is possible to find some of the determinants of promotion and therefore the wage drift.

3.3.3 Determinants of the wage drift

The wage drift increases if job switching (from jobs with a low wage to jobs with a high wage) becomes more likely and decreases if job switching becomes less likely. Therefore the following determinants can be found based on the theory described in section 3.3.2:

Cost of search

Workers face a trade-off between a higher (expected) future wage and the costs involved in searching[19] (Burdett, 1978). An increase in search costs discourages search activity. Therefore an increase in search costs may lead to a lower wage drift.

Labor market tightness

A decrease in labor market tightness will decrease the wage drift. When unemployment increases and/or the amount of vacancies decreases it will be more difficult for workers to find a better paid job, since they will have more competition or less better paid possibilities (Pissarides and Wadsworth, 1994).

Firm heterogeneity

An important factor that contributes to higher wages is firm heterogeneity (e.g. (Burdett and Mortensen, 1998) and (Lentz and Mortensen, 2010)). When firms become more productive they will have higher forgone profits when a vacancy is not filled. This means that they have

[19] Possible costs can be for example the effort of applying for a new job.

an incentive to offer a higher wage since it attracts more workers and reduces forgone profits (unless all firms raise their wages, so there should be some firm heterogeneity). Therefore wages go up if firm productivity goes up.

Personal characteristics

Personal characteristics can be very important in determining the wage drift. They could indicate different levels of search costs involved with on-the-job search. More ambitious workers are likely to have lower search costs. Age is also likely to be an important indicator of the wage drift. When one is older he is more likely to have found a high paid job already. Therefore at an older age there are less opportunities to find a job with a better wage and the wage drift reduces with age (e.g. Burdett (1978)). When a worker gets older the benefits of search activity also decrease. Therefore, if search costs do not decrease with age, search activity becomes more discouraged as one grows older.

Having a higher education level could also affect the wage drift. Workers that have a higher education level are likely to have more opportunities to find a better job. Therefore they are likely to have a higher wage drift than workers with a lower education level.

Job tenure is another factor that affects on-the-job search (Pissarides and Wadsworth, 1994). When job tenure is low a worker still learns the characteristics of a job. When the worker finds out that he dislikes the job he will have a bigger incentive to look for a new job. On the other hand if job tenure is high a worker might have accumulated a lot of job-specific skills. If he/she is paid for the accumulation of job-specific skills the incentive to leave the firm will also reduce (Pissarides and Wadsworth, 1994).

Tax rate

An increase in the marginal tax rate decreases the incentive for workers to look for a better paid job, since their gain from an increase in the wage is lower. However some firms may start raising their wages, in case of higher marginal tax rates, to still attract a sufficient amount of workers.

Contractual wage

In the literature the effect of a change in the contractual wage has not been linked to a change in the wage drift yet. However based on the theory it is possible to determine some relationships between the contractual wage and the wage drift.

Suppose that trade unions negotiate a certain contractual wage. This means that all firms at least have to pay the contractual wage negotiated by trade unions. Therefore some firms with low wages and high turnover cannot exist anymore. This will negatively affect the wage drift since workers from those firms would be the ones that make promotion quickest (since there are more jobs that offer a higher wage). Therefore the wage drift goes down if the contractual wage goes up in a friction model. However this is clearly an effect on macro-economic level instead of an individual level, whereas the focus of this thesis is on the micro-economic effect of the contractual wage on the wage drift.

A change in the contractual wage does not affect the incentive for firms to offer different wages. Since having the same wage is still unlikely because there would always be a firm that starts to deviate by offering a slightly higher wage. Therefore it is unlikely that a higher contractual wage will undo total wage drift.

However a higher contractual wage may affect the incentive to look for a job. Under the assumption that the marginal utility of consumption is decreasing in consumption, a higher contractual wage will decrease the incentive to look for a better job (all else equal). The increase in utility from a wage raise will be lower than without the increase in the contractual wage. Therefore workers will have less motivation to look for a better job (assuming there are some costs of searching involved). In that case it is possible to find a negative relationship between the wage drift and the contractual wage.

In the next section the dataset will be described and the methods that were used to test the determinants of the wage drift.

4. Data and Methodology

Section 4.1 describes the dataset and the criteria I used to construct my final sample and contains descriptive statistics of this sample. Section 4.2 describes the methods applied to test the hypotheses.

4.1 Data

I will use the Labor Market Panel of Statistics Netherlands. The dataset consists of 1.2 million individuals who have been followed for the period 1999-2009. The dataset combines data from municipalities, the Social Statistics Panel and the Labor Force Survey. The dataset contains information about the gross wage, age, education level, job status and gender of individuals. Information on the contractual wage[20], productivity per hour worked, the vacancy rate and unemployment has been added to the dataset (CBS, 2014). The contractual wage, productivity per hour worked (in €) and the vacancy rate is available at sector level for a limited amount of sectors[21]. With the data on the wage and contractual wage it is possible to calculate the wage drift on an individual level.

The unemployment rate is only available on a regional level or on a national level. The amount of vacancies is also available on a national level. Ideally the amount of vacancies and the level of unemployment should both be available on a sector level to measure the labor market tightness adequately, however the level of unemployment is not available on a sector level. Therefore it is useful to see whether different specifications of labor market tightness give consistent estimates of the effect of labor market tightness on the wage drift.

Data on the gross wage is available for 2001-2009. The gross wage does not include payments for overtime work or bonus payments. Therefore the wage of a worker only increases if he/she makes a promotion (finds a job with a higher base salary).

[20] Data on the contractual wage have been retrieved from (Deelen and Euwals, forthcoming). For calculation of the contractual wage growth see Appendix A2. All the collective labor agreements, that specify the contractual wages, have been extended to the whole sector.
[21] The labor market sectors for which all are available are displayed in appendix A1.

Between 2001-2005 and 2006-2009 the source of the gross wage changed. From 2001-2005 the gross wage has been derived from a labor force survey. From 2006-2009 the wage has been derived directly from taxes. Due to this inconsistency it is impossible to do a regression over the full period of time. For the main estimations data on 2006-2009 will be used since it is more recent and more reliable.

Data are available on the sector in which people work, however it is not possible to see whether workers have changed jobs. This means that it will not be possible to differentiate between job switchers and people who keep their job. Workers will be excluded if they switch sectors because it will not be possible to calculate their wage drift with this dataset. Workers under 24 are excluded from the sample, because they are not subject to contractual wage changes, but to changes in the minimum (youth) wage. Finally, in order to remove outliers from the data set, the top and bottom 1% will be removed[22].

Table 2 shows the descriptive statistics of my final sample. The descriptive statistics indicate that the external validity of the results may be limited. In the sample 75% of the individuals are female and only 28% of the individuals work full-time. This is a much lower percentage than in reality in the Netherlands. This casts some doubt about the representativeness of the available sectors with regard to the whole Dutch labor market. As long as only the descriptive factors (that are observed in the dataset) differ from the ones in the Dutch labor market there is no problem. A lack of external validity is only problematic for this study if the effect of independent variables on the dependent variables differs. This would be the case if for example the women included in the sample have lower wages than those excluded.

[22] Not doing so leads to an average wage drift of workers between 60-64 of about 50%, which is unlikely to be correct.

Table 2: Descriptive statistics dataset (2006-2009)

Variable	Mean	Median	Minimum	Maximum	5% percentile	95% percentile
Wage drift	1%	1%	-35%	68%	-12%	15%
Gender*	1,75	2	1	2	1	2
Age	43	44	24	63	26	58
Part-time**	0,72	1	0	1	0	1
Education Level						
Primary education	4%	----------	----------	----------	----------	----------
Mavo/Vbo (lower secondary school)	18%	----------	----------	----------	----------	----------
Havo/VWO/MBO	56%	----------	----------	----------	----------	----------
Bachelors degree HBO/WO	17%	----------	----------	----------	----------	----------
Masters/Doctors degree	4%	----------	----------	----------	----------	----------
Change in the contractual wage	3%	3%	0%	11%	0%	7%
Unemployment (regional)	5%	5%	3%	7%	3%	6%
Vacancy rate (sector)	21%	21%	16%	40%	18%	25%
Labor market tightness (national)	0,67	0,70	0,50	0,80	0,50	0,80
Productivity (sector)	42	43	42	273	42	273

*Gender = 1 if gender = male and 2 if gender = female. ** Part-time = 0 when someone works full-time and part-time = 1 when someone works part-time.

4.2 Methodology

In the theoretical framework I discussed how promotion is affected by different variables (see section 3.3.3). Since promotion is the only component of the wage drift available in this dataset, the relations from section 3.3.3 should hold. Therefore the following equation will be estimated using Ordinary Least Squares (OLS):

$$Wage\ drift = \beta_0 + \beta^c \left(\frac{W^c_{t+1} - W^c_t}{W^c_t} \right) + \beta^s Gender_i + \sum_{i=1}^{9} \beta^a_i age_i + \sum_{j=1}^{4} \beta^e_j educ_j + \beta^p part\_time + \beta^y \left(\ln\left(\frac{y}{l}\right)_t - \ln\left(\frac{y}{l}\right)_{t-1} \right) + \beta^u (\ln(u)_t - \ln(u)_{t-1}) + \beta^v (\ln(v)_t - \ln(v)_{t-1}) + \alpha_s + \varepsilon_t \quad (11)$$

With the wage drift defined as:

$$Wage\ drift = \left(\frac{W_{t+1} - W_t}{W_t} - \frac{W^c_{t+1} - W^c_t}{W^c_t} \right) \quad (12)$$

β^c shows the relationship between the contractual wage and the wage drift, which is expected to be negative. Gender, age, education and part_time represent dummies to find the effect of worker heterogeneity on the wage drift and to control for worker heterogeneity. Age is split up in separate categories of 5 years to account for non-linear effects. Controlling for worker heterogeneity is vital to find the correct relationship between the wage drift and contractual wage. If, for example, workers are relatively old in the dataset the relationship between the wage drift and contractual wage will be weaker because older workers do not make promotion as often as younger workers do. Therefore the offset of an increase in the contractual wage by the wage drift would be expected to be smaller in a dataset with mainly older workers.

Furthermore the first difference in the unemployment rate (u), the vacancy rate (v) and firm productivity (y/l) are included to find the effect of labor market conditions/firm characteristics. Firm productivity is measured as the revenues of a firm in a given year

divided by the amount of hours worked. Firm productivity is only available on sector level[23]. α_s Represents sector fixed effects, which have been included to account for differences among sectors that do not change over time. Perhaps search costs differ between sectors, which would make the contractual wage more important in some sectors than in others (although it is not a perfect control since search costs can change over time and sector fixed effects cannot control for that). Time dummies are not included because they would be omitted due to multicollinearity with unemployment, the vacancy rate and productivity of firms. The standard errors have been clustered at sector level, because part of the data is only available on sector level. Not clustering the standard errors leads to standard errors that are too high.

The OLS estimation has two main limitations:

- *Omitted variables bias.* If there are variables that influence both the independent and the dependent variables the estimate of the independent variable will be biased. As long as omitted variables are time invariant there is no problem, since wage changes only follow from changes in independent variables[24]. However when they are not time invariant and influence both the dependent and independent variable(s) it will bias the results. A possible omitted variable may be a sudden increase in the marginal tax rate. This makes promotion less attractive and therefore the wage drift will go down. Trade unions will also lower their wage demands. In that case the estimate would be an upper bound (too high).

- *Reverse causality or simultaneity bias.* This could be a serious threat to the internal validity of the results. The wage drift is likely to be affected by an increase in the contractual wage, however Lever(1993) and Hibbs and Locking (1996) have found that the wage drift also negatively affects the contractual wage. If this is the case the estimated coefficient for the relationship between the contractual wage and the wage drift will be too low. E.g. if a

[23] Unfortunately firm productivity on sector level may not be a perfect predictor of the effect of firm productivity from section 3.3.3. An increase in firm productivity would normally increase the wage that the firm offers, because the firm has higher forgone profits if it has open vacancies. Therefore wages would go up further controlling for the contractual wage. However since the variable is measured at sector level it will only give the right estimate if an increase in the wage in that sector can attract workers from different sectors.
[24] The degree with which the dependent variable is affected by the independent variables can depend on constant variables as labor supply and demand elasticity.

negative effect is found the real effect will be closer to zero (or positive) if there is reverse causality bias or simultaneity bias.

To address these problems a more sophisticated technique, such as an Instrumental Variables (IV) approach, is needed. The IV design depends on two assumptions. The instrument(s) should be a good predictor of the instrumented variable. To check whether the instrument(s) is (are) a good predictor of the instrumented variable one could check the p-value of the instrument(s). If the instrument that is used is a weak instrument it will result in high standard errors and could therefore result in high p-values. It is also useful to check the F-value of the excluded instrument(s) to see whether it is a strong instrument. Stock, Wright and Yoko (2002) suggest that F-statistics above 10 show that the excluded instrument(s) is a good predictor (are good predictors) of the first stage, though obviously this cannot be a theorem (Angrist and Pischke, 2008). Even if there is no endogeneity, the IV estimation is applicable, although at the cost of higher standard errors than OLS.

The second assumption is that the instrument(s) should not affect the dependent variable. This may be somewhat trickier because some variables that affect the wage drift also affect the contractual wage, such as the marginal tax rate.

In this thesis (section 5.2) an instrumental variable approach will be used as a robustness check for the OLS estimation. The change in the contractual wage will be instrumented by the change in the contractual wage one year before. Since collective labor agreements are often negotiated for more than one year the instrument should be a good predictor of the instrumented variable. Crucial is whether the instrument also affects the wage drift. Changes in the contractual wage normally lead to less room to negotiate for the wage drift (equation (10)). However the lagged value for the change in the contractual wage is not directly related to bargaining space, so it is unlikely that it directly affects the wage drift. Therefore the wage drift is only affected by the instrument through the change that it causes in the contractual wage.

5. Results

The results section is divided in 3 parts. In section 5.1 the main results will be discussed. Those involve the estimation of equation (11) with OLS. Then, in section 5.2, a number of robustness checks will be performed. This section ends with the implications of the results in section 5.3.

5.1 Main Results

Worker characteristics

The first two columns of table 3 show the results from the OLS estimation discussed in the previous section (with and without sector dummies). Worker characteristics prove to be important for determining the wage drift. Younger workers get a higher wage drift than older workers. There are a number of reasons for that result. Younger workers still have more possibilities to find a job with a higher wage. Younger workers are also likely to have less job tenure. Therefore they have less job-specific skills. If workers are paid for their productivity they have a higher wage when they have a higher job tenure and therefore less possibilities to find a job with a higher wage (and thus make promotion). Higher educated workers earn a higher wage drift, which could be because they are either more ambitious or simply have more possibilities to make promotion. Full-time workers have a higher wage drift than part-time workers and, perhaps surprisingly, females receive a somewhat higher wage drift than males.

Labor market conditions and firm characteristics

All the variables with regard to the labor market conditions and the firm characteristics confirm the signs that would be expected from the theory in section 3. When there are more vacancies it is easier for workers to find a job with a higher salary (as long as the additional vacancies are not only low wage jobs). A higher unemployment rate on the other hand increases the competition for those jobs and thus reduces the wage drift (the chance to make promotion decreases). Firm productivity also affects the wage drift. A higher firm

Table 3: Main results

Dependent variable: Wage drift	(1)	(2)	(3)
Intercept	0,045 ***	0,046 ***	0,050 ***
	(3,93)	(4,52)	(4,67)
Gender	0,012 **	0,010 *	0,010 **
	(2,21)	(2,03)	(2,07)
Age 25-29	-0,017 ***	-0,017 ***	-0,017 ***
	(-4,55)	(-4,52)	(-4,62)
Age 30-34	-0,027 ***	-0,027 ***	-0,027 ***
	(-6,03)	(-5,55)	(-5,66)
Age 35-39	-0,034 ***	-0,033 ***	-0,033 ***
	(-7,90)	(-6,80)	(-6,93)
Age 40-44	-0,036 ***	-0,035 ***	-0,035 ***
	(-6,95)	(-6,18)	(-6,30)
Age 45-49	-0,038 ***	-0,038 ***	-0,038 ***
	(-6,82)	(-6,06)	(-6,17)
Age 50-54	-0,040 ***	-0,040 ***	-0,040 ***
	(-7,09)	(-6,32)	(-6,45)
Age 55-59	-0,044 ***	-0,044 ***	-0,044 ***
	(-7,71)	(-6,91)	(-7,05)
Age 60-64	-0,041 ***	-0,041 ***	-0,041 ***
	(-5,73)	(-5,26)	(-5,36)
Primary education	0,004	0,004	0,004
	(1,34)	(1,55)	(1,58)
Mavo/Vbo (lower secondary	0,004	0,004	0,004
school)	(1,12)	(1,32)	(1,34)
Bachelors degree HBO/WO	0,000	0,001 **	0,001 **
	(-0,46)	(2,47)	(2,50)
Masters/Doctors degree	0,009 ***	0,011 ***	0,011 ***
	(4,46)	(5,33)	(5,44)
Part-time/Fulltime	-0,013 ***	-0,013 ***	-0,013 ***
	(-3,28)	(-3,09)	(-3,15)
dlog(unemployment)	-0,024 ***	-0,025 ***	-0,026 ***
	(-2,95)	(-3,13)	(-3,33)
dlog(vacancy rate)	0,049 ***	0,044 ***	0,047 ***
	(8,10)	(8,33)	(7,25)
dlog(productivity)	0,303 ***	0,177 **	0,192 ***
	(4,50)	(2,55)	(3,47)
d(Contractual wage)	-1,026 ***	-1,041 ***	-1,162 ***
	(-9,55)	(-19,10)	(-11,29)
Sector dummies	No	Yes	Yes
R-squared	0,05	0,05	0,05
Observations	100235	100235	100235

(1)+(2) OLS estimation for 2006-2009. Reference categories are male, age 24, education level havo/vwo/mbo 2+3+4 and full-time. */**/*** denote statistical significance at 10%/5%/1%. T-values in parentheses. d indicates the first difference operator. Standard errors are clustered at sector level.

(3) Instrumental variables estimation for 2006-2009, where (Wc(t+1)-Wc)/(Wc) is treated as endogenous and (Wc(t)-Wc(t-1))/(Wc(t-1)) is used as an instrument. Reference categories are male, age 24, education level havo/vwo/mbo 2+3+4 and full-time. */**/*** denote statistical significance at 10%/5%/1%. T-values in parentheses. d indicates the first difference operator. Standard errors are clustered at sector level.

productivity leads to a higher wage drift. More productive firms have more to lose when their vacancies are not filled and as result they start offering higher wages when their productivity goes up to retain and attract more workers.

The relationship between the contractual wage and the wage drift.

There is a clear negative relationship between the contractual wage and the wage drift. The estimate is somewhat smaller than -1, but not significantly different from -1 at a 5% significance level. This result indicates that an increase in the contractual wage does not lead to a higher actual wage, because the wage drift decreases in a 1:1 relationship. Lever (1993) also found a clear negative relationship between the wage drift and the contractual wage (of -0.7), however in that case an increase in the contractual wage still led to a higher actual wage.

The result is not (completely) in line with the theory. According to monopoly union/right-to-manage theory trade unions (section 3.1) always set a wage equal to or above the perfectly competitive labor market outcome. In this type of model there are only two possible reasons[25] for this relationship between the contractual wage and the wage drift. First trade unions have no bargaining power whatsoever. Or second trade unions misjudged labor demand and set a wage lower than the competitive wage (under the assumption that workers receive utility from leisure). In that case it would be possible that the contractual wage does not affect the actual wage.

It is difficult to explain the result with an efficiency wage model (section 3.2) since the contractual wage is assumed to be exogenous in those models. The contractual wage will not affect the actual wage if it is lower than the optimal wage. However theory does not provide an answer to the question why the trade union would set a wage below the optimal wage.

[25] The idea that workers are heterogeneous is not an explanation of the coefficient of -1. It can explain why some workers may not benefit from a higher contractual wage (they have an equilibrium wage that is higher than the contractual wage), but the coefficient indicates that no worker at all benefits from a higher contractual wage (unless some workers actually receive a lower wage after an increase in the contractual wage, but this cannot be explained by any theory).

Search models have been able to give a solid reason for the relationship between the other variables and the wage drift. However the relationship between wage drift and the contractual wage has not been studied in the search model literature. Even though this relationship has not been studied in the literature, a negative relationship between the wage drift and contractual wage is not unlikely in a search model.

The best explanation in this type of model is that the contractual wage puts a restriction on wage negotiations between a firm and a worker. The higher the restriction (contractual wage) the less room there is for negotiations. Therefore it makes sense that a higher contractual wage leads to a lower wage drift. Still the coefficient of -1 is unexpected since it suggests that trade unions are unable to negotiate a higher wage even for workers with very low bargaining power.

5.2 Robustness checks

To check the robustness of the results, three robustness checks will be performed[26]. First, to address omitted variable bias and reverse causality/simultaneity bias, I will use an instrumental variable approach to determine the relationship between the contractual wage and the wage drift. Second there will be a check whether the level of measurement for the unemployment rate and vacancy rate influences the results. Finally the regression will also be performed for 2001-2005 to see whether this gives consistent results.

Instrumental variable approach

Lever (1993) and Hibbs and Locking (1996) have found that not only the contractual wage affects the wage drift, but the wage drift also (negatively) affects the contractual wage. This results in simultaneity bias and an overestimation of the effect of the contractual wage on the wage drift. An instrumental variable approach can overcome this simultaneity bias. Therefore it is useful to perform a robustness check with the contractual wage instrumented

[26] I will only pay attention to the robustness of relationship between the contractual wage and the wage drift.

by the contractual wage one year before. The results of this estimation are displayed in column 3 of table 3. The results indicate that the relationship between the wage drift and the contractual wage that was established before is robust towards this different specification (The estimate is even slightly more negative than before).

The results from the first stage however are somewhat difficult to explain (see Appendix B). The F-statistic on the instrument is well above 10 and the t-statistic also indicates that the instrument is highly significant. However the estimate shows a negative relationship between the change in the contractual wage and the change in the contractual wage one year before. A possible explanation could be that if the contractual wage change was relatively high (low) it will be negatively (positively) adjusted in the contractual wage change one year later. However the estimate would be expected to be positive, since collective labor agreements are often valid for multiple years. Therefore the instrument may not be completely valid.

Different labor market tightness measure

In the first column of table 4 the results are displayed using the vacancy rate and the unemployment rate at a national level. The results are barely affected. A tighter labor market still leads to a higher wage drift. Note however that the amount of different observations for the labor market tightness is very low, given the short period over which data are available, meaning that the reliability of this variable is somewhat lower than of the vacancy rate at sector level and the unemployment on a regional level.

Different time period

In the second column of table 4 the results are displayed when equation (11) is estimated for 2001-2005. Those results differ from the previous one. Although the estimated coefficient for the contractual wage is still significantly smaller than 0 (at a 10% significance level) it is now significantly higher than -1. An increase in the contractual wage will affect the actual wage positively since the increase in the contractual wage is larger than the decrease in the wage drift. There may be a number of reasons for the difference in outcomes. First of all it

Table 4: Robustness checks for the wage drift.

Dependent variable: Wage drift	(1)	(2)
Intercept	0,007	0,059 ***
	(0,70)	(7,63)
Gender	0,009 **	0,001
	(2,67)	(0,85)
Age 25-29	-0,010 ***	-0,019 ***
	(-2,83)	(-4,00)
Age 30-34	-0,022 ***	-0,033 ***
	(-5,78)	(-5,80)
Age 35-39	-0,027 ***	-0,037 ***
	(-6,17)	(-5,83)
Age 40-44	-0,028 ***	-0,037 ***
	(-5,56)	(-5,13)
Age 45-49	-0,031 ***	-0,039 ***
	(-5,87)	(-5,50)
Age 50-54	-0,032 ***	-0,042 ***
	(-5,79)	(-6,95)
Age 55-59	-0,036 ***	-0,044 ***
	(-6,22)	(-7,74)
Age 60-64	-0,033 ***	-0,041 ***
	(-5,06)	(-6,29)
Primary education	0,001	-0,003
	(0,25)	(-0,79)
Mavo/Vbo (lower secondary	0,002	0,002
school)	(0,73)	(0,74)
Bachelors degree HBO/WO	0,002 **	0,002
	(2,57)	(1,34)
Masters/Doctors degree	0,011 ***	0,006 **
	(6,44)	(2,81)
Part-time/Fulltime	-0,012 ***	-0,003
	(-4,01)	(-1,15)
dlog(labor market tightness)	0,100 ***	----------
	(4,48)	----------
dlog(vacancy rate)	----------	0,033 ***
	----------	(6,93)
dlog(unemployment rate)	----------	0,004
	----------	(0,35)
dlog(productivity)	0,305 ***	-0,080 *
	(4,48)	(-1,79)
d(Contractual wage)	-0,979 ***	-0,131 *
	(-39,11)	(-1,97)
Sector dummies	Yes	Yes
R-Squared	0,13	0,01
Observations	132020	59854

OLS estimations. Reference categories are male, age 24, education level havo/vwo/mbo 2+3+4 and full-time. */**/*** denote statistical significance at 10%/5%/1%. T-values in parentheses. d indicates the first difference operator. Standard errors are clustered at sector level. Time period for (1) is 2006-2009. Time period for (2) is 2001-2005.

could be the case that there are omitted variables that affect the coefficients. Search costs, for example, could have been higher between 2001 and 2005 (and not constant) which would mean that the contractual wage would be more important between 2001 and 2005.

However it is also possible that the estimates are affected because the data between 2001-2005 are less reliable. The data in this time period have been derived from a labor market survey instead of directly from taxes. Less reliable data only affect the estimates if the wage drift of workers with a high contractual wage increase and workers with a low contractual wage increase is affected (by the reliability of the data) in a different way. Still the estimates for the unemployment rate and productivity show coefficients that do not suit the theory. This may indicate that something is wrong with the data.

A final reason can be that trade unions simply misjudged the state of labor demand between 2005-2009, thereby setting a wage that is lower than the equilibrium wage. In that situation there would be a positive wage drift to restore market equilibrium (Holmlund, 1986) and the contractual wage would not affect the actual wage at all. If the trade union did better between 2001-2005 and set a contractual wage that was above the equilibrium wage, an increase in the contractual wage would lead to an increase in the actual wage of a worker.

5.3 Implications

The relationship between the wage drift and the contractual wage has some implications with regard to the relevance of centralized wage setting.

There is a clear negative relationship between the wage drift and the contractual wage. This means that the total wage increase that follows from a contractual wage increase is mitigated by a decrease in the wage drift. Therefore trade unions may not be able to increase the actual wage of a worker even if they are able to negotiate a high contractual wage. This means that labor market conditions, personal characteristics and firm characteristics seem more important for the wage of an individual worker[27].

[27] Variables as the marginal tax rate and the level of unemployment benefits may also be important for someone's wage, but those variables have not been tested in this thesis.

The results in this thesis also have implications for wage moderation. In a market that is characterized by free entry and exit of firms, firms have profits equal to zero in equilibrium of opening a new vacancy (otherwise new firms will enter). When the labor market tightness remains the same (in a labor market with frictions) and the wage is set relatively low possible profits, from opening a vacancy, are higher than if the wage is high. Therefore more firms will open a vacancy and opportunities for unemployed workers go up (since there will be more vacancies per unemployed worker). This gives trade unions a reason to set a relatively low wage if unemployed workers sufficiently influence trade union behavior (Pissarides, 1986). However in this thesis a clear negative relationship between the wage drift and contractual wage was found. This means that if the contractual wage is relatively low, because trade unions want to create more opportunities for unemployed workers, the wage drift will be relatively high. This means that the effect of a lower contractual wage on the labor market tightness is mitigated by an increase in the wage drift.

There is another implication of this result. The number of trade union members has been decreasing for years. Between 2001 and 2013 the proportion of the labor force that is a member of a trade union has decreased with 4% (from 26,6% to 22,6%) (CBS, 2014). The ability of trade unions to negotiate a central wage increase depends crucially on the ability to decrease production[28] (Booth, 1995). Although both union and non-union members benefit from an increase in the contractual wage, there is a smaller incentive for non-union members to strike to get this wage increase. Non-union members will not receive any compensation when they strike, whereas union members receive compensation when they strike. Therefore non-union members are less likely to strike than union members. If the decreasing trend in the degree of organization of trade unions continues it will mean that contractual wage increases will become smaller in the future. However this will also lead to a higher wage drift in the future. This mitigates the negative effect on the wage of a smaller degree of organization.

In the next section the limitations of this study will be discussed and topics for future research are discussed.

[28] Lowering production leads to lower profits for the employer. In this case employers are willing to pay a higher wage if this increases the productivity more than it costs (in terms of an additional wage increase).

6. Limitations and future research

There are some limitations to this study. First of all the relationship between the contractual wage and wage drift is still not completely clear. An increase in the contractual wage leads to a lower wage drift, however the size of this offset is not robust. The estimates vary from a 13% offset to a full offset of changes in the contractual wage. A larger dataset[29] with more control variables (e.g. marginal tax rates) or different instrument(s) (e.g. trade union membership) to instrument the contractual wage might solve this problem.

External validity may be limited given the small set of sectors available for this research. If the effect of the independent variables used in this study on the wage drift differs in the sectors included from the sectors excluded the estimates are incorrect. This can be solved by a larger dataset (with more sectors included) in future research.

A final limitation of this thesis is that only part of the wage drift is reviewed. Wage drift can also exist if bonuses go up (or down) and if overtime payments go up (or down). This may potentially affect some of the estimates in this thesis. However it is not unlikely that, if those components were available, the sign of the estimates would remain more or less the same (e.g. if the labor market becomes tighter firms raise bonuses/overtime payments to attract labor).

For future research it is useful to assess whether changes in the contractual wage are more important for certain groups of workers than for other groups of workers. From the results it follows that higher educated workers have a higher wage drift than lower educated workers. This could imply that lower educated workers benefit more from a higher contractual wage than higher educated workers. In that case trade unions are less important for higher educated workers (which are likely to earn more) and can still be very important for less educated workers (which are likely to earn less). The results from section 5 only show an average effect of the contractual wage on the wage drift.

[29] A larger dataset will result in more precise estimates (smaller standard errors).

7. Conclusion

In this thesis I studied the existence of the wage drift. Some studies have found that the wage drift counteracts centralized wage agreements (e.g. Lever (1993) and Hibbs and Locking (1996)). If the wage drift counteracts centralized wage agreements it means that the positive effect of an increase in the contractual wage on the actual wage is offset by a decrease in the wage drift. Other studies have found no such effect and mainly attribute the wage drift to labor market conditions (e.g. Holden (1989[a]) and Holden (1998)).

In this thesis I found that there is a potentially large offsetting effect of the wage drift in response to changes in the contractual wage. Estimates range from a 13% offset to a complete offset. This means that the wage drift significantly counteracts centralized wage agreements, although the size of the exact effect needs more research.

The (strong) negative relationship between the wage drift and contractual wage indicates that the wage of a worker is largely determined by labor market conditions, firm characteristics and personal characteristics and not necessarily by a collectively set wage.

This has important implications for the effectiveness of centralized wage setting. The effectiveness of centralized wage setting is diminished by the wage drift. Trade unions may opt for a relatively low contractual wage so that more vacancies will exist than if they negotiate a high contractual wage (Pissarides, 1986). However if the wage drift goes up because of a low contractual wage, the amount of vacancies will not increase relative to the situation of a high contractual wage. Trade unions may also opt for a very high contractual wage because they care mainly about employed workers. In that case the wage drift would diminish the possibilities for trade unions to negotiate a higher actual wage (for the employed workers).

Appendix

A. Data

A1. List of sectors for which all data are available

Contractual wages are available for the following sectors:

- Manufacturing of metals
- Trade and repair of cars
- Trade and repair of motor vehicles and related parts
- Hotels, inns and conference resorts
- Road haulage
- General hospitals
- Child care, social work, social-cultural work and other welfare

The sectors can be divided in separate subsectors. This results in a total of 18 sectors.

A2. Calculation of the contractual wage growth

The wage floor in a sector is used as a proxy for the contractual wage. This means that differences in the contractual wage can be calculated as follows:

$$\frac{W_{t+1}^{c} - W_{t}^{c}}{W_{t}^{c}} = \frac{\underline{w}_{t+1} - \underline{w}_{t}}{\underline{w}_{t}} \qquad (A1)$$

The resulting change in the contractual wage will be wrong if changes at the wage floor are not equal to changes in the contractual wage at other wage levels. Inspection of the data shows that changes in the contractual wage are almost identical at any level.

B. First stage least squares result

Dependent variable: Contractual wage	(1)	
Intercept	0,047	***
	(223,95)	
Gender	0,000	***
	(5,29)	
Age 25-29	0,000	
	(-0,94)	
Age 30-34	0,000	
	(-1,11)	
Age 35-39	0,000	
	(-0,42)	
Age 40-44	0,000	
	(-0,41)	
Age 45-49	0,000	
	(-0,35)	
Age 50-54	0,000	
	(-0,84)	
Age 55-59	0,000	
	(-1,14)	
Age 60-64	0,000	
	(-0,29)	
Primary education	0,000	**
	(-2,57)	
Mavo/Vbo (lower secondary school)	0,000	
	(1,76)	
Bachelors degree HBO/WO	0,000	
	(0,29)	
Masters/Doctors degree	0,000	
	(0,30)	
Part-time/Fulltime	0,000	***
	(-11,85)	
dlog(unemployment)	-0,003	***
	(-9,60)	
dlog(vacancy rate)	-0,008	***
	(-35,95)	
dlog(productivity)	-0,061	***
	(-36,69)	
d(Contractual wage)	-0,528	***
	(-340,31)	
Sector dummies	No	
R-squared	0,86	
Observations	100235	

Reference categories are male, age 24, education level havo/vwo/mbo 2+3+4 and full-time. */**/*** denote statistical significance at 10%/5%/1%. T-values in parentheses. d indicates the first difference operator. Standard errors are clustered at sector level. Estimations are made for 2006-2009.

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