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Follow the leader?

Public and private wages in the Netherlands

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Annette S. Zeilstra and Adam C. Elbourne*† ‡ §

Abstract

This study investigates wage leadership in the Netherlands. We empirically examine public and private wages using several wage definitions for the period 1980-2012. We find no evidence for public wage leadership. Moreover, public wages return to their previous equilibrium value three to four years after an exogenous shock in public wages. By contrast, an exogenous shock to private wages has a permanent influence on both private and public wages. These findings suggest that although a public wage freeze lowers public expenditure in the short-run, it is not an effective policy measure to lower public expenditure in the medium and long-run.

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1 Introduction

Due to the current economic crisis, governments across Europe face soaring budget deficits and markedly increased public debt. To consolidate public finances, expenditures are being cut and taxes raised. One of the expenditure categories being cut is expenditure on personnel. For example, in the Netherlands the government budget balance dropped from a surplus of 0.5% GDP in 2008 to a deficit of 5.6% GDP in 2009 and recovered only moderately in 2010 (to 5.1% GDP), 2011 (to 4.3% GDP) and 2012 (to 4.1% GDP). In response the Dutch government raised taxes, cut several expenditures and announced a wage freeze for public wages for the period 2011-2014. It is unclear, however, if the public sector wage freeze will succeed in lowering the public sector wage bill in the long-run. If employees are free to choose between working in the public or private sector, then arbitrage between the two sectors will imply that the public wage rate cannot be considered independently of the private sector wage. To investigate this we pose the following two research questions: (*i*) Is there public or private wage leadership in the Netherlands? (*ii*) How long does it take before wages converge to their new (or previous) value after an exogenous shock to either public or private wages?

The empirical literature on the causal relationship between public and private wages is relatively scarce and the evidence is mixed.[1] Some recent examples are Lamo, Pérez and Sánchez-Fuentes (2013), Lamo *et al.* (2012), Pérez and Sánchez (2011), Friberg (2007), Lindquist and Vilhelmsson (2006) and Demekas and Kontolemis (2000).

Lamo *et al.* (2012) analyse public-private wage leadership for several OECD countries including the Netherlands. Their results show that, overall, the effect of private wages on public wages is stronger than vice versa. However, for the Netherlands, their results show evidence of long-run public-sector wage leadership and short-run private-sector wage leadership.

Pérez and Sánchez (2011) examine public and private sector wages in France, Germany, Italy and Spain combining annual, quarterly and monthly data from several sources. They control for other determinants of wages (prices, productivity and institutions) and find strong intra-annual links between public and private sector wages.[2] Their results regarding public or private wage leadership vary across countries and time periods. For example, in both France and Germany their estimates show private sector wage leadership for the period 1980-2007. However, for the subsample 1991-2007 they find evidence for public wage leadership. Lamo, Pérez and Sánchez-Fuentes (2013) find a positive correlation between collective

[1] Literature on the public-private wage differential on the other hand is extensive, for recent surveys see Lausev (2013), Gregory and Borland (1999) and Bender (1998).

[2] Lamo, Pérez and Schuknecht (2013) also find a significant contemporaneous correlation between public and private sector wages, based on annual data for several OECD countries.

bargaining and public wage leadership using data on several OECD countries.

Lindquist and Vilhelmsson (2006) analyse the wages of white-collar workers in the public and private sector in Sweden. According to their results the central government in Sweden does not act as a wage leader. By contrast, Friberg (2007) finds no evidence of a wage-leading role for the private sector in Sweden.

Demekas and Kontolemis (2000) develop a theoretical labour market model with two sectors and endogenous unemployment and test their model using data for Greece. They find evidence that increases in government wages led to higher wages in the private sector and higher unemployment.

Most studies in this field use the total compensation of employees to study the causal relation between public and private wages. From the perspective of the Netherlands, however, the total cost of employing someone may not be the best measure for investigating wage leadership. This is because some of the components of total compensation vary without directly changing the benefits that an employee receives, which is presumably an important factor when a worker chooses which sector to work in. An important example of this is the Dutch pension system. Typically, an employee is enrolled in a sector-wide defined-benefit pension fund - if their sector's pension fund performs badly in a given period, the pension premiums paid by employers are increased to rectify the projected shortfall. That is, total compensation increases but the benefits to the employee of working in that sector remain unchanged. Ideally, to study the relationship between wages in the two sectors, a wage measure that closely matches the benefits received by an employee should be used. This paper adds to the literature by analysing data for the Netherlands using two wage definitions. Our preferred wage measure, which does not include premiums paid by the employer that complicate the link between common wage measures and the benefits received by employees and which we therefore think is most relevant for labour market arbitrage has seldom been used in previous studies. Moreover, we establish how long it takes before public and private wages converge to their new (or previous) equilibrium value after an exogenous shock to either variable.

We find no evidence for public wage leadership. Moreover, public wages return to their previous equilibrium value three to four years after an exogenous shock in public wages. By contrast, an exogenous shock to private wages has a permanent effect on both private and public wages. These findings suggest that although there are short term gains for the public finances of a public wage freeze, it is not an effective policy measure to lower public expenditure in the medium and long-run.

This paper is structured as follows. In section 2 some stylised facts and theoretical considerations are provided. Section 3 describes the data. In section 4 the empirical model is delineated, whilst section 5 shows the results of our empirical

analysis. Finally, section 6 offers some conclusions.

2 Stylised facts and theoretical considerations

In the Netherlands, wage bargaining predominantly takes place at the sector or industry level.[3] Though union density is relatively low and decreasing (from 35% in 1980 to 19% in 2011),[4] the percentage of employees covered by collective wage bargaining agreements remains around 80%.[5]

The substantial collective coverage rates are in part due to two Dutch laws (see e.g. Hartog, 1999). The first law (from 1927) implies that the agreement an employer and a union reach, holds for all workers (both union and non-union members). The second law (from 1937) lays down the Ministerial extension of a collective agreement of a substantial majority of the industry to the entire industry.[6] By law, the maximum duration of a collective agreement is five years. However, the duration of collective agreements varies and the average length is one or two years Visser (2013a).[7]

One of the components agreed upon in a collective agreement between unions and employer's organisations is the increase in *contract wages*.[8] This increase is a general nominal increase (in percentage terms) of the entire wage distribution. All workers covered by the agreement receive the same percentage increase in their basic salary. On top of this contract wage increase, workers may receive higher pay due to increases in *incidental wages*, i.e. increases within the wage distribution for their job type related to tenure, promotions and bonuses.

A well known theoretical framework for analysing public and private wages is the so-called Scandinavian model of inflation. In this model, nominal wage changes in the competitive sector depend on productivity changes and changes in

[3]During the period 1980-2011 wage bargaining was mainly at the sectoral level, though in some years (around 25% of the period) wage bargaining was more centralised. Source: Visser (2013a), "Database on institutional characteristics of trade unions, wage setting, state intervention and social pacts, 1960-2011 (ICTWSS)", version 4.0, April 2013, http://www.uva-aias.net/208. An example of a year with more centralised level wage bargaining is 1982. In this year employers' and employees' organisations agreed at the central level on wage moderation in the so-called "Wassenaar Agreement" (for details see, e.g. Visser and Hemerijck, 1997).

[4]Source: Visser (2013a).

[5]The percentage of employees covered by collective agreements is 82% in 1980 and 84% in 2010. Source: Visser (2013a).

[6]For a more detailed description of the Dutch system of labour relations, see e.g. Hartog (1999), Van der Veen (1996, chap. 2), and Visser (2013b).

[7]The average length in years of collective agreements for the period 1980-2011 can be found in Visser (2013a). The average length of collective agreements in days can be found in (Harteveld and Rojer, 2005, fig. 2) for the period 1992-2005.

[8]Other components are e.g. working conditions, such as, working hours.

world prices. The competitive sector is the wage leader and the protected sector follows. For a more detailed description of the Scandinavian model of inflation, see Lindquist and Vilhelmsson (2006).

It can be argued that a similar theoretical framework is applicable for the Netherlands. The Netherlands has a small open economy, like Scandinavian countries. Moreover, the Dutch government has explicitly linked the development of Dutch public wages to the development of private wages for a large part of the period from 1961 onwards. However, during times of budget cuts, the Dutch government has limited the contractual public wage increase relative to the private wage increase in several years, for example, in the early 1980s and again recently.

Note that if the contractual wage increase in the public sector lags behind the contractual wage increase in the private sector in a specific period, there are no institutions that automatically lead to a relatively higher contractual wage increase in the public sector in the years thereafter. Even if the private sector is wage leader and the public sector follows, the adjustment does not need to take place through the relative development of contractual wages. An additional adjustment mechanism is the incidental pay component: public employers may increase incidental pay to retain their employees. This also makes sense from an arbitrage point of view: prospective employees care about how much money they take home at the end of the month, not the range of basic salaries offered to people employed in similar positions to them. If employees in one sector do not like their wage, they can always look for a job in the other sector. This arbitrage process should lead to the benefits received by the marginal worker being equal in both sectors in the long-run.

This paper does not a priori choose a specific theoretical framework in which either the public or private sector is a wage leader, but rather tries to determine empirically which sector, if any, is the wage leader.

3 Data

We have three sets (public and private) of wage data at our disposal:

1. the contractual wage increase, which is mostly fixed at the industry level in the Netherlands (i.e. the increase in *contract wages*);

2. the increase in contract wages plus incidental pay (i.e. the increase in the *wage rate*);

3. the increase in contract wages plus incidental pay plus employer's social security contributions and employer's contributions to occupational pension schemes (i.e. the increase in the *total compensation of employees rate*).

We use annual data for the Netherlands for the period 1980-2012. In this period the government imposed public wage cuts and wage freezes in a number of years making this an ideal sample for this analysis. We use percentage changes to construct indices, on which we perform our analysis. Graphs of the percentage changes are included in appendix B. A representation of the data in levels is shown in appendix C.[9]

In this paper we are specifically interested in how changes in wages in one sector affect the wages in the other, given that employees can choose which sector they want to work in. A critical factor for analysing this is to have a wage measure where variations in the measured wage closely match changes in the perceived benefits of being employed in each sector. The third measure, the total compensation of employees, includes a number of pension and social premiums that can vary without changing the benefits received or promised to employees. For example, in some cases an increase in total compensation in the public sector may simply reflect poor performance of the public sector pension fund (also relative to the performance of private sector pension funds) and subsequent higher employer contributions to pension funds. Since these types of changes in measured total compensation do not always directly change the benefits received by working in each sector, they also do not necessarily change the arbitrage process of employees choosing which sector to work in. In contrast, the second wage measure does not include these premiums, which makes it a clearer measure of the wage relevant for the arbitrage process of employees.[10]

Furthermore, we use real wages instead of nominal wages because nominal wage series may present some difficulties. Specifically, nominal wages are the product of real wages and the price level and there has been much discussion of whether the latter is integrated of order one or two (see, for example, Romero-Ávila and Usabiaga, 2009; Basher and Westerlund, 2008; Karlsson and Löthgren, 2000; and Culver and Papell, 1997). For cases where the underlying series are integrated of order two, the standard Johansen technique needs to be adjusted (Johansen, 1995) for inference to be valid. Given the uncertainty over the order of integration of

[9] At first glance, it seems that wages in the two sectors have diverged since 1980. However, this is merely an artifact of choosing 1980 as the base year: we could have defined the base year in 2012 and then it would look like the wages have converged. Also note that changing the base year only affects the estimates of the intercept term in our models - it has no effect on the conclusions we draw.

[10] We did not pursue an analysis of the contract wage on it's own because is not the relevant variable for our analysis. Employees make their decisions based on the wage they actually take home, which is most closely measured by our wage rate variable. In contrast, the contractual wage doesn't take into account things like wage drift so does not keep track of the real reward for working as well as the wage rate does. Moreover we would expect contract wages to be integrated of order one, because wages follow productivity. However, the ADF tests reject the null of I(1) for public wages, which calls into question the value of the contract wage measure for this study.

the price level and, since our primary focus is not on the nominal component of wages but rather the arbitrage process between the two wage rates, we specify our model in real terms using the consumer price index (CPI).[11]

4 Empirical model

This study aims to test the direction of wage leadership in the Netherlands. Ideally, to be able to come to a clear conclusion, we want to avoid imposing too much theory on our estimates as erroneously imposed theory could potentially bias our results. In such circumstances VAR models are commonly used to model the dynamic relationship between variables whilst only imposing a minimum of structure on the data, allowing the estimates to be almost entirely data driven. In essence, this is simply another way expressing Sims (1980) *incredible restrictions* critique where he argued for the use of VAR models as data driven arbiters of economic theory. Given that the theoretical discussion in section 2 focussed on an arbitrage condition for workers who can work in both sectors and also that both wage rates are integrated of order one and cointegrated, a VECM model is the correct specification of the dynamic relationship between the two wage rates (Lütkepohl and Krätzig, 2004). Equation (1) shows a VECM(p) model with p lags of the endogenous variables.

$$\Delta W_t = \alpha[\beta' : \eta']' \begin{bmatrix} W_{t-1} \\ D^{co}_{t-1} \end{bmatrix} + \Gamma_1 \Delta W_{t-1} + \ldots + \Gamma_p \Delta W_{t-p} + u_t \tag{1}$$

where t $(= 1, \ldots, T)$ refers to a given time period, Δ denotes the first-difference operator, $W_t \equiv (W^p_t, W^g_t)'$ is a vector containing the wage rates in both the private sector (denoted by a superscript p) and the public sector (denoted by a superscript g), D^{co} is a constant, η is a parameter of dimension one, β is a (2×1) parameter vector containing the long-run relationship between the variables (i.e. *cointegrating relations*), α is a (2×1) parameter vector containing *loading coefficients*.

Strict arbitrage over identical jobs in the two sectors should be expected to lead to a cointegrating vector [1,-1] with no constant. However, the two series may not have been in equilibrium in the base year used for constructing the level series for the wage rates and jobs in the two sectors may have some structural differences of value to prospective employees (for example, more job security in the public sector and more hours of work in the private sector). The constant we include in the cointegrating vector controls for these issues.

By estimating the model in VECM form we can look directly at the loading coefficients, $\alpha \equiv (\alpha^p, \alpha^g)$, to give an answer to the question of which sector, if any,

[11] As a robustness check we did analyses on nominal wages as well and obtained similar results to the ones presented in this paper. However, those estimates suffered persistently from autocorrelation.

is the wage leader in the Netherlands. The loading coefficients show how quickly and in which direction each of the series responds to deviations from the long-run arbitrage condition given by the cointegrating relationship.

If $\alpha^p = 0$ and $\alpha^g > 0$, then a positive long-run disequilibria (private sector wages are too high relative to public sector wages) will be corrected by increases in the public sector wage, not by decreases in the private sector wage. That is, the private sector wage is the wage leader and the public sector wage responds. If $\alpha^p < 0$ and $\alpha^g = 0$, the opposite is true and the private sector wage falls to bring the system back into equilibrium. That is, the public sector wage is the wage leader.

5 Results

As argued in section 2 for arbitrage purposes the *wage rate* (i.e. the contract wage plus incidental pay) is the relevant variable for our analysis. For this reason, we focus on the wage rate results in this section. However, the total labour costs employers actually face is our measure called total compensation of employees; it is also the most commonly used wage measure in comparable studies. Therefore, as a robustness check, the results for the total compensation of employees analysis are shown in appendix A.

According to our tests, both public and private wages are I(1).[12] In addition, Johansen tests do not reject that the two series are cointegrated, so we are able to apply a VECM-analysis, for which we use the standard Johansen method. We examined several lag length criteria tests to determine the appropriate lag length (p, see equation 1). The Akaike information criterion (AIC), Hannan-Quinn criterion (HQ) and Schwarz Criterion (SC) all point towards including one lag. However, the residuals from estimating the VECM(1) model for the wage rate suffer from serial autocorrelation. If we add one lag and estimate a VECM(2) the resulting residuals no longer show evidence of serial autocorrelation. We therefore set the lag length at two.

In the remainder of this section, we first consider wage leadership using the estimates of $\widehat{\alpha^p}$ and $\widehat{\alpha^g}$. Next, we present impulse response analysis to determine the effects of exogenous shocks to both private and public wages.[13]

[12] The results of the ADF, cointegration and lag length criteria tests can be found in appendix D.

[13] The analyses in section 5 and appendix A are conducted using the JMulTi software package of Lütkepohl and Krätzig described in Lütkepohl and Krätzig (2004).

5.1 Wage leadership

The estimates of the VECM(2) are presented in table 1. Both $\widehat{\alpha^g}$ and $\widehat{\alpha^p}$ are statistically significant and positive. This indicates that the public sector does all the adjustment towards the long-run equilibrium, i.e. private wages cause public wages in the long-run.

Interestingly, the statistically significant and positive sign of $\widehat{\alpha^p}$ indicates a disequilibrating movement of private wages after a shock hits. That is, after a positive shock to public wages, private wages fall. Consequently, a positive shock to public wages does not lead to higher public or private wages in the long-run.[14][15]

As a robustness check we estimated the VECM(2) using different time periods. We varied the starting date between 1981 and 1991 keeping the end date at 2012. Our results regarding wage leadership are robust against these sample changes.

Table 1: Wage rate estimates

$\widehat{\alpha^p}$	$\widehat{\alpha^g}$	$\widehat{\beta^p}$	$\widehat{\beta^g}$	$\widehat{\eta}$
0.154**	0.574***	1	-1.010***	-0.172***
(0.070)	(0.096)		(0.047)	(0.007)

Notes: *** and ** denotes statistically significance at respectively 1 and 5 percent significance and standard errors are in parentheses.

5.2 Impulse responses

We now turn to evidence from impulse response analysis. Since our data is annual, when one sector moves first the reaction of the other sector will likely begin within the same year. Hence the movement of the leader and the reaction of the follower will appear to be contemporaneous with our annual observations, rather than sequential as in reality. Therefore, to answer our research question we need some way to decompose the observed contemporaneous movement of both wages into cases where the public sector or the private sector moved first. The picture is further complicated, however, by omitted variables that cause both public and private wages to react. For this study we can think of many factors that would cause both public and private sector wages to move in the same direction, for example, if unemployment were to increase unexpectedly, this would likely put

[14] A test for Granger causality tests if adding a variable significantly improves forecasting accuracy of another variable. As such it does not distinguish between the sign of the correlation. Our VECM estimates give a positive $\widehat{\alpha^p}$, which would show up as Granger causality, but does not imply wage leadership. As a result, Granger causality testing shows a mutual causal relationship between public and private wages.

[15] Note that for public sector wage leadership $\widehat{\alpha^p}$ should have been negative and significant.

downward pressure on wages in both sectors. The positive correlation between the wage rates as a reaction to higher unemployment is not necessarily the same as the correlation between the wage rates when one sector exogenously decides to cut wages. In short, we can think of the observed contemporaneous correlation between the reduced-form error terms from our VECM model as being caused by three situations:

1. when public sector wages move first,
2. when private sector wages move first,
3. when some other omitted variable causes both public and private sector wages to move simultaneously.

To get an accurate measure of what happens when one of the sectors moves first we need some way to filter out the effect of omitted variables and decompose the remaining contemporaneous correlation into cases when each sector moved first.

Unfortunately there is no straightforward way of decomposing the contemporaneous correlation into the three causes - there is no obvious identification scheme that seems likely to be able to attribute the cross-correlation to the correct source. The commonly used Cholesky decomposition simply assumes that all of the observed reduced-form cross-correlation is caused by the variable ordered first moving first. In itself, this is clearly not a good measure of what we want since it biases the question of which sector is the wage leader towards the sector with the wage ordered first in the VECM. That is, if public sector wages are ordered first, then those occasions in our sample period that private sector wages moved first will be incorrectly attributed as cases where public sector wages moved first. This logic also holds true for omitted variables in the sense that omitted variable movements will also be incorrectly attributed to the variable ordered first. In contrast, when the non-leading sector moves first, we should not see a reaction by the other sector's wage - after all, the follower follows the leader and not vice versa. Nevertheless, using the Cholesky decomposition does give us an extreme bounds analysis of the size of the effects. If we use the Cholesky decomposition with public wages ordered first, we are biasing our impulse responses towards the hypothesis that the public sector is the wage leader and simultaneously biasing our results away from finding that the private sector is the wage leader.[16]

[16]Pesaran and Shin (1998) have proposed the use of generalised impulse responses as a way of avoiding having to specify a causal order for the variables in the VAR or VECM system. However, in linear models, such as the VECM model we are using here, the generalised impulse responses are equivalent to orthogonalised impulse responses using the Cholesky decomposition with the shocked variable ordered first. As such, generalised impulse responses offer us little help in identifying the correct policy shocks for our research question.

Impulse responses using the Cholesky decomposition with the public sector ordered first are shown in figure 1. The impulse responses are depicted by a bold solid line, while the dashed and dotted line represent 90% bootstrap confidence bands calculated using 10,000 replications as described in respectively Efron and Tibshirani (1993) and Hall (1992).

Panel A and C of figure 1 show the effects of a positive exogenous shock to public wages on public wages (panel A) and private wages (panel C), respectively. There is no evidence that private wages respond in the long run to the public wage shock: the zero line lies between the confidence bands for all horizons longer than 2 years (panel C). The statistically significant response in the first two years should not be interpreted as public wages causing private wages, because, as detailed above, the Cholesky decomposition employed here biases the results towards this finding. The effect of a public wage shock on public wages is also temporary. Initially public wages increase, but this effect dies out after three to four years (see panel A).

Panel B and D of figure 1 present the effects of a positive exogenous shock to private wages on public wages (panel B) and private wages (panel D), respectively. As a result of the private wage shock, both public and private wage increase permanently, see respectively panel B and D. In fact, both public and private wages follow largely the same trajectory following a private wage shock. The only noteworthy difference is that public wages start at zero in the year of the shock and this is simply a mechanical consequence of our biased identification scheme.

The main message emerging from figure 1 is that even when we deliberately bias our estimates towards finding that the public sector is the wage leader (and bias away from the private sector), we only find evidence consistent with the private sector being the wage leader. Moreover, the effect of the public wage shock on public wages largely dissipates after three to four years.

As a robustness check we have also included the impulse responses using the Cholesky decomposition with the private sector ordered first, which biases our results towards finding private sector wage leadership. This does not change our main results, as can be seen in figure 2.

6 Conclusions and policy implications

In this study we investigated public and private wages in the Netherlands, using two different wage definitions in VECM models estimated using Johansen's technique. Having different wage definitions allows us to focus on the wage measure most relevant for labour market arbitrage: a measure that has seldom been used in previous studies. We find no evidence for public wage leadership. Moreover, public wages return to their previous equilibrium value three to four years after an exogenous shock in public wages. By contrast, an exogenous shock to private wages has a permanent influence on both private and public wages.

These findings fit the theoretical framework offered by the Scandinavian model of inflation. In this framework, nominal wage changes in the competitive sector depend on productivity changes and changes in world prices. The competitive sector is wage leader and the protected sector follows.

Evidence on the causal relationship between public and private wages is still mixed. Different studies for the same country can find contrasting results. For example, according to Lindquist and Vilhelmsson (2006) the private sector acts as a wage leader in Sweden, while Friberg (2007), in contrast, finds no evidence of a wage-leading role for the private sector in Sweden. In addition, results may vary across different time periods for the same country (see, for example, Pérez and Sánchez, 2011).

Our findings are in line with the overall results of Lamo *et al.* (2012) who find that there appears to be a stronger influence of private wages on public wages than vice versa for several OECD countries including the Netherlands. However, our results do not completely mirror the results of Lamo *et al.* (2012) for the Netherlands. Using total compensation of employees their results show short-run private wage leadership and long-run public wage leadership, whereas we find no evidence of public wage leadership.

Our findings for the Netherlands suggest that a public wage freeze may lead to lower public wages and public expenditure in the short run. However, our results show that a public wage freeze is not an effective policy measure to lower public expenditure in the medium and long-run.

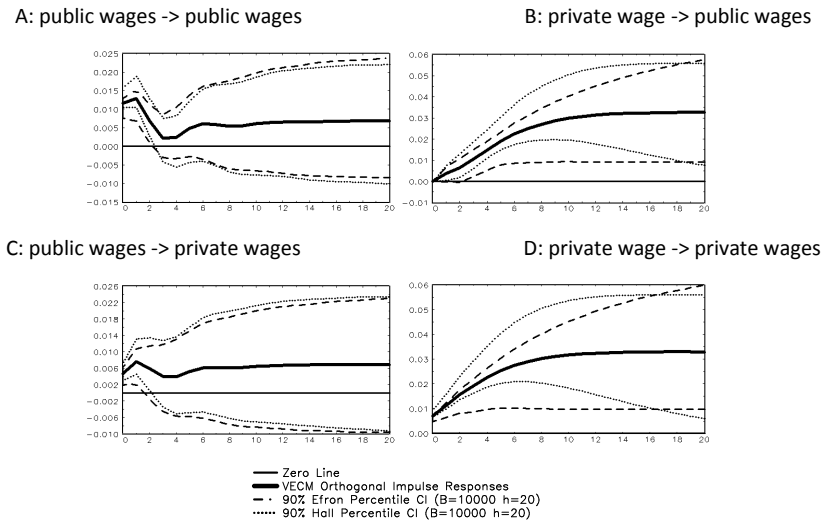

Figure 1: VECM impulse responses (public sector ordered first).

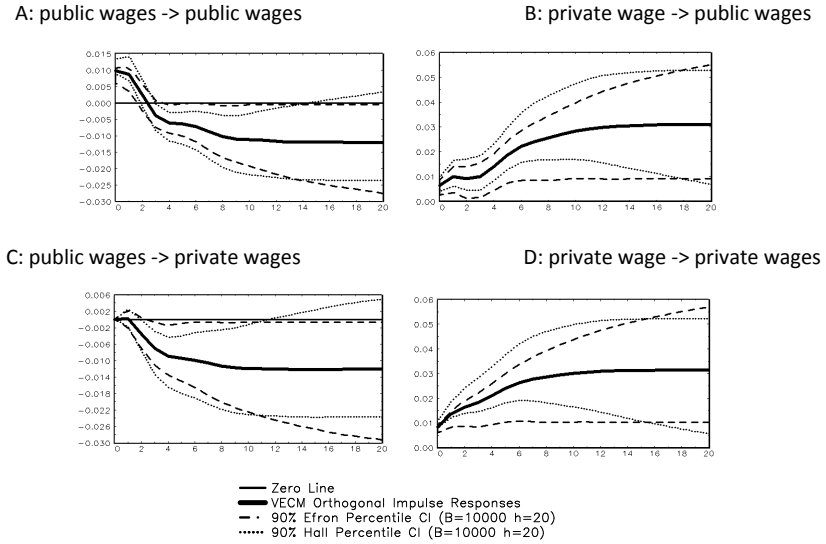

Figure 2: VECM impulse responses (private sector ordered first).

A Robustness checks with total compensation

As described in section 3, we have a number of different measures of wages available. Our cointegrating analysis of the dynamic relationship between the wages of the two sectors is built around an arbitrage condition facing a prospective employee. Hence our econometric specification should be most accurate with the wage measure that most closely resembles the relevant wage for the prospective employee. We have argued above that this is contract wages plus incidental pay (i.e. *wages*).

However, the total labour costs employers face is our measure called total compensation of employees. Hence, it is also of interest to see if our results are robust to this change in the definition of wages.

We tested public and private total compensation rates and both prove to be I(1).[17] In addition, testing shows us that both series are cointegrated, therefore we can apply VECM-analysis, for which we use the standard Johansen method. We examined several lag length criteria tests to determine the appropriate lag length (p, see equation 1). The lag length criteria tests (AIC, HQ and SC) suggest to include no lags. Moreover, diagnostic tests on the residuals resulting from the VECM(0) estimation show that the residuals are well-behaved. We therefore set the lag length at zero.

The VECM(0) estimates of the long-run relationship and the loading coefficients are shown in table 2. Since $\widehat{\alpha^g}$ is statistically significant and positive and $\widehat{\alpha^p}$ is statistically insignificant, the public sector does all the adjustments towards a long-run equilibrium and the private sector does not adjust after a shock. In other words, private total compensation rates cause public total compensation rates in the long-run.

Since the total compensation rates not only include contract wages and incidental pay, but also social security and pension contributions, the contemporaneously correlation[18] of the reduced form error terms from our VECM model can be expected to play an even larger role in the impulse responses than in the wage analysis in section 5 (see the discussion in section 5.2). This being the case, the impulse response graphs do not present a clear picture of adjustment mechanisms of the different shocks and therefore are not included in this appendix.

[17] The results of the ADF, cointegration and lag length criteria tests can be found in appendix E.

[18] E.g. due to omitted variables such as stock market returns on pension premiums.

Table 2: Total compensation estimates

$\widehat{\alpha^p}$	$\widehat{\alpha^g}$	$\widehat{\beta^p}$	$\widehat{\beta^g}$	$\widehat{\eta}$
0.067	0.350***	1	-0.874***	-0.172***
(0.053)	(0.055)		(0.062)	(0.008)

Notes: *** denotes statistically significance at 1 percent significance and standard errors are in parentheses.

B Data: percentage changes

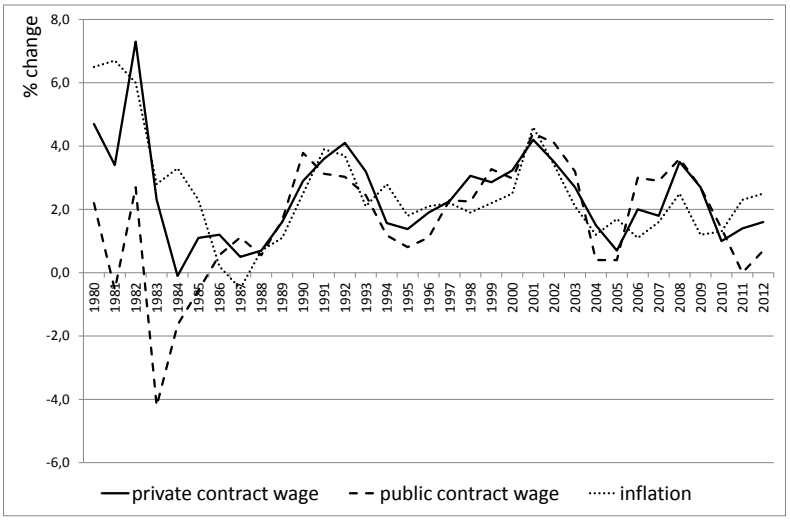

Figure 3: % change contract wages.

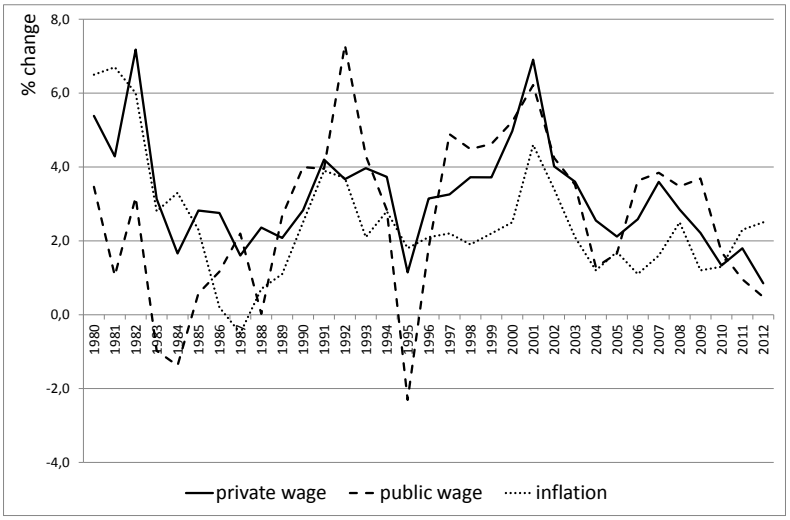

Figure 4: % change wages.

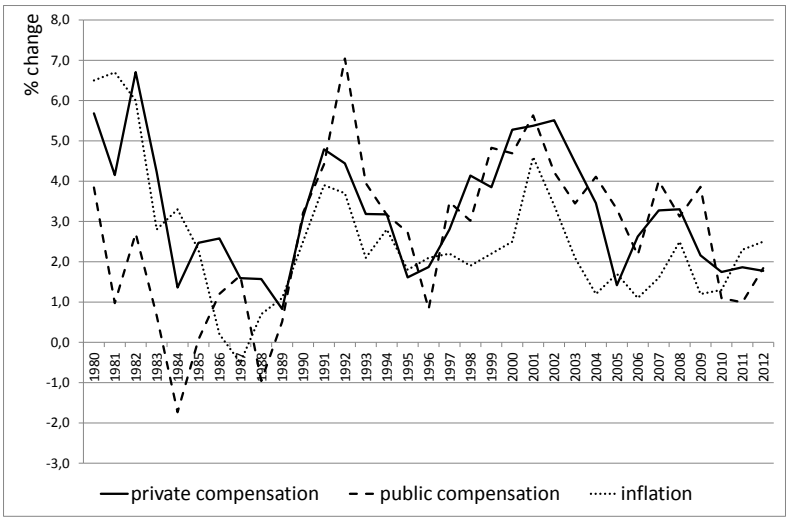

Figure 5: % change compensation of employee rates.

C Data: indices

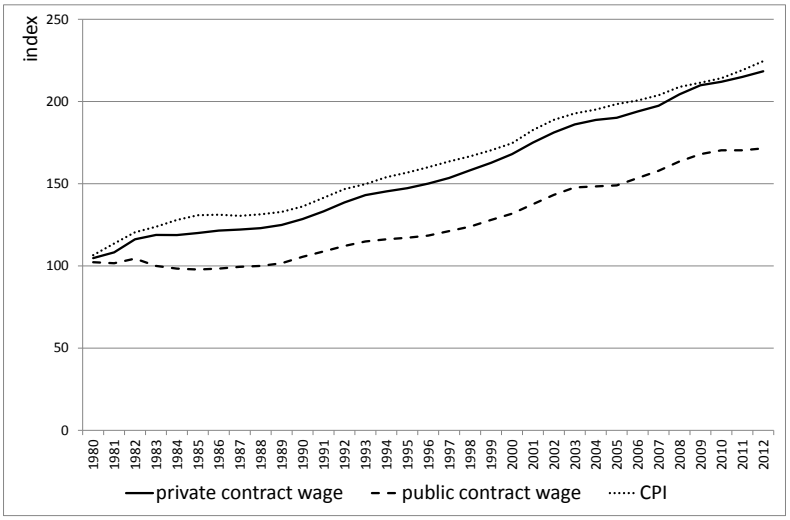

Figure 6: contract wage indices.

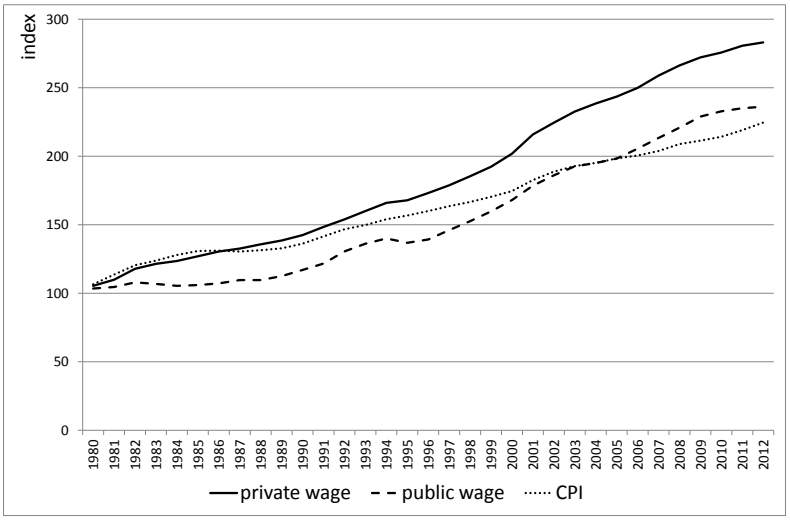

Figure 7: wage indices.

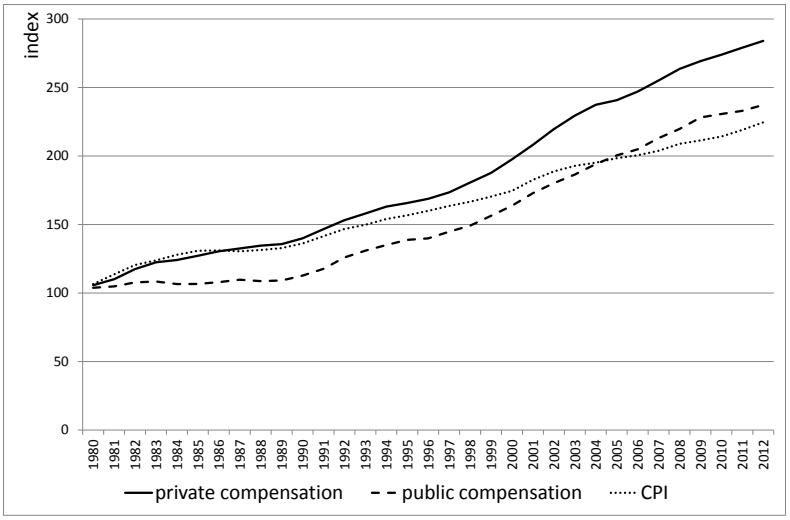

Figure 8: compensation of employee rate indices.

D Wages: ADF, cointegration and lag length tests

Table 3: Augmented Dickey-Fuller test

	Levels	First differences
private wage	-1.16	-4.21***
public wage	-1.11	-2.92**

Notes: *** and ** denotes statistically significance at respectively 1 and 5 percent significance.

Table 4: Johansen cointegration test between private and public wages

	LR stat.	p-value	10% Crit. value	5% Crit. value	1% Crit. value
$H_0 : r{=}0$	22.12	0.0036	13.42	15.41	19.62

Notes: r denotes the number of cointegrating vectors. Based on Schwarz criterion two lags are included.

Table 5: Lag length tests

	optimal number of lags
Akaike Info Criterion	1
Hannan-Quinn Criterion	1
Schwarz Criterion	1

Notes: denotes optimal number of lags in VECM specification.

E Total compensation: ADF, cointegration and lag length tests

Table 6: Augmented Dickey-Fuller test

	Levels	First differences
private total compensation	-0.49	-4.76***
public total compensation	-0.08	-3.67***

Notes: *** denotes statistically significance at 1 percent significance.

Table 7: Johansen cointegration test between private and public total compensation

	LR stat.	p-value	10% Crit. value	5% Crit. value	1% Crit. value
$H_0 : r{=}0$	37.02	0.0000	13.42	15.41	19.62

Notes: r denotes the number of cointegrating vectors. Based on Schwarz criterion one lag is included.

Table 8: Lag length tests

	optimal number of lags
Akaike Info Criterion	0
Hannan-Quinn Criterion	0
Schwarz Criterion	0

Notes: denotes optimal number of lags in VECM specification.

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