Aggregate and sectoral public-private remuneration patterns in South Africa

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ABSTRACT

This paper investigates the aggregate and sectoral public-private remuneration pattern in South Africa from 2001:q1 to 2017:q1. Co-integration analysis confirm a stable, long-run relationship. The adjustment to the deviations from this long-run relationship is strong and significant for public-sector remuneration, while private-sector earnings neither respond to the deviations from the long-run relationship nor lagged changes of public sector remuneration. No individual public-sector remuneration is found to Granger-cause an individual private-sector remuneration. On the other hand, causal relations between private-sector remuneration and public sector remuneration cannot be rejected. A traditional "Dutch-disease" hypothesis for South Africa is rejected. Widening this analysis to individual private and public sectors confirms the results with aggregate earnings with two exceptions: 1) Earnings in financial intermediation and private road transport can be better explained including public sector earnings, and 2) Earnings in manufacturing and mining are found to be related to public sector earnings in the long run. Nevertheless, the degree of fit is low for individual private sector variables except financial intermediation and private road transport while it is high for individual public sector earnings except local authorities. Efforts to slow down the speed of the wage-price spiral should not exclude the private sector.

JEL Classification: J30, C30, E30

Keywords: public-private sector earnings, co-integration, Dutch disease

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Introduction

This paper[4] provides an empirical investigation into the remuneration pattern in South Africa by examining the relationship between aggregate and sectoral public- and private-sector remuneration. It repeats the already published analysis with aggregate public and private earnings per employee and adds the econometric analysis with 5 individual public sectors and 6 individual private sectors. It complements those studies that are mainly concerned with the structural differences between public- and private-sector employment and remuneration (Kwenda and Ntuli, 2018; Bosch, 2006).

Remuneration patterns can have important consequences for inflation, unemployment, and – through work experience – productivity. Together, this has an impact on the sacrifice ratio or, in other terms, the real costs needed to maintain price stability. For instance, in a bargaining system with more than one trade union, wage leadership reduces the effective number of independent trade unions and increases the degree of centralization of wage bargaining. Either completely centralized or completely decentralized bargaining systems are associated with better macroeconomic performance (Calmfors and Driffill, 1988). If the leading trade union has some degree of inflation aversion, this could allow the central bank to be more accommodative while simultaneously reducing inflation and unemployment to their lowest socially optimal levels (Coricelli, Cukierman, and Dalmazzo, 2006).

One of the reasons why the remuneration pattern is important is its contribution to employment creation, growth and external competitiveness. It makes a difference whether a remuneration pattern is linked to labour market developments and external competitiveness or other considerations. In this context we deal with two questions: 1) What is the causal relation between aggregate public and private sector remuneration and 2) Is remuneration in the mining sector causing changes in the remuneration of other sectors. Causality is not rejected if past values of a remuneration indicator have a significant relation with current values of another remuneration indicator (Granger, 1969).

In general terms, one can assume that private-sector earnings are more driven by market developments than public-sector earnings. The direction of causality therefore either increases (in the case of public-sector earnings following the private-sector developments) or decreases (in the case of the private-sector following public-sector earnings) the role of market forces.

A similar situation exists for the mining industry. Its profitability is to a large extend driven by the development of international raw material prices and only to a smaller degree by domestic market developments. We are therefore interested whether we find evidence of “Dutch disease” in the sense that remuneration in the mining sector is spilling over to other sectors in the economy. If this is the case, then the consideration of market forces in non-mining sectors is reduced.

The sections that follow provide a short overview of the literature, describe the data, present the outcomes of the standard time series analysis for aggregate public and private remuneration, extend the analysis to sectoral public and private remuneration, investigate the presence of “Dutch disease” and end with conclusions.

Literature Review

The theoretical literature on pattern bargaining takes two opposing views. One string of literature, strongly influenced by Calmfors and Driffill (1988), takes an institutional approach, which links bargaining outcomes to the setup of the bargaining framework. In this context, not all externalities may be considered by individual economic agents. For instance, excessive payroll taxation and regulatory interference into wage formation can contribute to a loss of external competitiveness and a growing gap between productivity and wage costs (Agudelo and Sala, 2016). Beyond competitiveness, there is also the issue of fairness and

[4] Earlier versions on the aggregate public/private earnings pattern in South Africa were published as SARB and TU Wien Working Papers.

excessive inequality of pay (Gwatidzo and Benhur, 2013), which is particularly important for economies where monopsony plays a role.

Following this line of literature, there is possibly a positive role to play for pattern bargaining, removing information asymmetries, and internalising externalities, for instance from wage growth on inflation. This literature treats labour organisations like trade unions, as exogenous.

On the other side are authors like Pollan (2004), who consider the institutional setup, including the coverage of collective bargaining, as part of an economic optimization process. In this respect, pattern wage bargaining cannot improve outcomes compared with decentralized bargaining under inflation targeting (Calmfors and Seim, 2013). This is less relevant for the public- / private-sector earnings pattern because the public- / private-sector split of the economy can be assumed to be exogenous and only slowly changing.

In the area of macrostructural interactions, the Scandinavian model of inflation links inflation differentials to sectoral productivity differences in a model with centralized and solidaric wage determination (Frisch, 1977). In this model, the higher structural rate of inflation, which comes from the lower productivity growth in the domestic sector, does not pose a problem for international competitiveness. The wage leader in the export sector sets wage increases on a level which is compatible with international competitiveness. This pattern of wage outcomes is in line with macroeconomic stability and contributes to a lower sacrifice ratio. The disciplining effect of unemployment on wage formation is replaced by the internalization of the concern for international competitiveness through a centralized bargaining process with monopoly trade unions and employer associations. An important assumption in this model is that the size of the two sectors is exogenously given. In this type of model, private-sector earnings lead public-sector earnings because the wage ceiling is established by maintaining international competitiveness.

'Dutch disease' models describe cases in which one sector (usually resource extraction) grows because of newly discovered profitable deposits (like the gas fields in the Netherlands) and a wage differential therefore becomes necessary to attract workers from other sectors, mainly manufacturing. It is assumed that labour is not internationally mobile. The 'disease' element of this otherwise beneficial setting comes from the spillover of wage increases to sectors which face international competition (and therefore cannot pass on wages to higher prices) and/or which face technological and/or organisational barriers to increasing productivity. As a consequence, more workers lose jobs in export-oriented manufacturing than can find new employment opportunities either in mining or in services sectors, which benefit from the higher incomes generated by the expansion of the mining sector. A variant of the 'Dutch disease' can arise if internationally determined raw-material prices increase and thus increase the profitability of mining exports (Ahrend, de Rosa and Tompson, 2007).

For South Africa, mining is an important contributor to economic activity, exports, and jobs. While in the past productivity advances allowed mines to operate longer, internationally determined raw-material prices became the dominant determinant of the profitability of the sector from the beginning of the 2000s (Gwatidzo and Benhur, 2013). A similar context as in the case of 'Dutch disease' may have distorted the wage-setting process in post-communist countries (D'Adamo, 2014). In these countries, government played a big role in the redistribution of income and wealth through privatization and the restructuring of state-owned enterprises. It is therefore not surprising to find many cases of wage leadership by the public sector. This could also be the case for South Africa, if government revenue from mining is spent to increase public-sector wages above private-sector wages (including in the export industries).

In all variants of the 'Dutch disease', wage pressures arise which are not in line with macroeconomic stability and which therefore contribute to an increase of the sacrifice ratio. This is also the case if government benefits from extra revenue and uses it to increase wages in the public sector.

In most member countries of the Organisation for Economic Co-operation and Development (OECD), public-sector wages follow the outcomes of private-sector wage negotiations (Lamo, Pérez, and Schuknecht, 2012). However, there are also cases of public-sector leadership and spillover effects. The same authors find that public and private sector wages are correlated contemporaneously over the business cycle (Lamo, Pérez, and Schuknecht, 2013).

For Sweden, it is confirmed that the private sector is the wage leader and the public sector follows (Lindquist and Vilhelmsson, 2006). Public-sector wages do not Granger-cause private-sector wages. A similar result was also found recently for Croatia (Vuksic, 2018). For Austria, it is found, with data on collectively bargained wages, that reference norms play a significant role and that external norms seem to matter more than internal norms (Knell and Stiglbauer, 2012). However, in an earlier paper, Pollan (2004) finds Austrian remuneration outcomes characterised by high and rising diversity, which is incompatible with a wage pattern hypothesis. For the United States, Marshall and Merlo (2004) find that trade unions prefer pattern bargaining over simultaneous industry-wide bargaining and sequential bargaining with a random pattern. They also point out that pattern bargaining establishes significant entry barriers.

For the euro area, it is found that Germany acts as wage leader (Ramskogler, 2012). This could have encouraged the European Central Bank to run its accommodative monetary policy despite the warning signals from an overheating housing market during the run-up to the most recent global financial crisis.

Aggregate public and private remuneration analysis

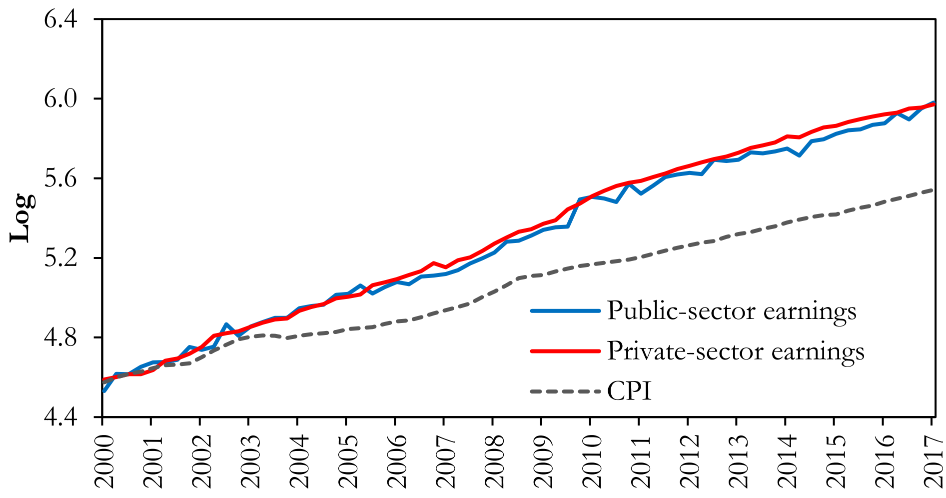
Aggregate Data

We use aggregate and disaggregated quarterly average remuneration (earnings) data from the first quarter of 2000 to the first quarter of 2017 for public and the private sectors. The choice of the observation period was motivated by the introduction of South Africa's inflation-targeting regime. Real remuneration is calculated by deflation with the deflator of gross value added excluding agriculture, following the methodology applied by Statistics South Africa (Stats SA).

Remuneration data are collected by Stats SA; the seasonal adjustment was carried out by the South African Reserve Bank. The term 'earnings' is used synonymously for 'remuneration'.

Figure 1 shows the development of aggregate public- and private-sector remuneration, together with the consumer price index (CPI). The CPI is shown because it is the headline inflation measure most popular in South Africa. All the variables are presented in logarithmic terms. A visual inspection of the data signals that aggregate private-sector earnings progress relatively smoothly, with only some cyclical responses, while public-sector remuneration is much more volatile. The CPI is quite smooth but shows more pronounced cycles.

Figure 1: Nominal public- and private-sector earnings and the consumer price index



Sources: SARB and Stats SA

These observations are confirmed by the descriptive statistics in Table 1. The nominal public- and private-sector earnings grow, on average, by 2.0% per quarter (by 8.1% and 8.2% respectively when annualised). Consumer price inflation amounts to 1.4% per quarter, which is equivalent to an average annual inflation of 5.6%.

Table 1: Descriptive statistics for changes of logs of aggregate nominal and real earnings and the consumer price index

	D(LCPI)	D(LWPU)	D(LWPR)	D(LRWPU)	D(LRWPR)
Mean	0.014	0.020	0.020	0.004	0.004
Standard Deviation	0.008	0.033	0.013	0.032	0.014

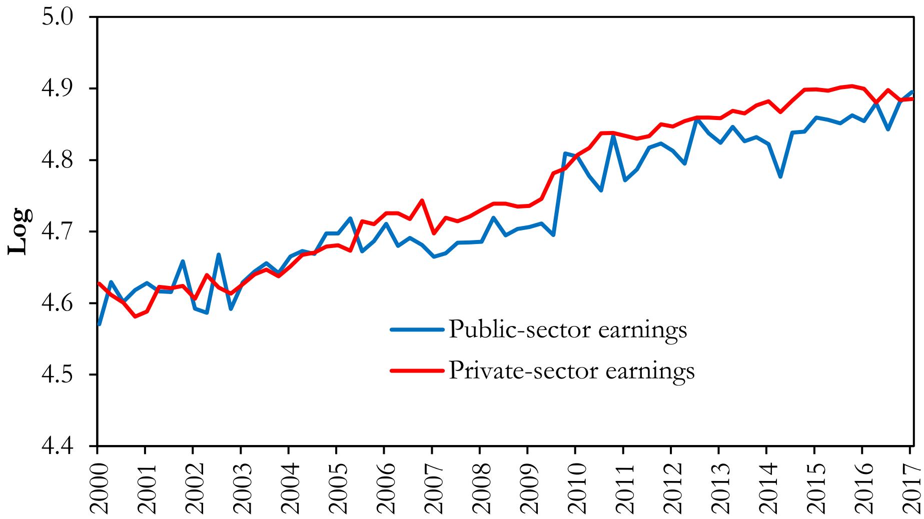
Because real earnings are deflated with a different price index, the adding-up conditions are not met.

Source: Own calculations from SARB database

While the rate of earnings increases in the public and private sectors is nearly identical, development in the public sector is much more volatile than in the private sector. The standard deviation of public-sector remuneration is about 2.5 times as big as in the private sector. This feature is preserved for the deflated earnings. In other words, consumer price inflation does not contribute to earnings volatility. The higher volatility of public-sector earnings must therefore have other reasons. Worthwhile to note is also the fact that the ratio between average nominal and average real earnings growth is above 5, which is unusually high, even for an emerging economy.

Figure 2 shows the development of real remuneration. It confirms the impression that public-sector remuneration is much more volatile than private-sector remuneration.

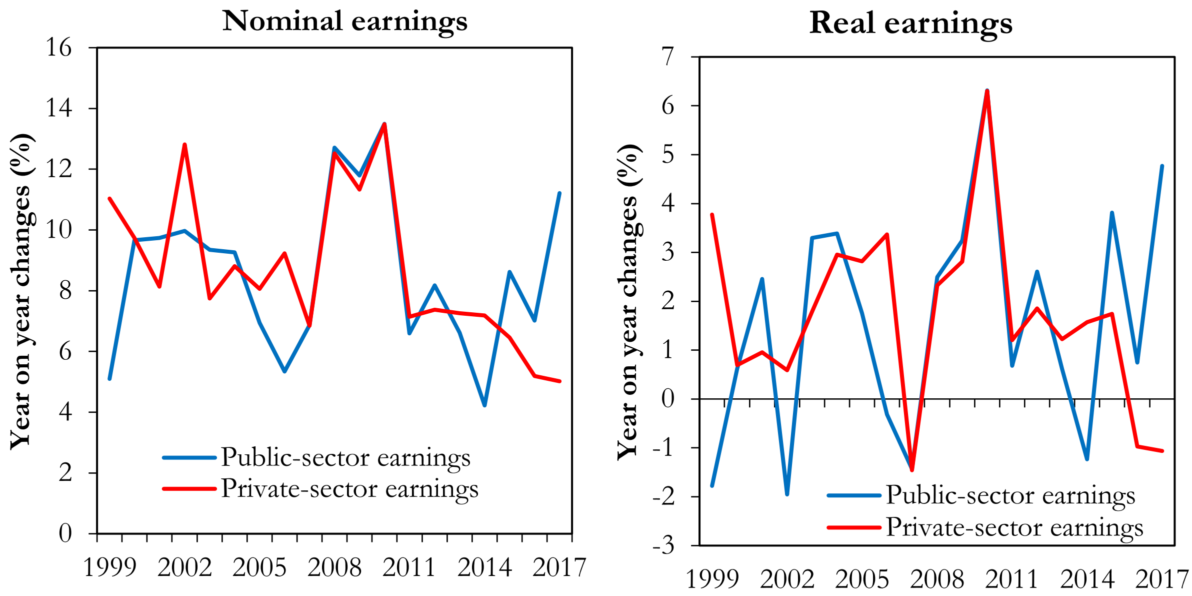
Figure 2: Real public- and private-sector earnings



Sources: SARB and Stats SA

Figure 3 shows the smoothed year-on-year growth rates of nominal and real public- and private-sector earnings. For both the nominal and the real series, public-sector earnings growth fluctuates around private-sector earnings, suggesting a pattern which is characterised by private-sector earnings being the mean to which public-sector earnings revert. According to this pattern, public-sector earnings should moderate again in the near future and cross the private-sector earnings growth line from above.

Figure 3: Nominal and real public- and private-sector earnings changes



Sources: SARB and Stats SA

Sources: SARB and Stats SA

Estimates: Aggregate public and private remuneration

We test the short- and the long-run public- and private-sector earnings pattern, using the well-known Granger causality test and the Vector Error Correction Model (VECM) methodology (Johansen, 1991). Lamo et al (2012) applied the same methodology for their investigation of public/private wage patterns in OECD countries.

Table 2 shows the results of a simple Granger causality test between the quarter-on-quarter changes of logged public- and private-sector earnings. The null hypothesis of no causality is rejected for nominal and real private-sector earnings causing public-sector earnings at a 5% significance level. The null hypothesis cannot be rejected for public-sector earnings causing private-sector earnings.

Table 2: The Granger causality test

Null hypothesis	Observations	F-statistic	p-value
Nominal earnings			
Private-sector earnings do not Granger-cause public-sector earnings	66	3.927	0.025
Public-sector earnings do not Granger-cause private-sector earnings		0.156	0.856
Real earnings			
Private-sector earnings do not Granger-cause public-sector earnings	66	3.371	0.041
Public-sector earnings do not Granger-cause private-sector earnings		0.2600	0.771

Source: Own calculations

The simple Granger test only takes the information from the first differences into account and therefore catches only the short-run elements of earnings leadership. VECMs also use information about levels and therefore cover also the long-run aspects of earnings leadership. The VECM methodology (Juselius, 2006) combines the estimate of a long run relation among the endogenous variables (in our case public and private sector earnings) with the short run adjustment towards it.

Table 3 reports the bi-variate co-integration tests for nominal remuneration in the public and private sectors and the consumer price index, as well as for real remuneration in the public and private sectors. The results clearly reject the null hypothesis of no co-integration relationship between nominal and real remuneration in the public and private sectors respectively. On the contrary, no co-integration between nominal remuneration in the public and private sectors respectively and the CPI cannot be rejected.

Table 3: Co-integrating relationships for nominal and real remuneration in the public and private sectors and the consumer price index

Co-integrating relationships	LWPU = (0.964 * LWPR) + 0.169 (no co-integration is rejected)
	LWPU and LCPI: no co-integration is not rejected
	LWPR and LCPI: no co-integration is not rejected
	LRWPU = (0.840 * LRWPR) + 0.738 (no co-integration is rejected)

Source: Own calculations

VECM and VAR estimates were calculated for nominal and real public- and private-sector remuneration. Table 4a and 4b summarise the results of these estimates.

No co-integration is rejected for nominal public- and private-sector earnings. Contrary to Lamo, Pérez, and Schuknecht (2012), we do not impose a unit coefficient for the co-integrating relationship but estimate it. It turns out that the estimated coefficient of private-sector earnings is close to, but significantly below 1 (-0.958249 for nominal earnings and -0.843923 for real earnings).

Nominal public-sector remuneration follows nominal private-sector remuneration because the estimated coefficient of the error correction term (the lagged deviation from the co-integrating relationship) is negative (-0.791588) and significant (standard deviation = 0.17580) in the equation for public-sector earnings changes and the error correction term enters the equation for private-sector earnings changes only with a small (0.045309) and insignificant (standard deviation = 0.09148) coefficient.

Table 4a: Summary of VECM estimates (2000q3:2017q1)

	Nominal earnings: D(LWPU) D(LWPR) Co-integrating (long-run) relationship			Real earnings: D(RLWPU) D(RLWPR) Co-integrating (long-run) relationship	
LWPU(-1)	1.000		LRWPU(-1)	1.000	
LWPR(-1)	**-0.958**		LRWPR(-1)	**-0.844**	
Standard error	(0.009)		Standard error	(0.038)	
	[-104.315]			[-21.955]	
C	-0.199		C	-0.720	
Error correction	D(LWPU)	D(LWPR)	Error correction	D(RLWPU)	D(RLWPR)
CointEq1	**-0.792**	0.045	CointEq1	**-0.710**	0.116
	(0.176)	(0.091)		(0.174)	(0.096)
	[-4.504]	[0.495]		[-4.092]	[1.212]
D(LWPU(-1))	-0.108	0.002	D(LRWPU(-1))	-0.113	-0.054
	(0.122)	(0.064)		(0.126)	(0.069)
	[-0.886]	[0.033]		[-0.901]	[-0.778]
D(LWPR(-1))	-0.047	-0.106	D(LRWPR(-1))	0.166	-0.221
	(0.264)	(0.137)		(0.229)	(0.126)
	[-0.177]	[-0.769]		[0.723]	[-1.748]
C	0.024	0.023	C	0.004	0.005
	(0.006)	(0.003)		(0.003)	(0.002)
	[3.863]	[7.105]		[1.189]	[2.908]
R-squared	0.449	0.026	R-squared	0.426	0.100
Adj. R-squared	0.423	-0.021	Adj. R-squared	0.399	0.057
F-statistic	17.147	0.554	F-statistic	15.601	2.322
Mean dependent	0.020	0.020	Mean dependent	0.004	0.004
SD dependent	0.034	0.013	SD dependent	0.033	0.014

Note: Bolded coefficients are significant at the 5% level

The explanatory power is high for public-sector remuneration (R2 = 0.449 for nominal earnings and 0.426 for real earnings) and insignificant for private-sector remuneration (0.026 for nominal earnings and 0.100 for real earnings). In other words, information in the past changes of private-sector earnings as well as deviations from the co-integrating relationship explain about 40% of the variance of public-sector earnings growth. On the other hand, the past changes of public-sector earnings and deviations from the co-integrating relationship have no explanatory power for nominal or real private-sector earnings. The adjustment is strong and rapid. About 80% of the deviation from the co-integrating relationship is compensated by public-sector earnings changes within one quarter. The reaction of private-sector earnings to deviations from the co-integrating relationship is small and insignificant. Figures 4a and 4b show the response of public and private sector earnings on a 1% shock of private and public sector earnings. A bit more than 80% of a private sector earnings shock remains permanent in private and public sector earnings after 4 quarters while only 5% of a public sector earnings shock remains permanent.

Figure 4a: Response on a 1% private sector earnings shock

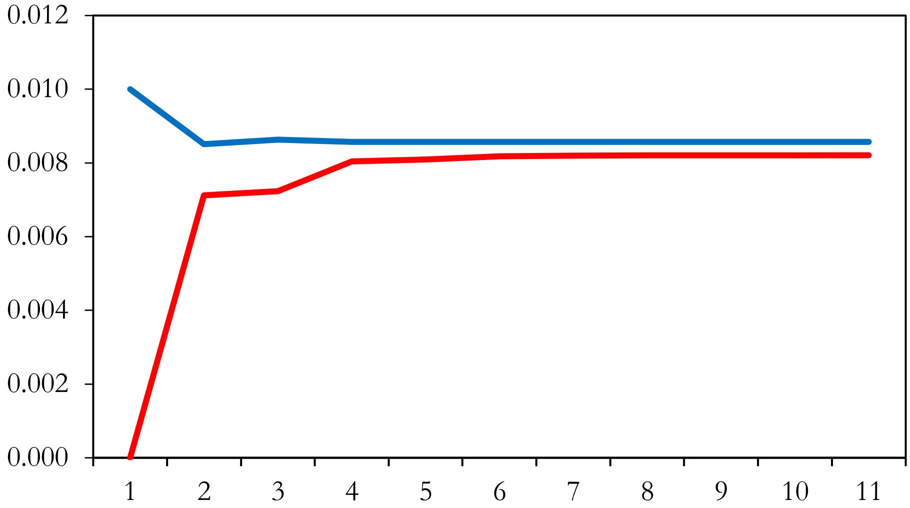
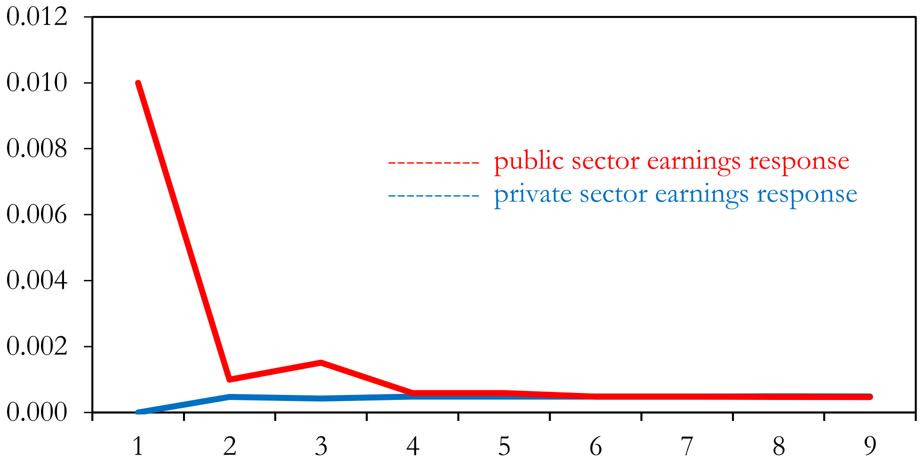


Figure 4b: Response on a 1% public sector earnings shock



Source: Own calculations according to the estimations in Table 4a

The coefficients of past changes of public- and private-sector earnings are small and insignificant. No co-integration is also rejected for real public- and private-sector earnings. Real public-sector remuneration follows private-sector remuneration. The co-integration relationship is a bit flatter for real earnings compared to nominal earnings, with an elasticity of 0.84 compared with 0.96 respectively. This could be coming from public-sector earnings recipients being a bit more affected by the inflation illusion. The lower coefficient of private-sector earnings in the co-integrating relationship reflects the fact that higher rates of inflation are indexed at a lower rate on public-sector earnings changes. On average, this is compensated by a higher constant (-0.720068 relative to - 0.199012). This is also confirmed by a smaller – albeit still significant – adjustment coefficient of 0.71 compared with 0.79 of the VECM for the nominal earnings. The explanatory power is again high for real public-sector remuneration and low but significant for real private-sector remuneration. The coefficients of the lagged changes of real public- and private-sector earnings are also small although partly significant at the 10% level.

Table 4b: Summary of VAR estimates (2000q4:2017q1)

	Nominal earnings: DLWPU DLWPR			Real earnings: DLRWPU DLRWPR	
	DLWPU	DLWPR		DLRWPU	DLRWPR
D(LWPU(-1))	**-0.719**	0.032	D(LRWPU(-1))	**-0.703**	-0.002
	(0.118)	(0.059)		(0.115)	(0.063)
	[-6.099]	[0.547]		[-6.104]	[-0.024]
D(LWPU(-2))	**-0.385**	0.010	D(LRWPU(-2))	**-0.449**	-0.038
	(0.114)	(0.057)		(0.110)	(0.060)
	[-3.389]	[0.183]		[-4.092]	[-0.638]
D(LWPR(-1))	**0.621**	-0.136	D(LRWPR(-1))	**0.596**	**-0.303**
	(0.258)	(0.128)		(0.230)	(0.126)
	[2.412]	[-1.060]		[2.586]	[-2.398]
D(LWPR(-2))	0.480	0.057	D(LRWPR(-2))	0.239	0.006
	(0.266)	(0.133)		(0.239)	(0.131)
	[1.803]	[0.430]		[1.000]	[0.048]
C	0.021	0.021	C	0.006	0.006
	(0.009)	(0.004)		(0.004)	(0.002)
	[2.293]	[4.785]		[1.568]	[2.945]
R-squared	0.399	0.030	R-squared	0.423	0.103
Adj. R-squared	0.359	-0.034	Adj. R-squared	0.386	0.044
Sum sq. resids	0.044	0.011	Sum sq. resids	0.040	0.012
S.E. equation	0.027	0.013	S.E. equation	0.026	0.014
F-statistic	10.117	0.471	F-statistic	11.198	1.747
Mean dependent	0.021	0.021	Mean dependent	0.004	0.004
S.D. dependent	0.034	0.013	S.D. dependent	0.033	0.014

Note: Bolded coefficients are significant at the 5% level

The estimation results of a VAR model with two lags (Table 4b) confirm our main finding of a causal relation from private sector earnings on public sector earnings with only insignificant feedback. In line with the Granger causality test (Table 2) only lagged changes of private sector earnings are significant in the public sector earnings equation, but lagged changes of public sector earnings are insignificant in the private sector earnings equation.

In the next section we explore whether the pattern for aggregate average remuneration that public sector earnings follow private sector earnings is also conformed on the sectoral level.

Sectoral public and private remuneration analysis

This section uses again cointegration and Granger causality tests to determine which private or public sub-sectors drive remuneration in South Africa. Using the Augmented Dickey-Fuller test for stationarity we find that all series have a unit-root and are all stationary at first difference. Johansen cointegration tests are performed and confirm the existence of a long-run stable relationship between remuneration in various sectors. The study then progresses to perform a vector error correction model (VECM) and tests for Granger causality between all sub-sectors. The data used in this study is again from the Quarterly Labour Force Statistics (QLFS) sourced from Statistics South Africa and seasonally adjusted by the South African Reserve Bank (SARB).

Sectoral Data

Table 5: Descriptive statistics for the private and public sector earnings and employment

Descriptive statistics of logs of nominal earnings													
	D(LW1)	D(LW2)	D(LW3)	D(LW4)	D(LW5)	D(LW6)	D(LW8)	D(LW9)	D(LW10)	D(LW11)	D(LW12)	D(LW13)	D(LW14)
Mean	5.321	5.276	5.449	5.393	5.274	5.384	5.255	5.297	5.348	5.284	5.294	5.300	5.371
Std. Dev.	0.433	0.419	0.523	0.511	0.405	0.428	0.438	0.418	0.447	0.427	0.386	0.421	0.420
Descriptive statistics for changes of logs of nominal earnings													
	LW1	LW2	LW3	LW4	LW5	LW6	LW8	LW9	LW10	LW11	LW12	LW13	LW14
Mean	0.020	0.020	0.023	0.025	0.019	0.020	0.019	0.020	0.023	0.022	0.020	0.022	0.021
Std. Dev.	0.013	0.013	0.028	0.035	0.020	0.030	0.034	0.034	0.046	0.046	0.030	0.115	0.077
Share of employment (average from 2000q1 - 2017q1)*													
Percent	79.056	14.542	6.596	5.106	21.005	22.691	3.589	20.944	4.357	10.242	2.611	1.816	1.271

* The total of subsector numbers does not add up to 100 because of the exclusion of non-gov. community, social & personal services (before 2002/03: washing & dry-cleaning)

Figure 5 and Table 5 show the average rate of growth (q-o-q) of disaggregated, private and public sector remuneration between 2000:q1 and 2017:q1 together with the standard deviation for each sector. The last line of Table 5 also shows the share of employment in the respective sectors. As for aggregate series remuneration is calculated as average earnings per employee without correction for different hours worked. Both in the private and public sectors aggregation masks a considerable sectoral differentiation. The volatility of public sector remuneration is considerably larger than in private sectors, only remuneration in local administrations has a similar standard deviation as in most private sectors. Mining and national departments experienced the highest growth of remuneration while private transport and local authorities in the public sector experienced the lowest remuneration growth rate.

Figure 6a and 6b show the evolution of logged quarterly remuneration of private and public sectors as well as their aggregates during the observation period. Like in Figure 1 natural logarithms of all remuneration series have been taken.

In the private sector it is interesting to note that construction and mining earnings experienced extraordinary growth after 2009.

Figure 5: Average nominal growth rate of average earnings per quarter

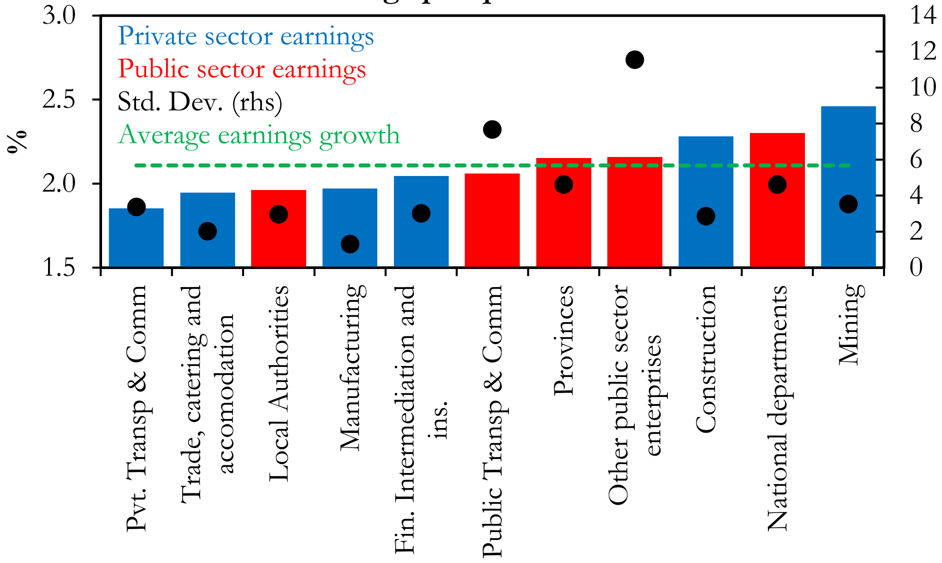


Figure 6a: Private sector earnings

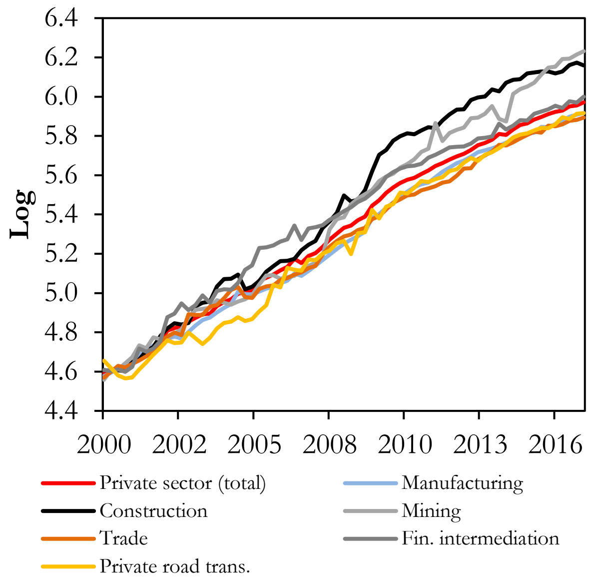
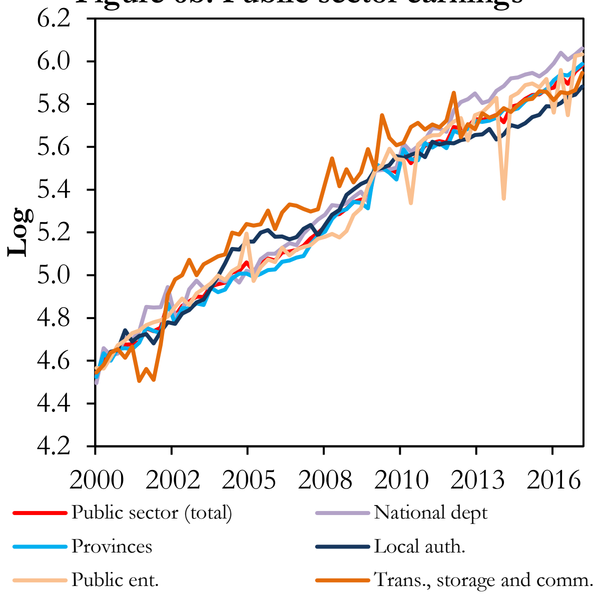


Figure 6b: Public sector earnings



Test and Estimates: Sectoral public and private remuneration patterns

Unit root testing

Table 6 shows unit root test results conducted using the Augmented Dickey-Fuller test on EViews in three versions: trend plus intercept, intercept and none. The Null-Hypothesis is the existence of a unit root. From the results we infer that all logged series are non-stationary (have a unit root) but stationary once all are differenced once (Δ).

Table 6: Unit root testing

Series	Model	ADF lags	Prob*	Series	Model	ADF lags	Prob*
			Private sectors				
LW1 Aggregate Private	Trend & intercepts	0	0.974	ΔLW1	Trend & intercepts	0	0.000***
	Intercept	0	0.590		Intercept	0	0.000***
	None	0	1.000		None	0	0.235
LW2 Manufacturing	Trend & intercepts	0	0.944	ΔLW2	Trend & intercepts	0	0.000***
	Intercept	0	0.750		Intercept	0	0.000***
	None	0	1.000		None	0	0.274
LW3 Construction	Trend & intercepts	0	0.960	ΔLW3	Trend & intercepts	0	0.000***
	Intercept	0	0.722		Intercept	0	0.000***
	None		1.000		None	0	0.000***
LW4 Mining	Trend & intercepts	0	0.256	ΔLW4	Trend & intercepts	0	0.000***
	Intercept	0	0.924		Intercept	0	0.000***
	None	0	1.000		None	2	0.010**
LW5 Trade, catering, accomm.	Trend & intercepts	0	0.359	ΔLW5	Trend & intercepts	0	0.000***
	Intercept	0	0.725		Intercept	1	0.000***
	None	0	1.000		None	2	0.053*

LW6 Fin. Interm. & insurance	Trend & intercepts	1	0.899	ΔLW6	Trend & intercepts	0	0.000***
	Intercept	1	0.283		Intercept	1	0.000***
	None	1	1.000		None	2	0.023**
LW8 Private road transportation	Trend & intercepts	1	0.281	ΔLW8	Trend & intercepts	0	0.000***
	Intercept	1	0.949		Intercept	0	0.000***
	None	1	1.000		None	1	0.001***
Public sectors							
LW9 Aggregate Public	Trend & intercepts	1	0.303	ΔLW9	Trend & intercepts	1	0.000***
	Intercept	2	0.772		Intercept	1	0.000***
	None	2	1.000		None	3	0.107
LW10 National Departments	Trend & intercepts	0	0.001***	ΔLW10	Trend & intercepts	3	0.019**
	Intercept	2	0.805		Intercept	2	0.000***
	None	2	1.000		None	3	0.019**
LW11 Provinces	Trend & intercepts	1	0.114	ΔLW11	Trend & intercepts	2	0.000***
	Intercept	3	0.933		Intercept	2	0.000***
	None	3	1.000		None	6	0.364
LW12 Local Authorities	Trend & intercepts	0	0.569	ΔLW12	Trend & intercepts	0	0.000***
	Intercept	0	0.539		Intercept	0	0.000***
	None	0	1.000		None	2	0.027**
LW13 Other public enterprises	Trend & intercepts	0	0.000***	ΔLW13	Trend & intercepts	0	0.000***
	Intercept	1	0.846		Intercept	0	0.000***
	None	1	0.998		None	0	0.000***
LW14 Transport storage communications	Trend & intercepts	1	0.579	ΔLW14	Trend & intercepts	0	0.000***
	Intercept	1	0.517		Intercept	0	0.000***
	None	1	0.998		None	0	0.000***

*, **, *** Statistically significant at the 10%, 5%, 1% level

Pairwise causality tests

With first differences being stationary we can test for Granger causality, capturing short run relations between sectoral earnings. Table 7 summarises the results of all pairwise Granger causality tests, which reject the Null-Hypothesis of no causality at 10%, 5% or 1% error probability. In a nutshell the results confirm the outcomes of the aggregate earnings patterns: No public sector earnings Granger-cause private sector earnings and aggregate and individual private sector earnings cause aggregate public sector earnings and individual public sector earnings with the exception of "National Departments and Other public enterprises".

Table 7: Pairwise Granger causality tests (q-o-q growth rates of average nominal earnings in private and public sectors) reject the no-causality hypothesis for the following sectors

Null Hypothesis:	F-Statistic	Probability
DLW1 does not Granger Cause DLW11	3.559	0.035**
DLW1 does not Granger Cause DLW14	3.022	0.056*
DLW2 does not Granger Cause DLW11	5.544	0.006***
DLW2 does not Granger Cause DLW8	2.397	0.100*
DLW2 does not Granger Cause DLW9	6.446	0.003***
DLW3 does not Granger Cause DLW11	4.982	0.010***
DLW3 does not Granger Cause DLW5	4.764	0.012**
DLW3 does not Granger Cause DLW6	3.205	0.048**
DLW3 does not Granger Cause DLW9	6.099	0.004***
DLW5 does not Granger Cause DLW9	4.084	0.022**
DLW5 does not Granger Cause DLW11	2.822	0.067*
DLW5 does not Granger Cause DLW12	2.473	0.093*
DLW5 does not Granger Cause DLW2	2.603	0.082*
DLW5 does not Granger Cause DLW3	3.320	0.043**
DLW6 does not Granger Cause DLW2	2.589	0.083*
DLW8 does not Granger Cause DLW3	3.509	0.036**
DLW10 does not Granger Cause DLW12	3.799	0.028**
DLW10 does not Granger Cause DLW13	2.423	0.097*
DLW11 does not Granger Cause DLW10	2.508	0.090*
DLW12 does not Granger Cause DLW10	3.457	0.038**
DLW12 does not Granger Cause DLW14	2.646	0.0791*
DLW14 does not Granger Cause DLW10	4.181	0.020**

*, **, *** Statistically significant at the 10%, 5%, 1% level

Vector error correction model estimates

Following up on the cointegration analysis with aggregate pulic and private sector earnings, this study broadens the search for a public-private sector earnings pattern with three VECMs: (1) Aggregate public sector earnings and individual private sector earnings (2) Aggregate private sector earnings and individual public sector earnings, and (3) Individual public and private sector earnings.

The motivation for this procedure is to exploit an eventual stable earnings pattern within the private and public sectors, which allows to reduce the number of estimated parameters and increase their significance. The reason behind still looking at the pattern among all individual sectors is to identify the role of mining earnings for other sectors, in particular manufacturing.

Aggregate public and individual private sector earnings (VECM1)

The VECM with aggregate public sector earnings and individual private sector earnings assumes that the earnings pattern between the private and public sector is not affected by aggregation of public sector earnings. In other words, this means that the model does not differentiate in which public sector and error correction of earnings takes place.

Table 8 provides the results for the tests concerning the number of significant cointegrating relationships. Both tests (Trace and Eigenvalue) suggest that there is exactly one cointegrating relationship between aggregate public sector earnings and individual private sector earnings.

Table 8: Unrestricted cointegration rank tests (Trace and Eigenvalue)

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.551	139.245	125.615	**0.006**
At most 1	0.368	85.560	95.754	0.204
At most 2	0.286	54.807	69.819	0.427
At most 3	0.156	32.212	47.856	0.600
At most 4	0.146	20.889	29.797	0.365
At most 5	0.107	10.339	15.495	0.256
At most 6	0.040	2.727	3.841	0.099

Trace test indicates **1 cointegrating** equation at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.551	53.685	46.231	**0.007**
At most 1	0.368	30.754	40.078	0.376
At most 2	0.286	22.594	33.877	0.562
At most 3	0.156	11.324	27.584	0.956
At most 4	0.146	10.550	21.132	0.692
At most 5	0.107	7.612	14.265	0.420
At most 6	0.040	2.727	3.841	0.010

* denotes rejection of the hypothesis at the 0.05 level

The results for the VECM1 estimate (aggregate public sector and individual private sectors) are provided in Table 9.

The goodness-of-fit indicators are clearly significant only for aggregate public sector earnings, finance and private road transportation. At the margin (with 10% error probability) the Null-Hypothesis that all coefficients are zero is rejected for the construction and trade sectors.

The cointegrating relationship is dominated by the relation between aggregate public sector earnings and private road transportation on one side and manufacturing, mining and financial services on the other side. Earnings in construction and trade are not a significant part of this relationship.

For manufacturing and mining there is neither a short nor a long run relation with other sector earnings. Marginally significance of changes in aggregate public sector earnings and construction earnings is questioned by the already above-mentioned overall insignificance of the model. The error from the cointegration relationship is only significant for the changes in aggregate public sector earnings, financial services and private road transportation. This means that only in these sectors earnings respond to a deviation from the long run relationship. This feedback is stable in the sense that the response according to the estimated coefficients reduces the deviation from the long run relationship.

Table9: VECM1 with aggregate public sector earnings and individual private sector earnings, Sample (adjusted): 2000q3 – 2017q1, 67 observations, t-statistics in [ ]

Cointegrating Equation:	**CointEq1**						
LW9(-1)	1.000						
LW2(-1)	-0.550						
	(0.095)						
	[-5.762]						
LW3(-1)	-0.017						
	(0.049)						
	[-0.347]						
LW4(-1)	-0.261						
	(0.043)						
	[-6.139]						
LW5(-1)	0.027						
	(0.075)						
	[0.354]						
LW6(-1)	-0.334						
	(0.034)						
	[-9.707]						
LW8(-1)	0.193						
	(0.046)						
	[4.174]						
C	-0.2520						
Error Correction:	**D(LW9)**	**D(LW2)**	**D(LW3)**	**D(LW4)**	**D(LW5)**	**D(LW6)**	**D(LW8)**
CointEq1	-0.799	0.170	-0.078	0.323	0.196	0.564	-0.622
	(0.239)	(0.116)	(0.244)	(0.320)	(0.175)	(0.241)	(0.278)
	[-3.341]	[1.471]	[-0.319]	[1.012]	[1.121]	[2.342]	[-2.232]
D(LW9(-1))	-0.122	-0.136	-0.060	-0.336	-0.198	-0.109	0.173
	(0.160)	(0.077)	(0.163)	(0.213)	(0.117)	(0.161)	(0.186)
	[-0.764]	[-1.742]	[-0.367]	[-1.575]	[-1.693]	[-0.678]	[0.929]
D(LW2(-1))	0.200	-0.127	-0.064	-0.087	-0.413	-0.281	-0.767
	(0.299)	(0.144)	(0.305)	(0.399)	(0.219)	(0.301)	(0.348)
	[0.670]	[-0.877]	[-0.210]	[-0.217]	[-1.887]	[-0.932]	[-2.206]
D(LW3(-1))	0.145	0.113	0.016	0.238	0.224	0.340	0.079
	(0.131)	(0.063)	(0.134)	(0.175)	(0.096)	(0.132)	(0.152)
	[1.113]	[1.787]	[0.123]	[1.365]	[2.345]	[2.582]	[0.517]
D(LW4(-1))	0.045	0.072	0.098	-0.099	0.150	0.131	-0.052
	(0.101)	(0.049)	(0.104)	(0.136)	(0.074)	(0.102)	(0.118)
	[0.441]	[1.472]	[0.948]	[-0.729]	[2.026]	[1.285]	[-0.439]
D(LW5(-1))	-0.053	0.096	0.371	0.075	-0.157	-0.065	0.119
	(0.180)	(0.087)	(0.184)	(0.241)	(0.132)	(0.181)	(0.210)
	[-0.293]	[1.108]	[2.015]	[0.314]	[-1.191]	[-0.360]	[0.568]
D(LW6(-1))	-0.131	-0.040	-0.015	-0.095	0.051	-0.204	-0.104
	(0.115)	(0.056)	(0.118)	(0.154)	(0.084)	(0.116)	(0.134)
	[-1.136]	[-0.713]	[-0.129]	[-0.615]	[0.605]	[-1.752]	[-0.773]
D(LW8(-1))	0.064	0.026	0.212	-0.106	0.018	0.151	-0.309
	(0.104)	(0.050)	(0.106)	(0.139)	(0.076)	(0.105)	(0.121)
	[0.611]	[0.515]	[1.990]	[-0.759]	[0.232]	[1.436]	[-2.549]
C	0.017	0.019	0.012	0.032	0.024	0.020	0.036
	(0.007)	(0.003)	(0.007)	(0.009)	(0.005)	(0.007)	(0.008)
	[2.459]	[5.734]	[1.709]	[3.516]	[4.843]	[2.900]	[4.483]
Adj. R-squared	0.370	0.046	0.085	-0.006	0.082	0.211	0.124
Sum sq. resids	0.041	0.010	0.043	0.073	0.022	0.042	0.056
S.E. equation	0.027	0.013	0.027	0.036	0.019	0.027	0.031
F-statistic	5.854	1.401	1.767	0.954	1.741	3.211	2.169

Prob (F-Statistic)	0.000***	0.216	0.102	0.480	0.108	0.004***	0.043**
Log likelihood	152.720	201.384	151.242	133.289	173.639	152.192	142.503
Akaike AIC	-4.290	-5.743	-4.246	-3.710	-4.915	-4.274	-3.985
Mean dependent	0.020	0.020	0.023	0.024	0.019	0.021	0.019
S.D. dependent	0.034	0.013	0.028	0.035	0.020	0.030	0.033
Determinant resid cov (dof adj.)	0.000						
Determinant resid covariance	0.000						
Log likelihood	1140.964						
Akaike information criterion	-31.969						
Schwarz criterion	-29.666						
Number of coefficients	70						

*;** & *** denote 10%; 5% and 1% level of significance

In the short run (q-o-q differences) there is a significantly negative relation between earnings in construction and lagged earnings in trade and private road transportation. Earnings in trade responds significantly to lagged earnings in manufacturing, construction and mining. Changes of earnings in financial intermediation are positively related to lagged changes of construction earnings. Changes of earnings in private road transportation respond negatively to lagged changes of earnings in manufacturing. Only earnings in the financial services sector and private road transportation have a significantly negative autoregressive term. Lagged changes in public sector earnings are not significant in any of the private sector earnings equations.

In a nutshell the results confirm the independence from aggregate public sector earnings for 4 out of 6 private sectors. Only for financial intermediation and private road transport a significant relation with aggregate public sector earnings (via the error of the cointegrating relationship) is found.

Aggregate private and individual public sector earnings (VECM2)

The VECM with aggregate private sector earnings and individual public sector earnings assumes that aggregation in the private sector does not matter for the earnings pattern structure with individual public sector earnings. In other words, it does not matter in which private sector the adjustment to the cointegrating relationships takes place.

Table 10 provides the results for the tests concerning the number of significant cointegrating relationships. Both tests (Trace and Eigenvalue) suggest that there are two cointegrating relationships between aggregate private sector earnings and individual public sector earnings.

Table 10: Unrestricted cointegration rank tests (Trace and Eigenvalue)

Unrestricted Cointegration Rank Test (Trace)

Hyp. No. of CE(s)	Eigenvalue	Trace Statistic	0.05 (Critical Value)	Prob.**
None *	0.523	127.158	95.754	0.000
At most 1 *	0.403	77.605	69.819	0.011
At most 2	0.306	43.083	47.856	0.131
At most 3	0.146	18.596	29.797	0.522
At most 4	0.076	7.998	15.495	0.466
At most 5	0.040	2.708	3.841	0.100

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hyp. No. of CE(s)	Eigenvalue	Trace Statistic	0.05 (Critical Value)	Prob.**
None *	0.523	49.553	40.07757	0.003
At most 1 *	0.403	34.521	33.87687	0.042
At most 2	0.306	24.487	27.58434	0.119
At most 3	0.146	10.598	21.13162	0.687
At most 4	0.076	5.290	14.26460	0.705
At most 5	0.040	2.708	3.841466	0.100

* denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values

The results for the VECM2 estimate (aggregate private sector and individual public sectors) are provided in Table 11.

The first cointegrating relationship is dominated by the relation between aggregate private sector earnings and local authorities' earnings on one side and provinces and public transport earnings on the other side. Earnings in other public enterprises do not play a significant part of this relationship. The second cointegrating relationship finds national departments and local authorities on one side and provinces, other public enterprises and public transport on the other side.

The goodness-of-fit statistics indicate that individual public sector earnings do not contribute significantly to the explanation of aggregate private sector earnings. On the contrary, for all individual public sector earnings equations the hypothesis that the model has no explanatory power (all coefficients are zero) is rejected with less than 5% error probability.

Table 11: VECM2 with aggregate private sector earnings and individual public sector earnings, Sample (adjusted): 2000q3 – 2017q1, 67 observations, t-statistics in [ ]

Cointegrating Equation:	**CointEq1**	**CointEq2**				
LW1(-1)	1.000	0.000				
LW10(-1)	0.000	1.000				
LW11(-1)	-0.953	-1.043				
	(0.075)	(0.155)				
	[-12.633]	[-6.716]				
LW12(-1)	0.207	0.749				
	(0.087)	(0.180)				
	[2.370]	[4.157]				
LW13(-1)	0.021	-0.377				
	(0.066)	(0.135)				
	[0.318]	[-2.791]				
LW14(-1)	-0.277	-0.301				
	(0.051)	(0.104)				
	[-5.461]	[-2.884]				
C	-0.009	-0.191				
Error Correction:	**D(LW1)**	**D(LW10)**	**D(LW11)**	**D(LW12)**	**D(LW13)**	**D(LW14)**
CointEq1	-0.055	0.968	1.059	-0.164	-1.402	0.533
	(0.085)	(0.219)	(0.194)	(0.171)	(0.554)	(0.448)
	[-0.643]	[4.427]	[5.464]	[-0.962]	[-2.530]	[1.190]
CointEq2	0.043	-0.497	-0.273	-0.152	1.082	0.071
	(0.048)	(0.122)	(0.108)	(0.095)	(0.310)	(0.251)
	[0.900]	[-4.068]	[-2.515]	[-1.594]	[3.49]	[0.282]
D(LW1(-1))	-0.101	-0.136	0.078	0.270	0.326	0.365
	(0.148)	(0.379)	(0.336)	(0.300)	(0.960)	(0.776)
	[-0.681]	[-0.358]	[0.233]	[0.914]	[0.340]	[0.470]
D(LW10(-1))	-0.007	-0.074	-0.173	-0.168	-1.249	-0.458
	(0.058)	(0.148)	(0.131)	(0.115)	(0.375)	(0.303)
	[-0.116]	[-0.499]	[-1.317]	[-1.458]	[-3.334]	[-1.513]
D(LW11(-1))	-0.013	0.102	0.041	0.023	0.253	0.880
	(0.060)	(0.153)	(0.135)	(0.119)	(0.388)	(0.313)
	[-0.220]	[0.664]	[0.304]	[0.193]	[0.653]	[2.808]
D(LW12(-1))	0.015	0.180	0.396	-0.139	0.513	0.489
	(0.060)	(0.154)	(0.136)	(0.120)	(0.389)	(0.315)
	[0.245]	[1.173]	[2.902]	[-1.156]	[1.316]	[1.554]
D(LW13(-1))	0.020	-0.135	-0.034	-0.052	-0.305	0.033
	(0.017)	(0.044)	(0.039)	(0.035)	(0.112)	(0.091)
	[1.164]	[-3.056]	[-0.867]	[-1.491]	[-2.717]	[0.369]

D(LW14(-1))	-0.001	-0.040	0.109	-0.056	0.047	-0.263
	(0.025)	(0.064)	(0.056)	(0.050)	(0.161)	(0.130)
	[-0.029]	[-0.621]	[1.925]	[-1.119]	[0.289]	[-2.013]
C	0.022	0.023	0.013	0.022	0.034	-0.000
	(0.003)	(0.009)	(0.008)	(0.007)	(0.023)	(0.018)
	[6.410]	[2.636]	[1.599]	[3.204]	[1.523]	[-0.023]
Adj. R-squared	-0.081	0.341	0.527	0.164	0.418	0.139
Sum sq. resids	0.011	0.071	0.056	0.043	0.456	0.298
S.E. equation	0.014	0.035	0.031	0.027	0.089	0.072
F-statistic	0.383	5.260	10.191	2.613	6.930	2.328
Prob (F-Statistic)	0.925	0.000***	0.000***	0.016**	0.000***	0.031**
Log likelihood	197.506	134.401	142.440	150.994	72.094	86.318
Akaike AIC	-5.627	-3.743	-3.983	-4.239	-1.883	-2.308
Mean dependent	0.020	0.021	0.020	0.019	0.022	0.020
S.D. dependent	0.013	0.043	0.045	0.030	0.116	0.077
Determinant resid covariance (dof adj.)		0.000				
Determinant resid covariance		0.000				
Log likelihood		810.823				
Akaike information criterion		-22.234				
Schwarz criterion		-20.062				
Number of coefficients		66				

*;** & *** denote 10%; 5% and 1% level of significance

The lagged error from the first cointegration relationship is only significant for the changes in national departments, provinces and public transportation earnings. The error from the second cointegration relationship is again significant for the same individual public sector earnings, but with changed sign. This means that only these sectors earnings respond to a deviation from the long run relationships.

In the short run (q-o-q differences) there is a significantly negative relation between the lagged earnings in other public enterprises and earnings in national departments.. Earnings in provinces respond positively to lagged earnings in local administrations. Earnings in other public enterprises respond negatively to lagged earnings in national departments. Earnings in public transportation respond significantly to lagged earnings in provinces. Only earnings in the public transport sector and other public enterprises have a significantly negative autoregressive term. Lagged changes in aggregate private sector earnings are not significant in any of the individual public sector earnings equations.

In a nutshell these results confirm that individual public sector earnings have no explanatory power for aggregate private sector earnings while aggregate private sector earnings have a significant long run relationship with individual public sector earnings with the exception of local authorities.

Individual private- and public-sub-sector earnings (VECM3)

Finally, an error-correction model for all individual public and private sector earnings is estimated.

Table 12 provides the results for the tests concerning the number of significant cointegrating relationships. The Trace test suggests 4 cointegrating relations and the Eigenvalue test results in 3 cointegrating relations.

Table 12: Unrestricted cointegration rank tests (Trace and Eigenvalue)

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesised No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 (Critical Value)**	**Prob.****
None *	0.686	373.049	285.143	0.000
At most 1 *	0.626	295.358	239.235	0.000
At most 2 *	0.605	229.474	197.371	0.000
At most 3 *	0.485	167.216	159.530	0.018
At most 4	0.390	122.715	125.615	0.074
At most 5	0.357	89.647	95.754	0.122
* denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hyp. No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 (Critical Value)**	**Prob.****
None *	0.686	77.691	70.535	0.010
At most 1 *	0.626	65.884	64.505	0.037
At most 2 *	0.605	62.258	58.434	0.020
At most 3	0.485	44.501	52.363	0.253
At most 4	0.390	33.068	46.231	0.587
At most 5	0.357	29.614	40.078	0.450
* denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values				

The results for the VECM3 estimate (individual private and public sector earnings) with four cointegrating relationships are provided in Table 13. The overall goodness of fit indicators (Adj. R2 and F-Test of all coefficients equal to zero) indicate that individual public sector earnings can be better explained by the model than earnings in individual private sectors. For earnings in construction and trade the model does not have significant explanatory power. Manufacturing and mining earnings can be explained with an error probability close to 5%. All public sector earnings reject the zero hypothesis (all coefficients equal to zero) except local authorities with less than 1% error probability. Among private sector earnings only financial services and private road

The first cointegrating relationship relates earnings in manufacturing and financial services with earnings in private road transport, national departments, local authorities and public transport. The second cointegrating relationship relates earnings in construction and financial services with private transport and public transport. The third cointegrating relationship relates earnings in mining, private transport, national departments and public transport with financial services, provinces and other public enterprises. The fourth cointegrating relationship relates earnings in trade and other public enterprises with earnings in national departments.

Table 13: VECM3 with individual private and public sector earnings, sample (adjusted): 2000q3 – 2017q1, 67 observations, t-statistics in [ ]

Cointegrating Equation:	CointEq1	CointEq2	CointEq3	CointEq4
LW2(-1)	1.000	0.000	0.000	0.000
LW3(-1)	0.000	1.000	0.000	0.000
LW4(-1)	0.000	0.000	1.000	0.000
LW5(-1)	0.000	0.000	0.000	1.000
LW6(-1)	0.852	3.012	-0.844	-0.199
	(0.106)	(0.473)	(0.303)	(0.250)
	[8.014]	[6.365]	[-2.789]	[-0.795]
LW8(-1)	-0.328	-1.777	0.726	0.083
	(0.067)	(0.299)	(0.191)	(0.158)
	[-4.883]	[-5.939]	[3.795]	[0.523]
LW10(-1)	-0.760	-0.399	0.689	-1.035
	(0.087)	(0.389)	(0.249)	(0.2067)
	[-8.704]	[-1.025]	[2.766]	[-5.023]
LW11(-1)	-0.090	-0.767	-2.223	0.003
	(0.102)	(0.457)	(0.292)	(0.242)
	[-0.876]	[-1.681]	[-7.614]	[0.012]
LW12(-1)	-0.368	0.497	0.278	-0.052
	(0.071)	(0.316)	(0.202)	(0.167)
	[-5.186]	[1.571]	[1.376]	[-0.308]
LW13(-1)	0.043	0.144	-0.381	0.392
	(0.041)	(0.184)	(0.118)	(0.097)
	[1.039]	[0.786]	[-3.240]	[4.031]
LW14(-1)	-0.345	-1.894	0.579	-0.126
	(0.049)	(0.218)	(0.139)	(0.116)
	[-7.033]	[-8.679]	[4.146]	[-1.095]
C	-0.023	0.635	0.842	-0.244

Error Correction:	D(LW2)	D(LW3)	D(LW4)	D(LW5)	D(LW6)	D(LW8)	D(LW10)	D(LW11)	D(LW12)	D(LW13)	D(LW14)
CointEq1	-0.393	-0.064	0.558	-0.070	-0.657	-0.572	1.235	0.716	0.075	0.3396	0.303
	(0.113)	(0.265)	(0.304)	(0.186)	(0.233)	(0.261)	(0.274)	(0.284)	(0.265)	(0.818)	(0.601)
	[-3.481]	[-0.241]	[1.837]	[-0.373]	[-2.817]	[-2.196]	[4.503]	[2.520]	[0.285]	[0.414]	[0.504]
CointEq2	0.056	0.005	-0.184	0.018	0.115	0.248	-0.145	0.025	-0.084	-0.108	0.213
	(0.026)	(0.060)	(0.069)	(0.042)	(0.053)	(0.059)	(0.062)	(0.065)	(0.060)	(0.186)	(0.137)
	[2.188]	[0.076]	[-2.671]	[0.425]	[2.165]	[4.190]	[-2.329]	[0.390]	[-1.389]	[-0.578]	[1.559]
CointEq3	0.041	0.029	-0.237	-0.051	-0.141	-0.029	0.160	0.407	-0.040	0.014	-0.258
	(0.034)	(0.081)	(0.092)	(0.057)	(0.071)	(0.079)	(0.083)	(0.086)	(0.081)	(0.249)	(0.183)
	[1.192]	[0.366]	[-2.566]	[-0.895]	[-1.983]	[-0.368]	[1.919]	[4.710]	[-0.493]	[0.057]	[-1.411]
CointEq4	0.159	0.027	-0.368	-0.062	0.269	0.057	0.233	0.216	0.151	-0.781	-0.181
	(0.051)	(0.120)	(0.137)	(0.084)	(0.107)	(0.118)	(0.124)	(0.129)	(0.120)	(0.371)	(0.272)
	[3.105]	[0.228]	[-2.674]	[-0.730]	[2.544]	[0.481]	[1.876]	[1.679]	[1.257]	[-2.106]	[-0.666]
D(LW2(-1))	-0.238	-0.101	0.112	-0.273	-0.217	-0.026	-0.394	0.014	-0.259	1.483	-0.517
	(0.153)	(0.360)	(0.413)	(0.253)	(0.317)	(0.354)	(0.373)	(0.386)	(0.360)	(1.112)	(0.817)
	[-1.549]	[-0.282]	[0.270]	[-1.080]	[-0.668]	[-0.074]	[-1.059]	[0.037]	[-0.719]	[1.333]	[-0.633]
D(LW3(-1))	0.076	0.028	0.291	0.222	0.332	-0.045	0.249	0.071	0.270	0.454	0.321
	(0.063)	(0.147)	(0.169)	(0.104)	(0.130)	(0.145)	(0.153)	(0.158)	(0.147)	(0.455)	(0.334)
	[1.210]	[0.190]	[1.724]	[2.143]	[2.559]	[-0.314]	[1.632]	[0.448]	[1.829]	[0.997]	[0.960]
D(LW4(-1))	0.058	0.131	-0.024	0.157	0.169	0.179	0.175	-0.187	0.068	0.4887	0.039
	(0.053)	(0.123)	(0.141)	(0.087)	(0.109)	(0.121)	(0.128)	(0.132)	(0.123)	(0.381)	(0.280)
	[1.112]	[1.062]	[-0.168]	[1.811]	[1.552]	[1.474]	[1.370]	[-1.413]	[0.548]	[1.282]	[0.138]
D(LW5(-1))	0.059	0.367	0.258	-0.116	-0.164	-0.002	-0.215	-0.072	0.058	-1.158	0.759
	(0.086)	(0.202)	(0.231)	(0.142)	(0.178)	(0.199)	(0.209)	(0.217)	(0.202)	(0.624)	(0.458)
	[0.684]	[1.821]	[1.115]	[-0.815]	[-0.922]	[-0.013]	[-1.029]	[-0.334]	[0.286]	[-1.857]	[1.657]
D(LW6(-1))	0.051	0.011	-0.185	-0.055	-0.345	-0.339	-0.193	0.006	0.116	-0.496	-0.256
	(0.069)	(0.162)	(0.186)	(0.114)	(0.143)	(0.160)	(0.168)	(0.174)	(0.162)	(0.501)	(0.368)
	[0.737]	[0.070]	[-0.993]	[-0.485]	[-2.416]	[-2.125]	[-1.149]	[0.035]	[0.716]	[-0.990]	[-0.694]
D(LW8(-1))	-0.005	0.180	0.053	-0.011	0.139	-0.346	0.322	0.048	-0.142	-0.121	-0.220
	(0.052)	(0.123)	(0.140)	(0.086)	(0.108)	(0.121)	(0.127)	(0.132)	(0.123)	(0.379)	(0.278)
	[-0.091]	[1.465]	[0.380]	[-0.129]	[1.289]	[-2.871]	[2.539]	[0.364]	[-1.162]	[-0.319]	[-0.792]
D(LW10(-1))	-0.045	0.011	-0.223	-0.048	0.027	-0.139	0.171	-0.023	-0.162	-1.192	-0.314
	(0.056)	(0.132)	(0.152)	(0.093)	(0.117)	(0.130)	(0.137)	(0.142)	(0.132)	(0.409)	(0.300)
	[-0.794]	[0.082]	[-1.470]	[-0.515]	[0.233]	[-1.067]	[1.247]	[-0.161]	[-1.226]	[-2.912]	[-1.045]

D(LW11(-1))	-0.002	-0.036	-0.071	-0.127	-0.151	-0.077	0.109	0.159	0.068	0.328	0.348
	(0.061)	(0.143)	(0.164)	(0.101)	(0.126)	(0.141)	(0.148)	(0.154)	(0.143)	(0.442)	(0.325)
	[-0.035]	[-0.250]	[-0.436]	[-1.260]	[-1.198]	[-0.549]	[0.736]	[1.035]	[0.475]	[0.742]	[1.072]
D(LW12(-1))	-0.121	-0.201	0.161	-0.133	-0.100	-0.276	0.191	0.302	-0.201	0.716	0.716
	(0.071)	(0.167)	(0.191)	(0.117)	(0.147)	(0.164)	(0.173)	(0.179)	(0.167)	(0.516)	(0.379)
	[-1.696]	[-1.206]	[0.843]	[-1.134]	[-0.678]	[-1.676]	[1.105]	[1.682]	[-1.201]	[1.386]	[1.889]
D(LW13(-1))	-0.035	-0.027	-0.007	0.007	-0.040	-0.036	-0.078	0.042	-0.058	-0.356	0.055
	(0.017)	(0.041)	(0.047)	(0.029)	(0.036)	(0.040)	(0.042)	(0.044)	(0.041)	(0.126)	(0.093)
	[-2.009]	[-0.672]	[-0.156]	[0.262]	[-1.104]	[-0.896]	[-1.838]	[0.954]	[-1.411]	[-2.823]	[0.598]
D(LW14(-1))	-0.023	0.018	-0.109	0.034	0.099	0.107	-0.064	0.077	-0.028	-0.087	-0.019
	(0.027)	(0.062)	(0.07138)	(0.044)	(0.055)	(0.061)	(0.064)	(0.067)	(0.062)	(0.192)	(0.141)
	[-0.881]	[0.286]	[-1.528]	[0.779]	[1.807]	[1.741]	[-0.991]	[1.158]	[-0.443]	[-0.450]	[-0.134]
C	0.024	0.0152	0.019	0.025	0.024	0.039	0.014	0.012	0.024	0.021	0.002
	(0.004)	(0.008)	(0.009)	(0.006)	(0.007)	(0.008)	(0.009)	(0.009)	(0.008)	(0.026)	(0.019)
	[6.740]	[1.840]	[2.040]	[4.266]	[3.322]	[4.772]	[1.601]	[1.364]	[2.876]	[0.812]	[0.092]
Adj. R-squared	0.157	0.003	0.158	0.036	0.314	0.288	0.534	0.543	0.094	0.430	0.304
Sum sq. resids	0.007	0.041	0.054	0.020	0.032	0.040	0.044	0.047	0.041	0.393	0.212
S.E. equation	0.012	0.028	0.033	0.020	0.025	0.028	0.029	0.030	0.028	0.088	0.064
F-statistic	1.815	1.015	1.826	1.162	3.017	2.783	6.048	6.232	1.457	4.318	2.919
Prob (F-Statistic)	0.058*	0.456	0.056*	0.330	0.002***	0.003***	0.000***	0.000***	0.158	0.000***	0.002***
Log likelihood	209.797	152.686	143.547	176.281	161.187	153.769	150.366	147.918	152.633	77.081	97.749
Akaike AIC	-5.785	-4.080	-3.807	-4.785	-4.334	-4.113	-4.011	-3.938	-4.079	-1.823	-2.440
Schwarz SC	-5.258	-3.554	-3.281	-4.258	-3.807	-3.586	-3.484	-3.411	-3.552	-1.297	-1.914
Mean dependent	0.020	0.023	0.024	0.019	0.021	0.019	0.021	0.020	0.019	0.022	0.020
S.D. dependent	0.013	0.028	0.035	0.020	0.030	0.033	0.043	0.045	0.030	0.116	0.077

Determ.resid cov.(dof adj.):4.35E-35 Determinant resid covariance: 2.16E-36Log likelihood; 1705.298Akaike information criterion; -44.33725Schwarz criterion; -37.09796Number of coefficients; 220

;* & *** denote 10%; 5% and 1% level of significance

The critical t-values are 1.645, 1.960 and 2.576 for 10%, 5% and 1% levels of significance.

Table 14: Significance tests for public/private earnings spillover

	Private sectors						Public sectors				
	Mfg. D(LW2)	Const. D(LW3)	Mining D(LW4)	Trade D(LW5)	Fin. Int. D(LW6)	Pvt. Trans. D(LW8)	Ntl. dept. D(LW10)	Provinces D(LW11)	Lo. Auth. D(LW12)	Publ ent. D(LW13)	Trans. & comm. D(LW14)
(1) VECM3 SSR complete (51)	0,007	0,041	0,054	0,020	0,032	0,040	0,044	0,047	0,041	0,393	0,212
(2) VECM1/2 SSR complete (58, 58)	0,010	0,043	0,073	0,022	0,042	0,056	0,071	0,056	0,043	0,456	0,298
(3) VAR reduced (60)/VECM2 reduced (59)	0,010	0,044	0,077	0,023	0,048	0,062	0,097	0,087	0,040	0,381	0,313
F-Tests											
(1-2): F(7,51) VECM3 vs VECM1/2	2,080	0,321	2,610	0,598	2,244	2,913	4,448	1,294	0,365	1,170	2,963
p-values	0.063*	0.941	0.022**	0.755	0.046**	0.012**	0.001***	0.272	0.918	0.337	0.011**
(1-3): F(9_8, 51) VECM3 vs VAR(60)/VECM2reduced(59)	2,004	0,353	2,372	0,777	2,840	3,154	7,661	5,291	-0,214	-0,194	3,027
p-values	0.058*	0.952	0.025**	0.639	0.009***	0.004***	0.000***	0.000***	-	-	0.007***
(2-3): F(VECM1/2 (2_1,58) vs VAR/VECM2(60,59)	1,539	0,509	1,289	1,473	4,284	3,248	21,293	32,126	-4,623	-9,547	2,810
p-values	0.223	0.604	0.283	0.238	0.018**	0.046**	0.000***	0.000***	-	-	0.099*

The numbers in (,) are the respective degrees of freedom. The first number refers to private sectors, the second to public sectors. The F-Tests for the model comparison (1-2) all have the same degrees of freedom (7,51). The comparisons (1-3) have (9,51) for the private sectors and (8,51) for the public sectors. The comparisons (2-3) have (2,58) for the private sectors and (1,58) for the public sectors.

In the short run only financial services, private transport and other public enterprises earnings have significant negative autoregressive terms. Lagged individual public sector have only one small significant coefficient in the equation for changes of manufacturing earnings, however the number of significant coefficients of errors from cointegrating relations in equations for individual private sector earnings is larger. Only construction and trade earnings are not significantly related to the lagged errors of the cointegrating relations.

This outcome is different from the estimates of the VECM1. It could be that the difference is coming from the cointegrating relations also capturing relations and adjustment among individual private sector earnings. Among individual public sector earnings, it is national departments and provinces which respond significantly to the errors from the cointegrating relations. For other public enterprise earnings this response is weak and for local authorities and public transport there are no significant relations with past errors from the cointegrating relations.

From the individual private sector earnings mining is of particular interest, because of its potential to generate Dutch disease. The error from the third cointegrating relation is only significant in the mining earnings equation and in the financial services sector earnings. Furthermore, lagged changes in mining earnings are only weakly significant for trade earnings. Both results do not point to "Dutch disease"-like spillovers from mining earnings to other sectors, which are important for international competitiveness, like manufacturing, but also transport. However, there seems to be a strong long-run relation between mining earnings and earnings in the public sector vie the third cointegrating relationship.

VECM private and public sub-sectors – Significance tests

Finally, we test whether the exclusion of public or private sectoral earnings is significantly changing the explanatory power of the respective earnings equation. Table 14 shows the sum of squared residuals of the three models presented in Tables 9, 11 and 13 and the calculated F-Tests according to the following formula:

$$F = \frac{(SS_E^{\prime} - SS_E)/m}{MS_E} \sim F(m, df_E)$$

m	difference of degrees of freedom for the complete and reduced models
dfE	degrees of freedom for the complete model
SSE'	Sum of squared residuals for the reduced model
SSE	Sum of squared residuals for the complete model

The test compares the sum of squared residuals for the complete models (VECM1, VECM2 and VECM3) with the reduced models, which eliminate public or private earnings variables. The first line of F-Tests compares for each sectoral earnings variable whether aggregating private or sectoral earnings generates a significant loss of explanatory power. This is the case for manufacturing, mining, financial intermediaries and private transport among private sector earnings indicators and national departments and transport and communications among public sector earnings indicators. The relatively large number of significant test results for this comparison suggests that aggregation comes with a significant loss of information.

The second line of F-Tests in Table 14 compares the complete model of all individual private and public sector earnings with reduced models, which eliminate public sector earnings in the VAR for individual private sector earnings. The respective test reveals that there is no cointegrating relation for individual private sector earnings variables. The loss of information from excluding individual public sector variables is biggest for earnings in the private road transport sector, followed by financial intermediaries, mining and still significant for manufacturing at a 5% level. For individual public sector earnings, the loss of information from omitting private sector earnings variables is most significant for national departments, followed by provinces and public transport and communications.

The public/private earnings pattern is therefore more nuanced than what was found with aggregate public and private sector earnings (Granger causality Table 2, VECM Table 4a, VAR Table 4b) and the Granger causality analysis with individual public and private earnings variables (Table 7).

The last line of F-Tests in Table 14 compares the complete VECM1 and VECM2 models, which include only aggregates of public or private sector earnings with the reduced VAR and VECM model only using individual private or public sector earnings variables. The omission of public sector earnings is significant for financial intermediation and private road transport, which could indicate that these sectors are hiring from a similar pool like public sector workers. For public sector earnings the omission of aggregate private sector earnings information is most significant for national departments, provinces and public transport and communications.

Conclusions

Two hypotheses of sectoral remuneration patterns have been explored in this paper:

a) Is there a relationship between aggregate remuneration in the public and private sectors for nominal and real (inflation-adjusted) series; and
b) is the found pattern on the aggregate level (public remuneration follows private remuneration) also confirmed on the individual sectoral level?

Statistical and tests and econometric estimates for aggregate data strongly suggest that nominal public-sector remuneration follows private-sector remuneration in the short and long run without feedback. This pattern also holds for real remuneration.

Past observations of aggregate public-sector remuneration have no explanatory power for aggregate private-sector remuneration. This difference in explanatory power is also confirmed for the real (inflation adjusted) remuneration series. The similarity of the estimation results with nominal and real remuneration data suggests that the response to inflation shocks is similar for public- and private-sector remuneration.

Extending the analysis to 11 individual public (5) and private (6) sector earnings per employee series the statistical and econometric findings suggest that the influence from public sector earnings on private sector earnings is either insignificant (Granger causality analysis reported in Table 7) or small (F-Tests of the significance of omitting public sector earnings variables in private sector earnings equations in Table 14).

For public sector earnings a very strong influence of aggregate and individual sector private earnings is found for National Departments, Provinces and Public Transport. (Table 14). Earnings in municipalities and other public enterprises are better explained with public sector earnings alone.

No evidence of "Dutch disease" can be found in the short run. Past changes of average remuneration in the mining sector has no explanatory power for other sectoral remuneration developments. For individual private sector remuneration, the hypothesis of a long run relation between public and private remuneration is rejected, which also rules out a long-run influence of remuneration in mining on remuneration developments in other private sectors in South Africa.

The main conclusion for economic policy is that efforts to reduce excessive nominal wage growth should not exclude the private sector. This holds of course only if the described earnings pattern remains stable. According to our findings public sector earnings are more influenced by private sector earnings than the other way around.

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Appendix

List of abbreviations

GDP	Gross Domestic Product
n/a	not applicable
OECD	Organisation for Economic Co-operation and Development
SARB	South African Reserve Bank
SD	Standard Deviation
Stats SA	Statistics South Africa
VAR	Vector Auto-Regression
VECM	Vector Error Correction Model

List of variables

LWPU	log nominal public-sector remuneration
LRWPU	log real public-sector remuneration
LWPR	log nominal private-sector remuneration
LRWPR	log real private-sector remuneration
LCPI	log consumer price index
D(LWPU)	quarter-on-quarter changes of log nominal public-sector remuneration
D(LRWPU)	quarter-on-quarter changes of log real public-sector remuneration
D(LWPR)	quarter-on-quarter changes of log nominal private-sector remuneration
D(LRWPR)	quarter-on-quarter changes of log real private-sector remuneration
D(LCP)I	quarter-on-quarter changes of log consumer price index

"log" is used to denote natural logarithm

Sources of variables

Series code	Series name	Description	Source(s)	Label
Public-sector wages				
LABP110D	Remuneration per worker in non-agriculture: public sector	Constant prices index = 2000	SARB and Stats SA	LWPU
LABP110L	Remuneration per worker in non-agriculture: public sector	Current prices index = 2000	SARB and Stats SA	LRWPU
Private-sector wages				
LABP120L	Remuneration per worker in non-agriculture: private sector	Current prices index = 2000	SARB and Stats SA	LWPR
LABP120D	Remuneration per worker in non-agriculture: private sector	Constant prices index = 2000	SARB and Stats SA	LRWPR
Consumer price index				
GEM(M1, CPI9100B)	Consumer price index = 2000	Seasonally adjusted quarterly series	SARB and Stats SA	LCPI

Reduced private sector VAR model

Vector Autoregression Estimates - Date: 01/23/19 Time: 15:45 - Sample (adjusted): 9/01/2000 3/01/2017
Included observations: 67 after adjustments - Standard errors in ( ) & t-statistics in [ ]

	DLW2	DLW3	DLW4	DLW5	DLW6	DLW8
DLW2(-1)	-0.179	-0.067	-0.204	-0.482	-0.379	-0.648
	(0.143)	(0.296)	(0.392)	(0.215)	(0.310)	(0.353)
	[-1.255]	[-0.228]	[-0.520]	[-2.239]	[-1.221]	[-1.837]
DLW3(-1)	0.098	0.010	0.201	0.202	0.326	0.100
	(0.063)	(0.131)	(0.174)	(0.095)	(0.137)	(0.156)
	[1.546]	[0.079]	[1.155]	[2.117]	[2.369]	[0.642]
DLW4(-1)	0.037	0.085	-0.186	0.099	0.097	-0.001
	(0.045)	(0.094)	(0.124)	(0.068)	(0.098)	(0.112)
	[0.818]	[0.902]	[-1.497]	[1.454]	[0.991]	[-0.012]
DLW5(-1)	0.108	0.355	0.091	-0.147	0.002	0.049
	(0.087)	(0.181)	(0.240)	(0.132)	(0.189)	(0.215
	[1.243]	[1.963]	[0.380]	[-1.119]	[0.012]	[0.228]
DLW6(-1)	-0.055	0.007	-0.113	0.039	-0.296	-0.009
	(0.054)	(0.112)	(0.149)	(0.082)	(0.118)	(0.134)
	[-1.012]	[0.063]	[-0.759]	[0.482]	[-2.516]	[-0.067]
DLW8(-1)	0.033	0.234	-0.076	0.034	0.102	-0.266
	(0.050)	(0.103)	(0.137)	(0.075)	(0.108)	(0.123)
	[0.655]	[2.270]	[-0.557]	[0.457]	[0.943]	[-2.168]
C	0.018	0.011	0.030	0.023	0.022	0.034
	(0.003)	(0.007)	(0.009)	(0.005)	(0.007)	(0.008)
	[5.600]	[1.568]	[3.318]	[4.639]	[3.123]	[4.182]
R-squared	0.117	0.182	0.077	0.153	0.205	0.144
Adj. R-squared	0.029	0.100	-0.015	0.068	0.125	0.058
Sum sq. resids	0.010	0.044	0.077	0.023	0.048	0.062
S.E. equation	0.013	0.027	0.036	0.020	0.028	0.032
F-statistic	1.331	2.223	0.835	1.801	2.572	1.683
Log likelihood	199.652	150.660	131.832	171.978	147.578	138.946
Akaike AIC	-5.751	-4.288	-3.726	-4.925	-4.196	-3.939
Schwarz SC	-5.520	-4.058	-3.496	-4.694	-3.966	-3.708
Mean dependent	0.020	0.023	0.024	0.019	0.021	0.019
S.D. dependent	0.013	0.028	0.035	0.020	0.030	0.033

Determinant resid covariance (dof adj.)	0.000
Determinant resid covariance	0.000
Log likelihood	960.788
Akaike information criterion	-27.427
Schwarz criterion	-26.044
Number of coefficients	42

Reduced public sector VECM2

Vector Error Correction Estimates - Date: 01/17/19 Time: 11:58 - Sample (adjusted): 9/01/2000 3/01/2017
Included observations: 67 after adjustments - Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	CointEq2			
LW10(-1)	1.000	0.000			
LW11(-1)	0.000	1.000			
LW12(-1)	0.604	-0.114			
	(0.290)	(0.192)			
	[2.082]	[-0.594]			
LW13(-1)	-1.374	-0.971			
	(0.171)	(0.113)			
	[-8.052]	[-8.592]			
LW14(-1)	-0.259	0.030			
	(0.188)	(0.124)			
	[-1.382]	[0.239]			
C	0.125	0.308			
Error Correction:	**D(LW10)**	**D(LW11)**	**D(LW12)**	**D(LW13)**	**D(LW14)**
CointEq1	-0.097	0.200	-0.268	0.260	0.279
	(0.111)	(0.105)	(0.071)	(0.220)	(0.199)
	[-0.875]	[1.900]	[-3.770]	[1.181]	[1.398]
CointEq2	-0.008	-0.399	0.426	0.554	-0.300
	(0.166)	(0.157)	(0.107)	(0.329)	(0.298)
	[-0.047]	[-2.540]	[3.998]	[1.680]	[-1.004]
D(LW10(-1))	-0.220	-0.350	-0.099	-0.838	-0.512
	(0.169)	(0.160)	(0.108)	(0.335)	(0.304)
	[-1.301]	[-2.185]	[-0.911]	[-2.498]	[-1.686]
D(LW11(-1))	-0.077	-0.103	-0.057	-0.014	0.726
	(0.180)	(0.170)	(0.115)	(0.357)	(0.323)
	[-0.426]	[-0.608]	[-0.495]	[-0.040]	[2.248]
D(LW12(-1))	0.034	0.256	-0.170	0.501	0.381
	(0.175)	(0.166)	(0.112)	(0.347)	(0.315)
	[0.195]	[1.543]	[-1.511]	[1.441]	[1.212]
D(LW13(-1))	-0.107	-0.033	0.001	-0.064	0.073
	(0.062)	(0.058)	(0.040)	(0.122)	(0.111)
	[-1.734]	[-0.560]	[0.041]	[-0.520]	[0.652]
D(LW14(-1))	-0.107	0.052	-0.055	0.048	-0.295
	(0.069)	(0.065)	(0.044)	(0.137	(0.124)
	[-1.544]	[0.804]	[-1.244]	[0.349]	[-2.382]
C	0.031	0.025	0.027	0.032	0.013
	(0.007)	(0.006)	(0.004)	(0.013)	(0.012)
	[4.807]	[4.073]	[6.530]	[2.491]	[1.144]
R-squared	0.208	0.354	0.323	0.573	0.206
Adj. R-squared	0.114	0.277	0.243	0.522	0.112
Sum sq. resids	0.097	0.087	0.040	0.381	0.313
S.E. equation	0.041	0.038	0.026	0.080	0.073
F-statistic	2.210	4.620	4.030	11.305	2.192
Log likelihood	123.926	127.674	153.776	78.117	84.732
Akaike AIC	-3.460	-3.572	-4.352	-2.093	-2.291
Schwarz SC	-3.197	-3.309	-4.088	-1.830	-2.027
Mean dependent	0.021	0.020	0.019	0.022	0.020
S.D. dependent	0.043	0.045	0.030	0.116	0.077
Determinant resid covariance (dof adj.)		0.000			
Determinant resid covariance		0.000			
Log likelihood		598.738			
Akaike information criterion		-16.38			
Schwarz criterion		-14.735			
Number of coefficients		50			