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Wage Dynamics in Romania

By Gaetano D'Adamo, Nora Hesse, Julien Hartley and Nicolae Bîea

Summary

Economy-wide real wage growth in Romania has been accelerating since 2015. While wages in Romania are low relative to the rest of the EU and they are expected to continue growing faster than the EU average as the economy catches up, wage growth in excess of productivity gains could lead to losses in competitiveness. Overall, the increase in real compensation per employee was broadly in line with that of labour productivity between 2011 and 2016. Already in 2016, however, real compensation started to race ahead and in 2017 unit labour costs expanded by more than 11%. While Romania's exports have fared well in recent years, the current account deficit has been gradually increasing since 2014 as imports accelerated in line with booming private consumption, itself stimulated by a persistently pro-cyclical fiscal policy. Thus, a deteriorating external competitiveness and export performance due to rising production costs could pose significant macroeconomic risks. Against this background, this paper seeks to investigate the role of public sector wages in leading wage changes in the economy as a whole, which in turn might influence Romania's cost competitiveness. The analysis shows that, over the period 2000-2017, the public sector was the leader in the wage setting process while the "tradable" (i.e. manufacturing) sector and the market "non-tradable" (i.e. services) sector have been the followers. These results suggest that, notwithstanding nominal exchange rate developments, spillovers from wage growth in the public sector to the private sector could undermine Romania's external competitiveness. Therefore, a responsible wage setting policy is needed to ensure that overall wage dynamics are attuned to productivity developments in the tradable sector and reflect prevailing conditions on the labour market.

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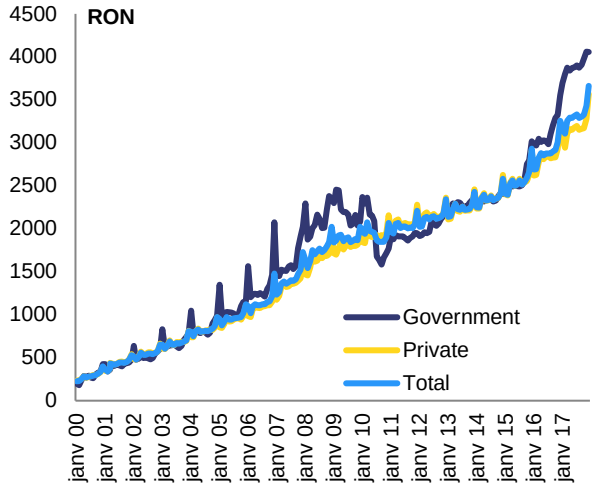
Introduction

Economy-wide real wages in Romania have been growing at double-digit rates (year-on-year) since late 2015. In the fourth quarter of 2017 average real compensation per employee had increased by around a third when compared to the same quarter of 2015. Public wage growth considerably outpaced wage growth in the private sector, with public wages increasing by more than 60% in real terms over the same period. Ad hoc public wage hikes and consecutive increases of the minimum wage, which rose by almost 40% in real terms between end-2015 and end-2017, have been among the drivers of these developments. Romania has one of the highest shares of workers earning the minimum wage in the EU, suggesting a relatively strong relationship between minimum and average wages.[1] This is particularly true for the public sector, as about 40% of public servants were receiving the minimum wage at the beginning of 2015.

Graph 1: **Monthly average wages in Romania**



Source: European Commission

Looking into potential spillovers between public and private wages and the direction of influence in wage determination is therefore particularly relevant. Previous literature has shown that public sector wages play an important role in the determination of labour costs in major euro area economies. Perez and Sanchez (2011), for example, analysed the interaction between public and private wages in the four largest euro area economies. They found evidence of pure public wage leadership in Germany and France and of bi-directional links between public and private wages in Italy and Spain. Given repeated public wage hikes in recent years, the question of whether in Romania increases in public wages are likely to push up private sector wages as well becomes pertinent.

Wages in Romania are low relative to the rest of the EU and they are expected to continue growing faster than the EU average as the economy catches up. To avoid competitiveness losses, however, wage growth needs to be commensurate with productivity gains. Overall, the increase in real compensation per employee was broadly in line with that of labour productivity between 2011 and 2016. In 2016, however, wages started to race ahead of productivity and in 2017 the growth rate of real compensation per employee was more than double that of productivity.

Admittedly, Romania's export prices in both RON and EUR have remained relatively subdued and export performance has fared well in recent years. Romania had the highest global export market share gains in the EU in 2016, and the sixth highest in 2017. Despite this strong export performance, however, the current account deficit has been gradually widening since 2014 as imports accelerated in line with booming private consumption, itself stimulated by a persistently pro-cyclical fiscal policy. In consequence, a deteriorating external competitiveness and export performance due to rising production costs could pose significant macroeconomic risks.

Using data covering the period 2000-2017, this paper investigates whether public wage hikes play a role in pulling up wages in the private sector as well, which in turn may have the potential to damage external competitiveness, particularly if Romania's nominal effective exchange rate continues to remain relatively stable.

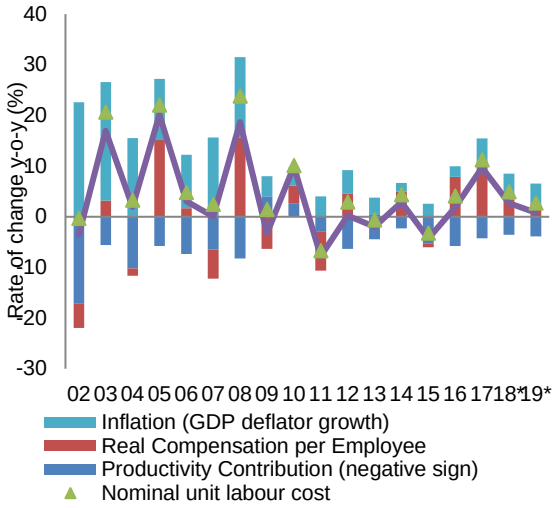
Wage developments since 2008

In the run-up to the 2008 crisis, Romania saw an economy-wide pick-up in wage growth. This acceleration, however, was substantially steeper in the public sector (Graph 1). Rising wages lead to an increase in unit labour cost despite significant improvements in labour productivity (Graph 2).

In the wake of the crisis, wage restrain was a key element of Romania’s stabilisation policies. As part of the fiscal stabilisation measures under the 2009-2011 balance-of-payments financial assistance

programme, the government imposed in May 2010 a 25% reduction of public wages for all public sector employees[2]. The wage bill of state-owned enterprises was also constrained, while the minimum wage level was frozen at RON 600 (~ EUR 140) in 2009 and 2010. These steps, together with major slack in the economy, moderated wage growth. This helped contain labour compensation growth in line with productivity gains during the post-crisis years (Graph 3). Sustaining this trend in the future would help preserve Romania's cost competitiveness.

Graph 2: **Unit labour cost decomposition**

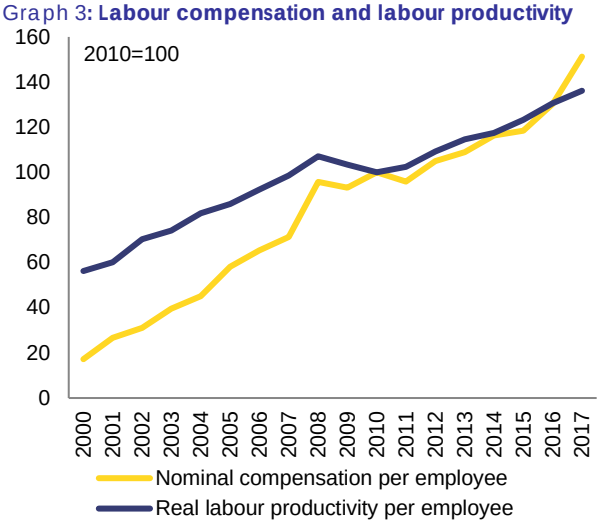


Source: European Commission

Wage growth, however, has been picking-up since the second half of 2015, in the context of a tightening labour market and repeated public wage and minimum wage increases. Average compensation per employee grew by 10% in 2016 and by 16% in 2017, almost four times the growth rate of real labour productivity. In consequence, nominal unit labour costs rose by 4% in 2016 and 11% in 2017. In addition, although the nominal effective exchange rate has remained relatively stable over the last few years, the acceleration of wage growth has led to a real exchange rate appreciation of around 13% in 2016 and 2017.[3] The deterioration of external competitiveness due to rising labour costs could pose important macroeconomic risks considering that the current account deficit has been gradually widening since 2014.

The rise in labour costs, however, has not been uniform across sectors (Graph 4). Productivity gains and contained labour compensation during the post-crisis years have curbed unit labour cost growth in the tradable and private non-tradable sectors. In contrast, the public sector has seen a marked acceleration of labour costs in recent years. The increase in unit labour costs in the public sector, however, might pose a risk of higher costs in the private sector as well. More attractive wages in the public sector might foster wage pressure in the private sector as well. Thus, accelerating wage growth in the public sector could also have a negative impact on Romania's cost competitiveness.

Graph 3: **Labour compensation and labour productivity**



Source: European Commission

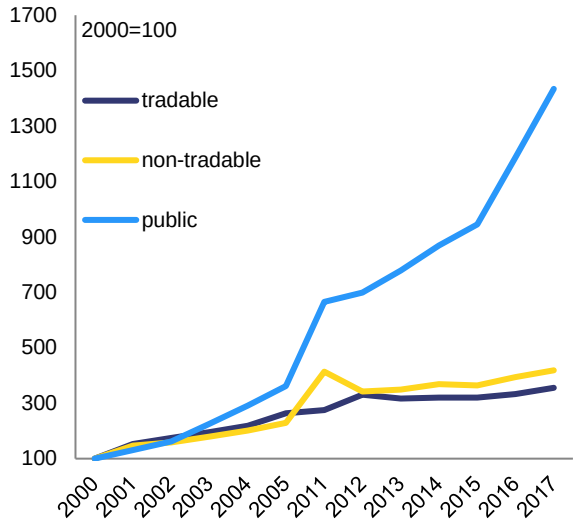
Public wages have been raised significantly since 2015 - largely on an ad-hoc basis. The government has justified the increases as necessary to attract and retain high-quality staff in the public sector, in line with its priority to improve the quality and efficiency of public sector services.

Public sector wage policy could affect economy-wide wage settlements in a number of ways. Sharp increases in wages in the public sector, which accounts for almost 20% of employees, could provide a strong signal to private sector wage-setting (demonstration effect). Higher wages could also attract private sector employees to the public sector, forcing private companies to increase wages, particularly if the labour market is tight. Competition by the government for the hiring of educated and skilled employees could also create tensions in particular segments of the labour market. Overall, a substantial impact of public sector wage hikes on private sector wages will tend to weaken the link between wages and productivity in the latter.

Wage-setting institutions

Wage setting institutions in the private sector were streamlined with the amendment of the social dialogue code in 2011. This reform was designed to allow wages to better reflect productivity developments. Wage bargaining was decentralised substantially, with collective negotiations mandatory at the firm level (in firms with at least 21 employees) but merely optional at the branch level. The extensions of the branch collective agreements to all companies in the branch were also abolished.

Graph 4: **Nominal unit labour cost growth by sector**



Source: European Commission

According to Romania's Labour Code, the minimum wage is set by the government after consultation with trade unions and employer's organisations. The law does not mandate any particular timing or frequency of adjustment of the minimum wage. Thus, the government is free to change the minimum wage when and as often as it wishes. Furthermore, the level of the minimum wage is also at the discretion of the government and is not influenced by any rule-based indexation mechanism.

The minimum wage was frozen in 2009 and 2010 and grew at a moderate pace until 2013. Since 2013, however, minimum wage growth has picked up significantly. Between February 2013 and February 2017 the minimum wage almost doubled – from 750 RON (~EUR 170) to 1450 RON (~EUR 317) – with a net average annual growth rate of 18%. Starting with January 2018, the minimum wage grew by a further 9% in net terms. These successive minimum wage hikes have resulted in a highly compressed wage distribution. The share of workers earning minimum wage, which was below 10% until 2012, has grown to more than 30% in 2017[4].

Public sector wage setting was overhauled with the 2010 unified wage law (UWL). The law was adopted with the aim to (i) limit and control the public wage bill over the medium term and (ii) provide for transparent and comparable conditions of employment for public sector employees. The UWL introduced a unitary wage schedule in the public sector and abolished a number of discretionary wage supplements. According to the unitary wage schedule, public employees were allotted "salary coefficients", with 1 corresponding to the minimum wage and 12 to the largest possible public sector wage. This was meant to ensure that any future wage growth would have to be system-wide rather than targeted at particular categories of public employees. The new wage schedule was to be gradually phased in, taking into consideration the available fiscal space. With little fiscal space available, however, implementation of the UWL was constrained and wage increases continued to be given on an ad hoc basis.

In 2017 a new unified wage law was adopted to significantly increase public sector wages over 2017-2021. In 2018, however, the effect of the new UWL on net public wages and the public wage bill is expected to be in part neutralised by a transfer of most social contributions previously paid by employers to the employees.[5]

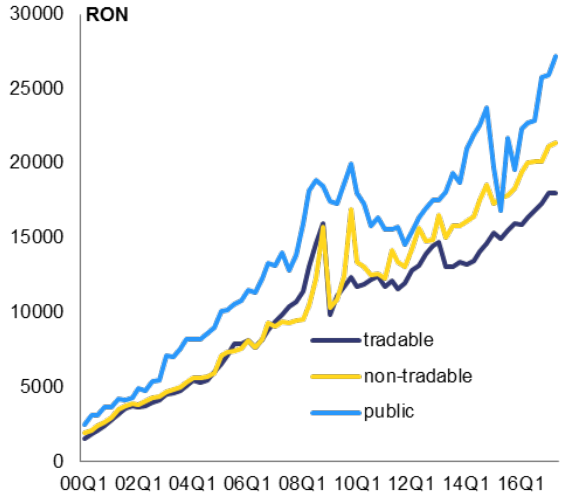
Wage spillovers between the public and the private sector

According to the classic Balassa-Samuelson model, the leader in wage determination should be the sector which is open to international competition, i.e., the tradable / manufacturing sector[6]. Wage *spillovers* imply that, under the assumption of free inter-sectorial labour mobility, if wages in one sector increase relative to those of the rest of the economy, workers would move to that sector until wage equalisation is ensured again. Therefore, the economic theory regarding wage spillovers makes two clear predictions which are empirically testable: (i) the traded sector is the leader, and (ii) relative wages are constant (or, less restrictively, the wage ratio is stationary).

However, leadership of the tradable sector in wage determination may not occur in practice, and other sectors could, for various reasons lead the wage determination. First of all, non-tradable-sector firms operate in a less competitive environment, since they are not open to international competition. Therefore, unions might have stronger bargaining power and, as a result, wage bargaining in non-tradable sectors may have higher wages as their outcome, other things equal. Second, depending on the political pressure that public employees are able to exert on the government, also wage bargaining in the public sector may lead to higher wage-outcomes and be the *de facto* leader in wage determination. In addition, free inter-sectorial labour mobility may not hold in practice. If inter-sectorial labour mobility is limited, full wage equalisation may not occur.

Real wages in different sectors in Romania tend to move very closely together, especially in the case of manufacturing and services (Graph 5), and even more so since the end of 2010. While public wages tend to be highly correlated with those in other sectors, they increased at a higher speed until the crisis and then dropped sharply during the crisis – including due to a 25% wage cut in the public sector in the third quarter of 2010. After 2010, wages in the three sectors started following a very similar path until the third quarter of 2015, when public wage growth accelerated again.

Graph 5. **Sectoral wages in Romania, 2000Q1-2017Q2**



Note: T=Tradable sector (Manufacturing); N=non-tradable sector (Services of the business economy); P=public sector (public administration and defence, compulsory social security, health, education, social services).
Source: European Commission

Empirical model

Which sector leads the wage determination process is ultimately an empirical question. In recent literature, the hypotheses at the basis of the wage spillovers theory are tested using Vector Error correction Models (VECM), which allow testing for both wage leadership and wage equalisation. The VECM, in other words, is an entirely data-driven approach for investigating wage leadership. The approach in this paper follows D'Adamo (2014) and includes three sectors: tradable, non-tradable and public (see Box 1 for a methodological overview)[7]. In this model, a sector *i* is the leader in wage determination if wages in that sector do not adjust to shocks in other sectors (i.e. α_i=0), i.e. that sector is weakly exogenous in the VECM. Long-run wage leadership, therefore, implies that the leader defines the stochastic trend at which wages develop, while not ruling out the possibility that the leading sector is in turn affected, in the short run, by wage shocks in other sectors[8] (See Annex 1-2 for methodology).

In the empirical analysis we focus on real wages, since using nominal wages might leave non-stationarity in the present model[9]. We use quarterly data for the period 2000Q1-2017Q2 for three sectors: traded (NACE sectors B-E), non-traded (NACE sectors G-N) and public sector (NACE sectors O-Q). Wages are calculated as real compensation per hour worked. The technical details of the specification and of the tests of cointegration rank are reported in the Appendix.

Table 1: **Tests of wage leadership 2000Q1-2017Q2**

Leading sector	*Test results (p-value)*
w_T	11.358 (0.003)
w_N	11.655 (0.003)
w_P	2.361 (0.307)

Note: The tests of wage leadership are distributed as χ^2_q where q is the number of degrees of freedom

Tables 1 and 2 summarise the results of the tests of wage leadership and the estimated long-run relationships (the β matrix) and corresponding adjustment coefficients (the α matrix) [10].

The tests clearly show that the wage leader in the period 2000-2017 was the public sector. The hypothesis of weak exogeneity (i.e. that the adjustment coefficients can be restricted to zero) cannot be rejected only in the case of the public

sector (see Table 1). This result confirms that in D'Adamo (2014), which covered only the period up to 2010. Since the public sector is found to be the wage leader, the corresponding adjustment coefficients (the alphas in the VECM) can be restricted to zero.

Table 2: **Estimation results 2000Q1-2017Q2**

Adjustment coefficients		*Long-run coefficients*	
$\alpha_{1,T}$	-0.317** (-3.492)	$\beta_{1,T}$	1.000 (N.A.)
$\alpha_{1,N}$	-0.424** (-3.621)	$\beta_{1,N}$	-
$\alpha_{1,P}$	0.000 (N.A.)	$\beta_{1,P}$	-0.659** (-6.540)
$\alpha_{2,T}$	-0.040 (-0.422)	$\beta_{2,T}$	-1.000 (N.A.)
$\alpha_{2,N}$	-0.406** (-3.308)	$\beta_{2,N}$	1.000 (N.A.)
$\alpha_{2,P}$	0.000 (N.A.)	$\beta_{2,P}$	-
Test of restr. model: χ^2_3=2.398 (p.value: 0.494)			

Note: T-values in parenthesis. N.A. = not applicable (coefficient has been restricted). **= significant at 1%; *significant at 5%. The deterministic part (trend and break) is not included in the table.

Table 2 focuses on the long-run relationships between sectoral wages[11]. Since the cointegration analysis suggested the presence of two cointegrating vectors, Table 2 reports two long-run relations. The left-hand side reports the adjustment coefficients and the right-hand side reports the long-run cointegration coefficients.

The error correction terms in Table 2 are written as:

$$\varepsilon_t = w_{i,t} - \beta_j w_{j,t}$$

where *i*, *j* are sectors and *w* the corresponding real hourly wage. In both cointegration relations, the coefficient of the sector that is significantly adjusting to each of the two relations has been normalised to one.

The first long-run relationship is between wages in the public sector and in the tradable sector:

$$w_T = 0.659 w_P + \varepsilon$$

In this case, while a positive long-run relationship is present, it is less than proportional (indeed, a test restricting the coefficient of w_P to 1 was rejected at all significance levels). This is also clear from Graph 5, where we could see that, at various periods, public sector wages grew at a higher speed than wages in the other sectors.

The second long-run relationship is between wages in the tradable and the non-tradable sector and can be re-written as:

$$w_{T,t} = w_{N,t} + \varepsilon_t$$

As seen, the coefficient of non-tradable sector wages can be restricted to 1. In other words, the hypothesis of full wage adaptability between w_T and w_N cannot be rejected.

The adjustment coefficients on the left-hand side of Table 2 tell us how each variable reacts when there is disequilibrium in either of the two cointegration relations. Thus, for example, $\alpha_{1,T}$ in Table 2 tells us how tradable sector wages react to a shock to the first long-run relationship. The fact that the coefficient is of the opposite sign than the corresponding one in the long-run relationship (i.e., in this case, $\beta_{1,T}$) means that the variable indeed adjusts to a disequilibrium. As a back-of-the-envelope calculation, the fact that $\alpha_{1,T} = 0.317$ implies that, when a shock to $w_P$occurs, other things being equal (i.e. the short-run effects notwithstanding), it is re-absorbed after three quarters. In the second cointegration relation, a coefficient of $\alpha_{2,N}$ = -0.406 implies that the disequilibrium is absorbed, other things being equal, after two and a half quarters.

The results reported in this paper are robust and in line with the findings of D'Adamo (2014), even though that study used a different sample period (2000-2010) and wage series (the labour cost index for wages and salaries). Second, to further check for the robustness of the results, the model was estimated for a reduced sample (until 2010Q4) and then, observations were recursively added one at a time. None of the estimated coefficients showed signs of instability and the results of the tests of restrictions were stable as well.

Implications

Our analysis suggests that the public sector leads wage determination in Romania, in line with earlier studies. These results imply that with the public sector as a leader, the wage setting policy should ensure that overall wage dynamics are attuned to productivity developments in the tradable sector and reflect prevailing conditions on the labour market.

Or alternatively, imprudent public wage policy carries the risk of triggering economy-wide wage dynamics that are inconsistent with productivity developments and can therefore lead to an erosion of competitiveness.

What determines, in turn, wage leadership? This question is more difficult to answer. In principle, institutional and structural factors should lie behind the leadership structure (Perez and Sanchez 2013, D'Adamo 2014). For example, more open and globalised countries should be characterised by leadership of the traded sector. According to the KOF Index of Globalisation, however, Romania ranked 25th in the EU in terms of globalisation in. 2018. On the other hand, countries in which the public sector is large and has bargaining strength or which have higher union membership could tend to be characterised by leadership of the public or the non-traded sector.

One caveat should, however, be added to the present analysis. Since minimum wages, as well as public sector wages, have increased substantially between 2015 and 2017, the estimated leadership of the public sector might actually be a by-product of minimum wage increases. However, as discussed above, this result was also found on sample periods where minimum wage increases had not been large. Since the share of public employees who earn the minimum wage relative to the share of private employees has actually decreased in recent years,[12] moreover, public wages are less likely to be affected by minimum wage hikes than private wages, and therefore their leadership role would still be valid.

Box: Methodological overview

As in D'Adamo (2014), we test for wage leadership using a vector error correction model (VECM). We include three sectors: tradable, non-tradable and public sector (i.e. non-market, non-tradable). We use quarterly data for the period 2010Q1-2017Q2 from Eurostat. Wages are calculated as compensation (wages and salaries) per hour worked, measured using the Labour Cost Index (wages and salaries) for three sectors: industry except construction (NACE sectors B-E), services (NACE sectors G-N) and the public sector (NACE sectors O-Q). We prefer using compensation per hours worked to compensation per worker to take into account the potential effect of part-time work.

The basic idea is that, since workers can move across sectors, wages in different sector should move together. More precisely, wage setting in one sector (the "leader") spills over to wages in other sectors ("followers"). As a result, there will be a long run, equilibrium relationship between wages in different sectors. We can write the equilibrium relationship between wages in different sectors as:

$$w^F = \gamma + \beta w^L + \varepsilon \qquad \text{(B.1)}$$

Where w^F is the (log real) wage in the sector that acts as a "follower" and w^L is the wage in the sector that acts as a leader and β expresses the degree of "wage adaptability". The closer β is to 1, the more there is "full wage adaptability" (see Frieberg 2007).

Having spillovers across wages in different sectors implies that, with three sectors (manufacturing, services and public sector), in a VECM (i) we can identify two long-run relationships (or cointegrating relations) and (ii) the wages in the sector that acts as a leader are weakly exogenous, i.e. they do not adjust to disequilibria in the long-run relations. The coefficients in equation (B.1) will appear in the cointegration vector of the VECM. The adjustment to the long-run relationship is expressed, in the VECM, by the coefficients in the "alpha" matrix (see Annex 2). While studying wage spillovers in Romania in the period 2000-2017, a break (level shift) had to be included to distinguish between the 2000Q1-2010Q2 period and 2010Q3-2017Q2 (see Annex 1)..This was necessary to take into account the 25% cut in public wages occurred in 2010Q3.

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Annex 1. Sample and model specification

Table A1. Sample and model specification

Estimation period	**2000Q1-2017Q2**
Effective sample	2000Q3-2017Q2 (68 obs.)
Shift and /or dummy series	Level shift 2010:03; Transitory Dummy 2008Q4-2009Q1
Deterministic part	Unrestricted constant
No. of lags	2

Annex 2. Empirical approach

Following the related empirical literature (D'Adamo 2014; Camarero et al. 2014; Orsini and Ostoijc 2015; Lamo et al. 2012, to name but a few) we employ a Vector Error Correction Model (henceforth VECM) that, in our case, includes wages in the traded sector, w_T , wages in the non-traded sector, w_N , and wages in the public sector, w_P:

$$\begin{bmatrix}\Delta w_{T,t}\\ \Delta w_{N,t}\\ \Delta w_{P,t}\end{bmatrix} = \boldsymbol{\alpha\beta'}\begin{bmatrix}w_{T,t-1}\\ w_{N,t-1}\\ w_{P,t-1}\end{bmatrix} + \boldsymbol{\Gamma}_1\begin{bmatrix}\Delta w_{T,t-1}\\ \Delta w_{N,t-1}\\ \Delta w_{P,t-1}\end{bmatrix} + \boldsymbol{\phi' D}_t + \boldsymbol{\varepsilon}_t$$

where the matrix β, with rank r < 3 represents the coefficients of the long-run cointegrating relations, α are the adjustment coefficients, Γ_i are the matrices of short-run coefficients, and D is a vector of unrestricted dummy variables. Long-run wage leadership of sector i implies that w_i is weakly exogenous in the VECM, i.e., that the vector of adjustment coefficients $\alpha_i = 0$.
In other words, $\alpha\beta'$ can be re-written, extensively, as:

$$\begin{bmatrix}\alpha_{1,T} & \alpha_{2,T} & \alpha_{3,T}\\ \alpha_{1,N} & \alpha_{2,N} & \alpha_{3,N}\\ \alpha_{1,P} & \alpha_{2,P} & \alpha_{3,P}\end{bmatrix}\begin{bmatrix}\beta_{1,T} & \beta_{2,T} & \beta_{3,T}\\ \beta_{1,N} & \beta_{2,N} & \beta_{3,N}\\ \beta_{1,P} & \beta_{2,P} & \beta_{3,P}\end{bmatrix}'$$

where, for example, $\alpha_{1,T}$ is the coefficient expressing how wages in the traded sector adjust to the first equilibrium relationship. The "traditional", Scandinavian model of wage leadership suggests that the traded sector is the leader in wage determination and other sectors adjust. In this case, we would not be able to reject the following restriction:

$$\begin{bmatrix}0 & 0 & 0\\ \alpha_{1,N} & \alpha_{2,N} & \alpha_{3,N}\\ \alpha_{1,P} & \alpha_{2,P} & \alpha_{3,P}\end{bmatrix}\begin{bmatrix}\beta_{1,T} & \beta_{2,T}\\ \beta_{1,N} & \beta_{2,N}\\ \beta_{1,P} & \beta_{2,P}\end{bmatrix}'$$

However, how many cointegration relations are actually present is an empirical issue and has to be tested. If two cointegration relations are found, then there may be only one common stochastic trend among the three variables (i.e. one "wage leader"). If only one cointegration relation is found, however, we may find up to two wage leaders, which would mean that the third sector adjusts to a linear combination of the others.

For what concerns the choice of the cointegration rank, Juselius (2006) suggests that an approach combining different criteria should be used. In other terms, the number of cointegration relations should be chosen according to (i) the Johansen trace test, first and foremost; (ii) the significance of the *alphas* in the cointegration relations, (iii) the modulus of the largest unrestricted root of the companion matrix (which, as a rule of thumb, with quarterly data should not be above 0.82), (iv) the underlying economic theory.

The Table below reports these criteria in our case. The underlying economic theory suggests a choice of rank (r) equal to 2, as highlighted above. All criteria point to the same direction, therefore we include two cointegration relations and one stochastic trend.

	Trace test (p-value)	Largest unrestricted root	Largest t-value of the alphas in the r-th vector
$r = 0$	34.150 (0.009)	0.328	N.A.
$r = 1$	15.215 (0.042)	0.647	3.848
$r = 2$	3.071 (0.075)	0.687	3.131

[1] According to Eurostat's latest Structure of Earnings Survey, around 15% of workers earned the minimum wage in Romania in 2014. Given that the minimum wage has considerably outpaced the average wage since 2014, this share is expected to have increased substantially. Estimates of the Ministry of Labour suggested that around a third of all workers earned the minimum wage in 2017.

[2] The measure was temporary and was reversed in several steps as fiscal space became available: i) in January 2011 an increase of 15% compared with October 2010; ii) in June 2012, increase of 8% compared with May 2012; iii) in December 2012, an increase of 7.4% compared with November 2012.

[3] The real effective exchange rate was deflated using unit labour costs. For a comparison, over the same period Poland's real effective exchange rate appreciated by 5%, Bulgaria's by 8%, and Hungary's by 10%.

[4] SWD (2016) 91 final: Country Report Romania 2016

[5] Social security contributions paid by the employees are part of the gross wage, while those paid by the employers are not. In consequence, transferring social contributions from the employers to the employees will automatically increase gross wages even if net wages remain constant.

[6] See Balassa (1964) and Samuelson (1964). For subsequent models with similar predictions, see the Scandinavian Model of wage determination (Aukrust, 1970) and the Froot and Rogoff (1995) model of the Balassa-Samuelson effect.

[7] For similar approaches see also Demekas D.G. and Kontolemis Z.G. (2000) "Government employment and wages and labour market performance". Oxford Bulletin of Economics and Statistics 62(3), pp. 391–415; Jacobson T, Ohlsson H (1994) Long-run relations between private and public sector wages in Sweden. Empirical Economics 19, pp. 343–360; Lindquist M. and Vilhelmsson R. (2006) Is the Swedish central government a wage leader? Applied Economics 38(14), pp. 1617–1625.

[8] A stronger form of leadership would be testing for strong exogeneity in the VECM, i.e. Granger causality. However, the related literature tends to distinguish between short- and long-run leadership, as we do, because of their different relevance outlined above (Fischer 2007, D'Adamo 2014). We have performed Granger causality tests and found no clear evidence of "strong" leadership, with the exception of the public sector which appears to have had "strong" leadership on the traded sector until 2010. Results of the Granger causality tests are available upon request.

[9] See Juselius (2006) on the possible I(2) nature of nominal variables such as prices and nominal wages.

[10] As explained in Juselius (2006), we use several criteria to identify the rank of the VECM, that is, the number of long-run relationships, namely (i) Johansen's trace test, (ii) the roots of the companion matrix and (iii) the significance of the coefficients in the α matrix. While the approach (i) suggests there should be one long-run relationship, the others suggest there are two. Given this and our a priori theoretical expectations, we opt for two.

[11] In order to have an identified system, in a VECM with two cointegrating relations we must introduce at least one restriction in each cointegrating relation. Therefore, as it is shown in Table 1, we first normalise to 1 one of the coefficients, so that the relationship is interpretable as the error form of equation (1), and then we restrict one of the other coefficients to zero.

[12] See Heemskerk et al. (2018), page 12.

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