# Begging thy coworker – Labor market dualization and the slow-down of wage growth in Europe

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**Abstract**

Does the structure of labor markets – and the possibility to employ temporary workers – affect aggregate wage growth? After the global financial crisis (GFC) a rich debate had ensued about the reasons for the delayed pick up of wage growth. However, structural labor market aspects remained strangely absent from this discussion. We contribute by incorporating labor market dualization into the standard Phillips Curve model to explain wage growth in 30 European countries in the period 2004-2017.

We find that the presence of temporary contracts in Europe's labor markets slows down aggregate wage growth due to the competition that temporary workers exert on permanent workers. This competition effect is most pronounced in countries, where trade union density is low. Moreover, we establish that labor market dualization has been at least as important in slowing wage growth since the GFC as unemployment, i.e. the observed flattening of the Phillips Curve.

**JEL classification:** J31, J42, J82

**Keywords:** Wage Growth, Labor Market Dualization, Involuntary Temporary Work, Phillips Curve, Competition effect

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# 1 Introduction

After the global financial crisis (GFC), wage growth in Europe remained surprisingly slow, even after labor markets had started to recover. A rich debate ensued that questioned the validity and nature of the relation between labor market slack and wage growth; i.e. the Phillips curve. Some explanations for the surprising slow-down in wage growth focused on improving the identification of slack (e.g. Bell and Blanchflower, 2021) while others recalled the old Keynesian argument of downward rigidity of nominal wages (e.g. ECB, 2015). The debate considerably deepened our understanding of current labor market dynamics. However, not much attention was paid to the implications from the interaction between different groups of workers.

In this paper, we set out to broaden the discussion by bringing the institutional dimension to the fore. A remarkable increase in labor market dualization has occurred over recent decades that most notably precipitated in a trend increase in the incidence of temporary workers. We argue that this development fundamentally altered the wage setting behaviour, thereby building on the insights of a relatively recent strand of literature (see e.g. Bellani and Bosio, 2019; Damiani et al., 2018). For the first time, we are able to demonstrate that involuntary temporary employees dampen wage growth at the macroeconomic level by putting a drag on the growth of wages of permanent employees. Larger shares of involuntary temporary workers result in a larger drag on wage growth - what we refer to as a competition effect between temporary and permanent workers. This effect is uneven across countries, altered by labor market institutions, in particular the inclusiveness of organized labor. While we cannot solve the post-GFC 'Phillips curve puzzle', we conclude that the institutional dimension plays a crucial role in understanding macroeconomic dynamics, such as wage growth. In fact, we demonstrate that the degree of labor market dualization via temporary workers is of comparable importance in dampening wage growth as the unemployed rate.

The paper is structured as follows. We briefly present the discussion on the slow-down of wage growth that followed after the GFC and synthesize its main results in a concise graphical model in section 2. Building on the findings from the macroeconomic debate, in

section 3, we revisit institutional arguments from the labour market dualization literature and derive our main hypothesis. We discuss its implications for the macroeconomic theory and incorporate our hypothesis in the graphical model developed in section 2. In section 4, we present the empirical model and set out how we isolate the impact of labor market dualization on wage growth, stripped off of potential composition effects resulting from a varying share of temporary employees. In section 5, we will present our results. The final section concludes.

## 2 Is there a drag on wage growth in Europe?

Aren't wages *always* growing too slow from an employees' and too fast from an employers' point of view? The answer – following the macroeconomic literature – is no. In a business cycle perspective[1] wage growth can be considered to be slow if the current rate is lower than it usually has been at the given level of labor market slack – most commonly measured by the unemployment rate – at least if this cannot be explained by others factors such as e.g. a slow-down in productivity growth. This Phillips curve interpretation of labor markets typically also considers inflation and productivity as key determinants of wage growth, thereby linking the business cycle to the long run perspective of growth models. It is this view that dominates the macroeconomic debate.

After the GFC, wages were expected to grow much faster than they did. Projections for wages based on the historical relationship between wage growth and labor market slack started to systematically overshoot realised wage growth; thus diverging substantially from historical experiences. A flattening of the Phillips curve relationship (for high rates of unemployment) emerged as the most popular explanation for the period of depressed wage growth (2012-2017). Evidence of a flattening of the Phillips curve had already started to emerge early after the GFC (Anderton and Boele, 2015) and the period from 2012 on was identified as

[1] An alternative approach would be to take the long run view. In the steady state setting of all major growth models, wage growth can be considered to be slow when it is below the inflation rate plus productivity as in this case the functional distribution of incomes is not constant, thereby yielding systemic instability Gaechter et al. (2018). This however, is a completely different time dimension than investigated in this paper.

the starting point of disinflation driven by domestic factors such as wages (Ciccarelli and Osbat, 2017; Moretti et al., 2019).

Nickel et al. (2019) identify wage growth as too slow and find non-linearities of the Phillips curve as one of the many explanations for the protracted reaction of wages to the labor market recovery. For a group of advanced economies this finding is supported by Arsov and Evans (2018) and it corroborates earlier findings by the IMF (2017). There are views countering this finding[2]. In fact, most cross-country surveys find a flattening of the Phillips Curve – that cannot be only explained by standard factors like the post-crisis productivity slow down – while some country specific time series surveys do not. Yet, the discrepancies seem to be linked to the research set-up with some single country time series surveys failing to identify the flattening while most approaches covering Europe or the euro area as a panel identify a break in wage setting behavior.

If thus, overall wage growth had experienced a negative shock after the GFC – over and above the development of its standard drivers – what was the underlying cause? Why was wage growth depressed after the GFC in Europe? There are two streams of literature that set out to explain this anomaly.

### 2.1 Potential explanations – Hidden slack and non-linearities

The first literature strand that sets out to explain the slow down in wage growth focuses on the correct identification of labor market slack. The major part of the debate concentrates on the question what labor market slack really is, or rather how it is best measured[3], and whether

[2]For instance Kiss and Van Herck (2019) find the decline in wage growth to be primarily driven by standard factors and identify the flattening as being not statistically significant. The latter result, however, is quite obviously driven by the choice of their time frame that already starts in 2010. This might also apply to the findings of Bonam et al. (2021) and Bulligan and Viviano (2017) who both chose 2008 as starting date for their analysis. Both papers investigate large euro area member economies and note that the flattening turns out to be robust only in the case of Germany. Bonam et al. (2021) even identify a steepening for some countries using an alternative rather unconventional indicator (The alternate indicator they propose only checks for robustness and is based on an indicator that primarily appears to signal the shortage of technical competences (McGrath and Beehan, 2018). There is no clear case set out for why this should be a better proxy for labor market slack than more conventional indicators. Bulligan and Viviano (2017) (for the pre-2016 period) seem to support these findings for Italy and France.

[3]Another argument again focuses on the measure for inflation Ball and Mazumder (2020).

the implication here is that the headline unemployment rate has lost its accuracy in capturing the supply-overhang of labor. Excess labor supply may be hidden for different reasons, such as discouraged workers stopping to search actively for jobs, interrupted employment spells, or involuntary reductions in working time materialising in short-time work or part-time work. Indeed, broader measures of labor-under-utilization, such as marginally attached workers, temporary workers and involuntary part-time employment have increased more strongly during the recession than the unemployment rate as shown in Hurley and Partini (2017) at least relative to their pre-crisis trend (ECB, 2017)[4]. In a key contribution Bell and Blanchflower (2019) derived an index for labor under-utilization for the UK that is constructed based on desired hours of work to capture the degree of underemployment. In a complimentary analysis, they demonstrate that this index improves the Phillips curve fit for Europe (and the US) (Bell and Blanchflower, 2021). The OECD (2018) supports this at least as regards composition effects of part-time workers. For advanced economies, Hong et al. (2018) find further evidence that involuntary part-time employment helps to explain wage developments, which is corroborated by the IMF (2017). Similarly, Zhang (2019) finds that broader cyclically adjusted measures for unemployment such as the hours gap or the non-employment gap improve the fit of the Phillips curve in the EU. Nickel et al. (2019) broadly concur with these findings deviating only in so far as finding only some marginal gains of unconventional slack measures. They also use broader measures of slack, such as extensions of the unemployment rate by different aggregates of involuntary part-time- and marginally attached workers. Indeed, their findings indicate that these broader measures are relevant for wage growth but they do not exceed the explanatory power of the headline unemployment rate in their estimations.

The second line of reasoning is motivated by the traditional Keynesian assumption of downward rigidity (but upward flexibility) of nominal wages (see e.g. Dolado et al., 2003). The main argument is that a recession warrants real wage cuts in order to clear the labor market;

[4]This result might be driven by the wide spread introduction of short-time working schemes after their initial success in Germany. The benefit of these schemes is to preserve employment during crisis but short-time work may also hamper GDP and job growth during the recovery (Baller et al., 2018; Hijzen and Martin, 2013). It is possible that the resulting pick-up in involuntary part-time – really being nothing else but hidden excess supply – puts a drag on wage growth in the recovery.

this is commonly understood as a situation in which the unemployment rate is brought down to its market clearing (or its natural or NAIRU) level. After the GFC, however, wage setters had been faced with a low-inflation environment. Chances to hide real devaluation of nominal wages behind inflation collapsed against the benchmark of a zero lower bound making it much harder to bring labor markets into equilibrium. In the debate particularly the ECB and the Deutsche Bundesbank have propagated this view (ECB, 2015; Bundesbank, 2016) and for the euro area it has recently been supported by a DSGE modelling exercise (Iwasaki et al., 2021). The non-linearity explanation is also supported by the findings in Marotzke et al. (2017) based on a survey of 25 European countries for 2010-2013. This corresponds to the findings of ECB researchers who attest limited wage flexibility for Europe (Rusinova et al., 2015). Indeed, in most Euro area countries only very few firms had reported (nominal) wage cuts during the height of the crisis (Izquierdo et al., 2017), a fact that lends some support to the argument of non-linearities. The results of the ECB's wage dynamics network also point in the direction of nominal wage resistance during downward adjustments (Izquierdo et al., 2017). At the same time - the argument goes (Ciccarelli and Osbat, 2017) - excess capacities have built up and led to labor hoarding, thereby resulting in excess employment at the prevailing wage level. If this is the case, wage growth will exhibit a delayed reaction to a decline in unemployment during the recovery.

### 2.2 A graphical synthesis of the debate

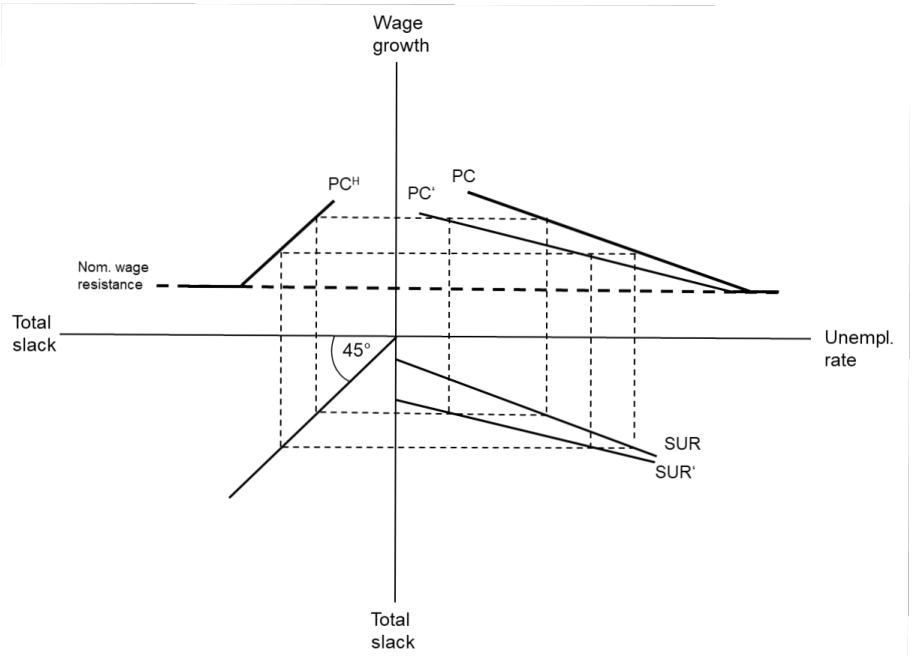
To sum up, there are two major possible explanations for the slow-down of wage growth after the GFC. First, there appears to be a non-linear element of the Phillips curve, that might be caused by downward wage rigidity. Second, it is not only the rate of unemployment alone that affects wage growth but slack has to be understood as a broader concept that does not necessarily correlate perfectly with the rate of unemployment.

We synthesized these findings in a graphical model in figure (1). Let us start in the upper left quadrant in which the relationship between total labor market slack and wage growth is depicted. Given the fact that total slack might entail hidden components next to the

unemployment rate, we will refer to the relationship in the upper left quadrant as the 'hidden' Phillips curve ($PC^H$). This hidden Phillips curve is linked to the 'traditional' Phillips curve via the relationship between the unemployment rate and the rate of total slack ($SUR$). The theoretical argument linking the rate of unemployment to the rate of wage growth is that unemployment is the first best proxy to capture potential substitute workers. A higher unemployment rate makes it easier for employees to be replaced with jobseekers. In turn, the bargaining power of employees decreases. According to the 'hidden slack' approach broader measures of unemployment capture more accurately the amount of potential substitute-employees (or employees' working hours) than the unemployment rate alone. Following the approach, it is important to control for effects of people at the fringe of the labor market $MARG$ on wage growth.

Note that in this case the unemployment rate is defined as $u = U/(EMP + U)$ whereas the rate of total slack ($TS$) is defined as $TS = (U + MARG)/(EMP + U + MARG)$. Hereby it is important to note that the denominator of $TS$ is (typically) larger than that of $U$ implying that $\delta(TS)/\delta(U) < \delta(u)/\delta(U)$. Thus every reduction of the unemployment rate materializes only as a relatively smaller reduction of total slack. This is exactly the relationship that $SUR$ captures and it allows us to project the $PC^H$ into the unemployment wage growth space to derive a conventional Phillips curve relationship ($PC$). Both $PC^H$ and $PC$ are limited by nominal wage resistance, accounting for the non-linearity approach and indicated by the dashed line.

*Figure 1:* Synthesis of the main findings




During the post-2012 recovery with depressed wage growth, total slack increased relative to unemployment as evidenced by the literature in section 2.1. In such a situation, gradual reductions in the unemployment rate are accompanied by smaller reductions in total slack. This dynamic is captured in figure (1) by a partial clockwise rotation of the $SUR$ to $SUR'$. Eventually, this results in a flattening of the $PC$ (but not of the $PC^H$ as long as slack is correctly defined).

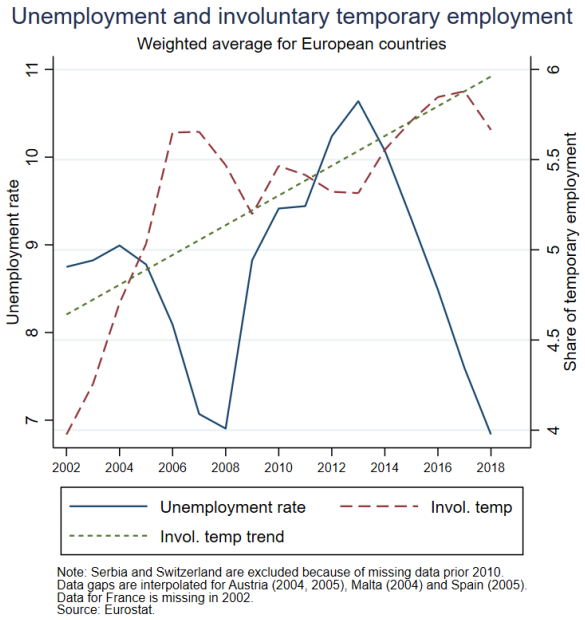
# 3 Labor market structure and wage growth – Bringing in the institutional dimension

The basic premise of this paper is that the development on labor markets is influenced by more than meets the eye. Structural change and rolling reforms have fundamentally altered the nature of employment in many countries. One of the most remarkable effects is that a growing number of employees ceases to be on permanent full-time contracts (Gonzalez Vazquez et al., 2019). While the increasing importance of part-time labor has been accounted for in the literature on 'hidden slack' – most elaborately in the approaches by Bell and Blanchflower (2021) – this has not been the case for employees on temporary

contracts.

However, the number and incidence of temporary workers shows a clear trend increase (Figure 2 and e.g. ILO, 2016; Gonzalez Vazquez et al., 2019).[5] In principle this could reflect worker's preferences but several scholars have argued that structural drivers, such as the rise of the service sector (Marx, 2011), as well as political origins rooted in liberalisation and deregulation policies have driven dualization of labor markets (Emmenegger et al., 2012; Thelen, 2014; Biegert, 2014). As a result of dualization, workers are increasingly separated in a disadvantaged and an advantaged group.

*Figure 2:* Labor market dualization in Europe




Our main hypothesis is that the nature of the employment contract (permanent vs. temporary) has implications on the wage setting process. The wage penalty is well established: all conditions equal, a worker on a temporary contract typically receives a smaller pay cheque than a worker on a permanent contract (c.f. Kahn, 2016; Dias da Silva and Turrini, 2015; Westhoff, 2020; Pavlopoulos, 2013). However, it is ambivalent whether and if so how the prevalence of temporary workers affects permanent workers' wages. Do permanent workers profit from dualization by shifting flexibilization pressures on temporary workers to extract rents? Or are permanent workers threatened by temporary workers as competition is undermining workers' bargaining power? The nature of this relationship between temporary and permanent workers may affect the overall impact of labor market dualization on wage

[5]Figure 2 shows the development of unemployment and *involuntary* temporary employment (both measured in % of the labor force) in Europe over the past two decades. The variables are weighted averages of 28 European countries. Due to the lack of data we excluded CH and RS in this illustration to draw a consistent picture of the development over time.

growth. We elaborate on this in the following.

### 3.1 Understanding the role of temporary employment

The most prominent model for understanding the relationship between temporary and permanent employees is based on the insider-outsider theory. According to this approach, insiders use their favourable employment position to bargain higher wages and stable employment to the detriment of outsiders. Outsiders reversely bear the brunt of cushioning labor market shocks, thereby allowing insiders to maintain high wages and stable employment (Lindbeck and Snower, 2002, 1988). While the initial insider-outsider theory has defined insiders as workers and outsiders as unemployed, the dualization literature has included atypical employment in the definition of outsiders (c.f. Rueda, 2005; Schwander, 2019). Apparently, it is common practice that temporary employment is used to cushion firms against labor market fluctuations (Draeger and Marx, 2017; Hijzen et al., 2017). Indeed, Hirsch (2016) and Gebel and Giesecke (2011) demonstrate that temporary agency workers have lower job stability than non-temporary workers suggesting that they are more likely to be laid-off during unfavourable economic conditions as the costs of separation tends to be smaller (Costain et al., 2010). For this reason – i.e. the higher transaction costs – insiders are in a more powerful bargaining position. This divides the workforce into separated groups - one with a relatively high level of socio-economic security, good protection, and material compensation, vis-a-vis one with a more fragile character (Häusermann et al., 2020). The first group (permanent employees) hereby has the potential to extract rents that (implicitly) are financed via the more unfavourable outcome of the second group (temporary employees). This links insider-outsider theory to the the empirically observed wage penalty that we have discussed above (c.f. Kahn, 2016; Dias da Silva and Turrini, 2015; Westhoff, 2020; Pavlopoulos, 2013).

For the macroeconomic perspective, there are two possible implications of the existence of a negative wage penalty of a large group of employees. Either, the wage penalty fluctuates along the relative proportions of insiders and outsiders. If we stick as close as possible to optimisation logic, factors of production – i.e. capital and labor – are necessarily remunerated

at the level of marginal factor productivity. If we deviate in the case of outsiders, the aggregate production factor 'labor' still can be remunerated at the level of marginal productivity with rents affecting the relative distribution within the two groups of employees. However, in this case an increase in the proportion of 'insiders' automatically increases the available rents that might be distributed to outsiders. As a necessity, optimal factor remuneration thus would imply that the wage penalty fluctuates along the relative proportions of insiders and outsiders. Alternatively though, and in our view more likely at least for the short run, it is possible that the level of the wage penalty is relatively constant. In this case the rate of wage growth is directly affected by changes in the incidence of outsiders. The mere possibility of this channel necessitates to control for composition effects.

However, while the insider-outsider theory portrayed outsiders as vicarious agents for insiders to fulfill their rent-seeking motives, this view has become substantially more nuanced in recent contributions questioning the clear-cut insider-outsider distinction (Rehm, 2009; Rehm et al., 2012; Schwander and Häusermann, 2013; Busemeyer and Kemmerling, 2020). Rolling labor market reforms over the past decades have reduced employment protection and facilitated the hiring of temporary employment (Boeri, 2011), while at the same time trade unions have lost bargaining power. As observed in Dolado et al. (2002), reforms of temporary employment created conditions for reforms that worsened the conditions of permanent employees. Boeri (2011) observes that a significant number of so called two-tier labour market reforms actually increases asymmetries between temporary and permanent employees. Nonetheless, it must be understood that the targeted steady state of these reforms usually implies worse conditions for all employees, temporary as well as permanent.

In a dynamic model Koutentakis (2008) demonstrates that the prevalence of temporary employment tends to suppress wages of permanent employees, once the transaction costs associated with firing permanent employees become lower than the wage penalty. This mechanism has become more likely with an increasing share of temporary workers. Moreover, employers may breed discord between different groups of workers to prevent unification of one organised labor bloc as discussed by Bellani and Bosio (2019). Competition dynamics

between different groups of workers can emerge that bear the potential to turn the original insider-outsider logic upside down. If this is the case, there may exist a *competition effect* allowing the prevalence of temporary employment to dampen wage growth of permanent employees. The effect may depend on the concrete institutional configuration and may be of macroeconomic relevance. We test this hypothesis in section 5.

Indeed, Ramskogler (2021) indicates that temporary employment has a negative effect on aggregate (unadjusted) wage growth in Europe. Note, though that Ramskogler (2021) considers overall temporary employment, which includes both, voluntary and involuntary temporary workers as a distinction is not feasible at a quarterly frequency. This however, is a clear shortcoming. As neatly demonstrated in Louis Hyman's brilliant case study TEMP (Hyman, 2018) there are two groups of temporary employees. On the one hand there is a rather small group of highly skilled, highly mobile professionals such as e.g. consultants that opt in for flexibility and might even experience a positive wage penalty. On the other hand, there are rather badly paid employees that often would prefer more permanent working relationships but are rationed in this regard. It is particularly the second group, involuntary temporary employees that is driving the negative wage penalty and it is the group of involuntary temporary employees that is of particular interest here.

A rise in the importance of the competition effect might be linked to the fact that temporary employees are employed in an increasing number of occupations and sectors (Polavieja, 2006). Indeed, competition between permanent and temporary employees appears to exist according to a recent case study (Voinea, 2018). Damiani et al. (2018) show that reductions in employment protection legislation for temporary workers tend to reduce general wage shares. These results lend support to the hypothesis of competition between permanent and temporary employees. This is supported by the findings of a key contribution by Bellani and Bosio (2019) who find that average hourly wages of permanent employees at the occupational level are negatively affected by the incidence of temporary employees.[6]

[6]Notably, effects are not equal along the income distribution. Weisstanner (2020), for instance, shows that deregulating flexible employment has a negative effect on the wage share of the lower and middle income groups while having a positive effect on the top group. In this case, the aggregate effect will depend on which of the respective income groups dominates in the composition of the wage bill.

However, labor market institutions are likely to affect the relationship between insiders and outsiders. Whether insiders benefit from the existence of outsiders or are threatened by them may be related to the institutional configuration. The theory behind this rationale goes back to Mancur Olson's theory that collective interests might be harmful if they are significant but not encompassing on a societal level (Olson, 1971). This can be linked to the insider-outsider model: the share of insiders needs to be large in order to have relevant bargaining power with macroeconomic effects. If the number of insiders is small there is not much bargaining power and external effects are unlikely to be large. If the share of insiders is very large there are not many outsiders left that could bear the costs of externalization and overall external effects are likely to be small.

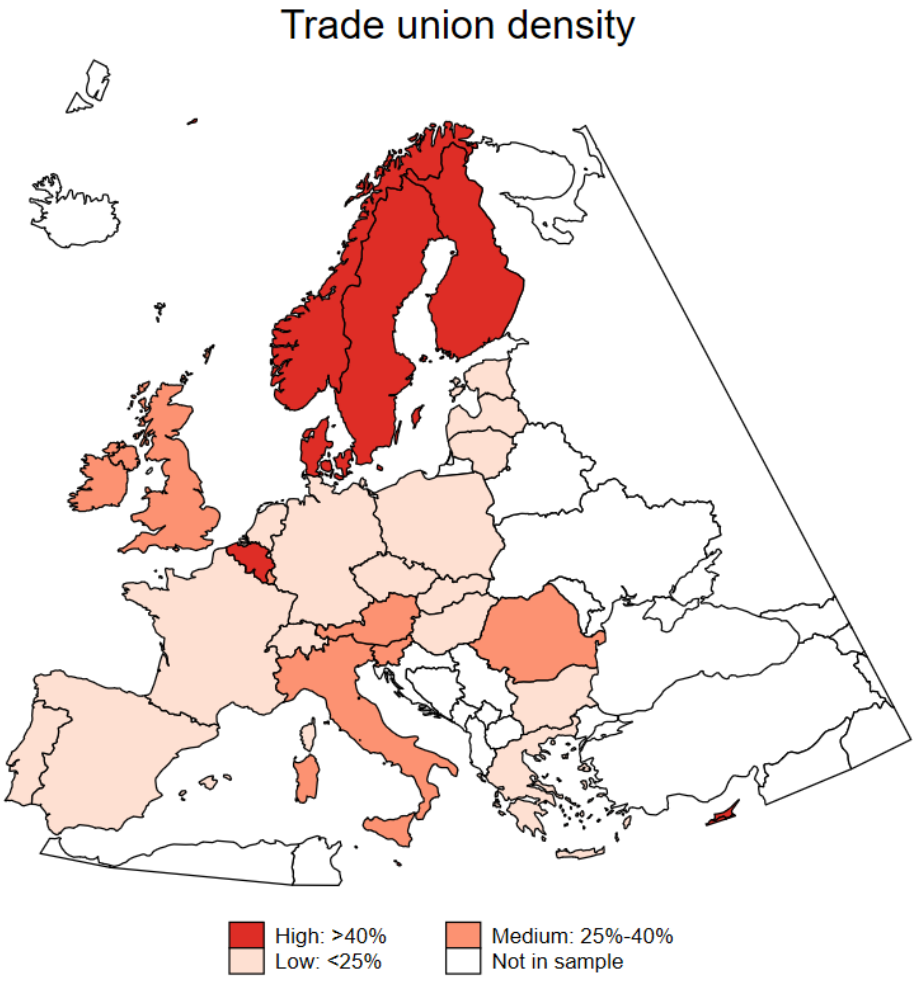
While a large stream of literature starting in the 1990ies centered around the implications of Olson's theory for the centralization and coordination of wage bargaining (Calmfors et al., 1988; Soskice, 1990), the simplest measure for how encompassing trade unions are, is their membership density (Lange, 1984). Trade union activities are usually closely related to the representation of insiders' interests. Following Olson's theory, the insider-outsider theory is most likely to apply to cases with a medium trade union density (TUD), i.e. insiders are likely to be most effectively sheltered from competition by outsiders or even profit from their existence. For our empirical analysis, we expect the competition effect to be non-existent or small in countries with medium trade union density. By contrast, the competition effect will likely be largest in countries with low trade union density because insiders do not have sufficient power to shelter themselves. Finally, countries with a high degree of trade union density are expected to face no competition effect because the outsider interests are likely to be internalized.

It should be noted that TUD does not correlate strongly with the incidence of temporary workers - if this was the case it could be interpreted as a signal for weak trade unions causing higher shares of temporary employment due to their inability to prevent substitution of good jobs with bad jobs. Since this is not the case, TUD captures a different kind of relationship: in our view the institutional capacity of labour bargaining power to prevent temporary

workers from exerting wage pressures on permanent workers. In countries with low TUD, workers do not have much bargaining power. Workers cannot use union power to protect themselves.

Figure 3 presents our country groupings by the level of trade union density. Grouping countries is usually prone to stir debate. The easier part is to separate countries with high trade union density: Only the Nordics and Belgium have managed to sustain high membership rates above 40% of the labour force by relying on the Ghent system with unemployment insurance linked to trade union membership. Malta and Cyprus also fall in this group due to its sustained tradition of high union membership despite recent declines. Choosing the cut-off between low and medium trade union density is less obvious. The distribution of membership rates across countries suggests 25% as a naturalcut-off. We use different cut offs to test robustness of this empirically informed country grouping. Changing the cut off between the low and medium group to 20% or 28% respectively results only in little variation with Greece or the UK switching between the low and medium group. All other countries in the low density group have even lower membership rates and the grouping is thus relatively clear-cut.

*Figure 3:* Trade union density in Europe




Note: Annual average 2003-2018.
Source: OECD/ICTWSS.

### 3.2 Theoretical implications

Based on the discussed literature, we expect involuntary temporary workers to have an effect on overall wages. This is not necessarily indicated by the insider-outsider framework, which implies that the wage penalty for temporary employees affects the distribution of wages between permanent and temporary workers but does not necessarily change aggregate wages. By contrast, in the presence of a competition effect, changes in the incidence of temporary employment can affect the aggregate rate of wage growth via two channels: first, mechanically via the employment composition caused by a varying share of temporary workers reducing average wages and second, via dampening wage growth of

permanent worker. However, it remains unclear to what extent the effect on wages is due to competition or only accrues out of a fluctuating work force suffering from a wage penalty (employment composition). This differentiation is crucial to understand the forces responsible for the slow-down of wage growth in Europe.

We explore the implications of the dualization literature in the simple graphical model developed above. It is crucial to understand that hidden slack is associated with the macroeconomic performance and the unemployment rate. Looser attached labor market segments such as involuntary part-time or marginally attached workers add up to hidden slack. Put bluntly, the extent of labor market slack explains the size of the reserve army of labor.

The incidence of temporary workers is different to this. In case a competition effect exists it rather answers the question: To what degree are employees competing amongst each other? By its very nature it thus helps to measure a qualitative aspect of the labor market. This is also reflected by the fact that a clear correlation between the incidence of temporary employment and unemployment does *not* exist[7]. The incidence of temporary employment is, thus, an exogenous variable in the wage growth labor market slack space. As a result changes to the incidence of temporary employment affect the intercept of the Phillips curve. The observed trend increase in temporary employment – signifying increasing competition between employees – thus materializes as a shift of the Phillips curve towards the origin. In figure 4, temporary employment shifts the $PC^H$ and accordingly the $PC$ towards $PC'$. Consequently, any given rates of unemployment and of total slack result in a smaller rate of wage growth.

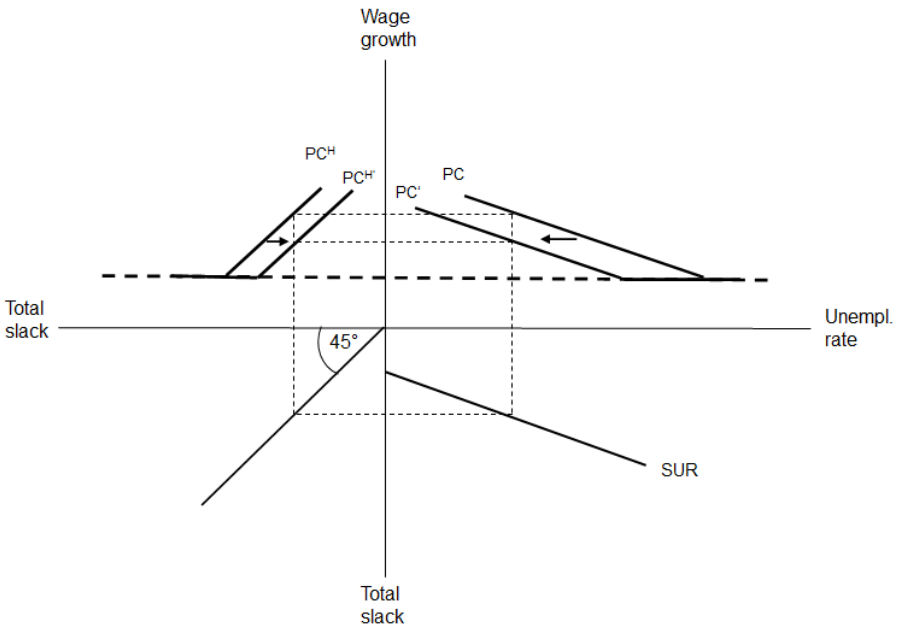
In the counterfactual – if no competition effect exists – the dynamic is different: the change in the incidence of temporary employment only affects wages by changing the employment composition and will be *transitory*. Wage growth will return to normal levels once the tran-

[7]The incidence of temporary workers increases during an early economic recovery as employers are more willing to hire less protected workers under heightened uncertainty. As the business cycle matures and unemployment approximates a full employment level, the incidence of temporary employment starts to decline with more and more temporary workers being able to secure permanent positions. Once a recession hits, the remaining temporary workers are laid-off first and their share in the labor force drops further. Alongside these business cycle dynamics, temporary employment has increased over time (see Figure 2).

sition to a new steady state level of temporary employment is completed and the traditional Phillips curve relationship will return. In figure 4, the Phillips curve would not change, i.e. $SUR$ would be constant even for changes in the incidence of temporary employment due to their exogeneity. Thus, dualization does not affect the relationship between $PC^H$ and $PC$.

Let us reformulate this as a concrete empirically tractable hypothesis: an increase in the incidence of temporary workers reduces wage growth via a *competition effect*. This effect may be large enough to be of relevance at the macroeconomic level. We expect this effect as particularly pronounced under weak trade union power. If this is the case, the competition effect contributes to existing theoretical explanations of wage setting. We test the hypothesis within a Phillips curve framework at the country level, to identify whether the competition effect has an impact on aggregate wage growth. This approach allows us to compare the magnitude of both effects, the one resulting from dualized labor markets and the other stemming from the unemployment rate. Hence, we will be able to assess the relative importance of these effects in explaining Europe's wage dynamics.

*Figure 4:* Dualities and the Phillips curve




# 4 The empirical approach

Has the increase in labor market dualization really shifted the Phillips curve to the center? There is empirical evidence that temporary employees have a dampening effect on aggregate wage growth (Ramskogler, 2021). However, this does not answer our question. Say for instance, temporary workers earn on average a lower wage than permanent workers due to the wage penalty. If the share of temporary workers increases from one year to the other, the changing employment composition mechanically reduce the average wage per worker in a country, thus lowering aggregate wage growth. Hence, an observed negative relationship between temporary workers and wage growth may be caused simply by a changing composition of workers with different wage levels, i.e. a *composition effect*. It is necessary to correct for this composition effect to reversely identify the potential *competition effect* of temporary workers on wage growth in our cross-country panel estimations (section 5).

So far, macroeconomic research has relied primarily on country level data (section 2). As available aggregated wage data do not distinguish between permanent and temporary employees, macroeconomic approaches were unable to disentangle competition from composition effects. A distinction is fundamental in our case since variation in our main independent variable – the incidence of temporary employment inherently affects the employment composition and mechanically wages. By contrast, dualization research (section 3), has primarily used individual level data to investigate heterogeneous effects on employment and wages at the meso- or micro level. The effect on wage growth and its macroeconomic relevance was not yet analysed. Our empirical approach brings both strands together. We start at the individual level, where we are able to distinguish between temporary and permanent employees to aggregate the respective individual wage data up for each country and year. This allows us, to rule out possible composition effects in our estimates of a wage Phillips curve in a relatively comprehensive macro-panel.

More specifically, we rely on micro data to construct a country-year panel for wage growth of only permanent employees. If a competition effect exists, temporary workers have a negative impact on the wage growth of permanent employees. As permanent workers make up around 90% of Europe's labor force, wage growth of permanent employees is very likely to be close to

overall wage developments. Nevertheless, the use of micro data allows us to easily construct a wage growth series for *all* employees in a country (not only the permanent ones) while netting out potential composition effects. By this, we are able to estimate the sensitivity of *overall* aggregate wage growth with respect to the prevalence of temporary work in Europe.

### 4.1 Adjusting for a changing employment composition

To construct our dependent variable, wage growth, we rely on data of the European Union Statistics on Income and Living Conditions (EU-SILC). It is a representative population survey and contains the longest running cross-national dataset available with annual information on employment and wages[8]. In particular, it allows to distinguish employees on temporary contracts from permanent ones, which is crucial for our research question. Although the primary focus of EU-SILC lies in collecting representative data on income rather than on the labour market status, the share of temporary in total employees in EU-SILC (11.7%) is quite comparable to the respective figure in the Labour Force Survey (13.9%), which is the most widely used and comprehensive source of labour market indicators in Europe.[9]

The survey combines demographic variables from the current year with wages from the previous year (except for Ireland and the UK) (Eurostat, 2018). Since we focus on wage growth, we use the year of the reported wage, i.e. one year prior to the other data collected. We use all waves 2004 to 2018 and hence yield an (unbalanced) macro-panel of wage data spanning the period 2003 to 2017[10]. We use *gross employee cash or near cash income (PY010G)* for dependent workers as our main variable for wages since we are interested in the pre-tax wages. We rely on the *number of hours usually worked per week in main job (PL060)* to compute hourly wages at the individual level. We compute aggregate measures at the country level using the *personal cross-sectional weight (PB040)* and compute the average annual

[8]The EU-LFS individual data do not contain the wage level. The EU-SES is only conducted every four years.

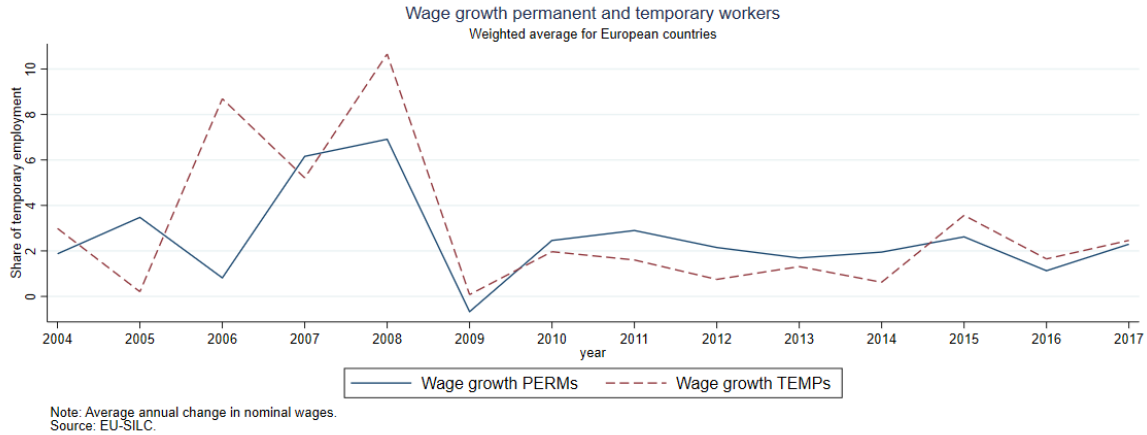
[9]The reported figures represent the weighted average of the share of temporary employees in total employees of all European countries in our sample in the observation period 2004-2017. Note also that the share of temporary employment according to EU-SILC seem to follow a quite similar pattern over time compared to the respective series form the EU-LFS. This is reflected by a relatively high correlation coefficient of 0.88 between both series.

[10]Note that our dependent variable is wage growth, i.e. the effective sample starts only in 2004.

change in nominal hourly wages. We discuss the data and aggregation of country level time series in appendix A. To confirm the validity of our aggregation, we compare our time series to Eurostat's officially published EU-SILC country-level data.

In addition to the *unadjusted* aggregate wage growth variable of all employees included in the survey, we calculate a wage growth variable of permanent workers as discussed above based on the information about the contract type of employees (*PL140*). Figure 5 illustrates wage dynamics in Europe for both contract groups separately. What stands out immediately is that wage growth has slowed down since the onset of the GFC, a stylized fact that has been discussed in detail in section 2. Interestingly, this applies to both groups, but seems to be more pronounced in the group of temporary workers. It might be related to the strong *relative* demand for temporary employees before the onset of the crisis (see figure 2), which could have accelerated wage growth for temporary workers compared to permanent workers. Likewise, the weakened relative demand from 2008 to 2014 might be the reason for the observed slower wage growth of temporary workers in the respective period and the economic recovery gaining traction thereafter fulling demand for temporary labour for the respective reversal from 2015 onwards.

*Figure 5:* Wage growth permanent and temporary workers




Finally, we calculate a counterfactual wage growth variable by assuming that the share of temporary employees had stayed constant since 2004. More specifically, we employ *inverse probability weighting (IPW)* (Rosenbaum and Rubin, 1983; DiNardo et al., 1996;

Fortin et al., 2011)[11] to obtain a wage growth variable of a pseudo-workforce with a constant employment composition over time. We follow in the application the procedure as in Fessler et al. (2017). First, we use a logit model to predict the probability of each observation of being in temporary employment per year and country. Second, we use the propensity scores obtained to re-weight the cross-sectional population weights of each observation to equal the employment composition with regard to work contract in the first year available. Finally, we aggregate the individual level data at the country year level to obtain our adjusted measure for aggregate wage growth that is based on a counterfactual employment composition constant over time with regard to employment contract.

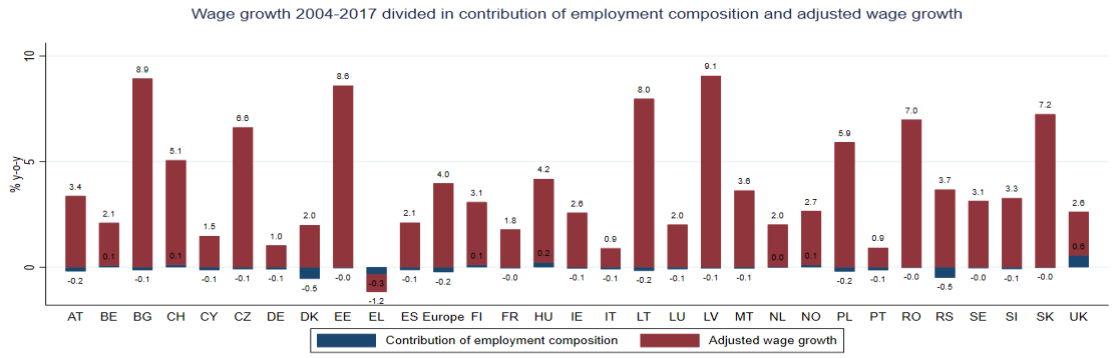
Figure 6 presents the adjusted wage growth variable for each country (averaged over the whole sampling period) and the employment composition effect. The latter represents a pure mechanical effect from the changing share of temporary workers over time. Since temporary workers suffer from a wage penalty compared to permanent workers, an increasing share of temporary workers lowers the aggregate average wage. The size of the composition effect is very heterogeneous at the country level and sizeable in some countries, in particular Denmark, Serbia and the UK. However, interestingly it does not play such a large role for Europe as a whole. Some countries are characterised by substantial wage differences between temporary and permanent workers and have experienced a strong increase in temporary work. However even in those cases, temporary workers as a share of all employees have only changed by a few percentage points over several years resulting in a minor impact of employment composition changes on wages. Some countries exhibit larger composition effects in specific years when the share of temporary workers changed, such as Germany, Italy, Spain, the UK and others in the post 2008 crisis period (see figure B.1). The adjustment allows us to control for heterogeneity between countries in the panel estimations described in the next section.

It should be noted that the difference we find between adjusted and unadjusted wage growth is quite small. However, it has to be stressed that it is only by adjusting that we can clearly

[11] IPW is typically used to estimate the counterfactual outcome when assignment is not random or all subjects in the population were assigned treatment. It removes confounding by re-weighting to create a pseudo-population in which the treatment is independent of the measured confounders.

identify the underlying mechanism that impacts on wage growth. If we don't control for composition we will never know whether composition or competition is driving whatever effect we find. However, this differentiation is crucial to understand whether the effect we find is permanent or transitory.

*Figure 6:* Wage growth 2004-2017 divided in contribution of employment composition and adjusted wage growth




*Note: Contribution in employment composition refers to the part of wage growth that originates from the change in the share of temporary workers over time. Temporary workers have a lower average wage than permanent workers. A change in the share of temporary workers lowers the average wage level and thus, annual wage growth.*
*Adjusted wage growth refers to aggregate wage growth minus the contribution of the employment composition. It represents the rate of wage growth if the share of temporary workers would have remained constant over time.*
*Wage growth refers to average annual change in nominal wages. Periods may be limited depending on countries data availability. Europe refers to the simple average of all countries shown. The weighted average of adjusted wage growth only amounts to 2.7% since small CEE countries are driving up the simple average.*

## 4.2 Estimating factors of wage growth

Having stripped our wage variable off potentially misleading composition effects we proceed to specify our empirical strategy. The most widely used empirical model to study the cyclical drivers of wage growth is the wage Phillips curve. The traditional wage Phillips curve relates nominal wage growth to a measure of labor market slack. Additional determinants that are typically considered are (expected) inflation and labor productivity growth (see e.g. Nickel et al. (2019)). We will use such an augmented Phillips curve setup to study the impact of dualization on nominal wage growth in Europe. We estimate a standard reduced form

equation in a panel data frame-work of the form:

$$\dot{W}_{i,t} = \alpha_1 + \alpha_2 \mathrm{U}_{i,t} + \alpha_3 \mathrm{Prod.}_{i,t} + \alpha_4 \mathrm{Infl.}_{i,t} + \alpha_5 \mathrm{Involv.\ Temp}_{i,t} + \mu_i + \tau_t + \epsilon_{i,t} \qquad (1)$$

As outlined in the section above, our dependent variable is nominal wage growth obtained from EU-SILC data. As a benchmark, we will first study the dynamics of the unadjusted aggregate wage growth to represent the work horse Phillips curve model. In a second step, we will look at the impact from labor market dualization on nominal wage growth of permanent employees and finally implement our main dependent variable, which is nominal wage growth net of composition effects ($\dot{W}_{i,t}$). While the bulk of studies estimating wage Phillips curves uses quarterly data[12], we have to stick to an annual frequency (like in the original contribution by Phillips (1958) or more recently in Kiss and Van Herck (2019)) as the computation of our dependent variable is only feasible based on yearly data (see also section 4.1). Our sample includes 30 European countries ($i$) and ranges from $t = 2003, ..., 2017$, which leaves us with roughly 340 observations[13]. We intentionally choose a static representation as we do not observe any persistence in wage dynamics in our sample (likely due to the annual frequency of data). Moreover, as we are interested in the within-variability of the data, we consider the time-invariant country effects ($\mu_i$) as fixed (and not random).

As a baseline, we use the most conventional labor market slack indicator, which is the headline unemployment rate $\mathrm{U}_{i,t}$, but consider also several other measures of labor market slack for robustness. Further, we control for the impact of labor productivity ($\mathrm{Prod}_{i,t}$) on wages, which we measure as the growth rate of real output per employment, as well as for inflation ($\pi_{i,t}$). Empirical studies using quarterly wage growth data often employ (one quarter) lagged inflation implying backward-looking expectations (Ramskogler, 2021; Nickel et al., 2019; IMF, 2017). Given the annual frequency of our data, we assume a contemporaneous effect from inflation (measured as the annual change in the harmonized

[12]Examples are Bonam et al. (2021), Nickel et al. (2019) and Bulligan and Viviano (2017)

[13]Note that data for some countries are only available after 2003, such that the overall sample size is reduced to 341.

index of consumer prices) on nominal wage growth in our baseline setting[14].

Finally and most importantly, we add to this standard Phillips curve specification a variable to identify the competition effect resulting from the presence of a dualized labor market. So far, studies exploring the impact of dualized labor markets on wages have considered *overall* temporary employment as a proxy (Ramskogler, 2021; Bellani and Bosio, 2019). Given the annual frequency of our empirical setup, we are able to differentiate between involuntary and voluntary temporary employment as data for the respective sub-groups are available on a yearly basis. This distinction is important for the identification of the competition effect, which is supposed to be triggered by the presence of a disadvantaged group of workers, i.e. by those who would prefer to have a permanent contract but were only able to find a temporary one. More specifically, we measure the extend of labor market dualization by the number of *involuntary* temporary employees as a share of the active working-age population (Invol. $\text{Temp}_{i,t}$). This indicator is a survey-based measure provided by Eurostat (based on the Labor Force Survey), which is collected since 2002 and is available for all countries in our sample. A detailed description of the measurement of all variables and their sources is included in table E.1 in the Appendix.

# 5 Results – Dualization and the macro-economy

The micro-data based measure of wage growth, which we introduced in detail in the previous section, allows us to empirically investigate our main research hypothesis. Accordingly, we will test whether competition effects are relevant in a macroeconomic context (section 5.1). If a competition effect, as defined above, existed we should be able to identify a dampening effect of the incidence of involuntary temporary employment on the aggregate wage growth of permanent employees. Moreover, by having netted out composition effects (caused by changes in the share of temporary employment), we are able to estimate the sensitivity of

[14]We have also considered a survey-based measure capturing forward-looking inflation expectations provided by the European Commission (Exp. Infl.). As this variable is not available for two of our countries (Switzerland and Norway) and did not improve the explanatory power, we decided to stick to realized consumer price inflation.

overall aggregate wage growth (i.e., the wage growth of all employees in an economy) with respect to labor market dualization. In the second sub-section (section 5.2) we aim to address whether the competition effect is significant in economic terms as well. More specifically, following our discussion of the literature on subdued wage growth in section 2, we explore the relative importance of the competition effect for aggregate wage growth within the traditional Phillips curve framework, where we take account of various labor market slack measures as well as the possibility that the Phillips curve might have flattened in the period after the GFC.

### 5.1 The competition effect at the macroeconomic level

We start out presenting the result for the work horse Phillips curve model, which we summarize in column (1) of Table 1. The coefficient estimates have the expected signs and are statistically significant. An increase in labor productivity growth has a positive effect as it raises the demand for labor, which in turn puts upward pressure on wage growth. We also observe a positive impact from inflation with a regression coefficient standing around 1. Hence, an increase in the inflation rate transmits almost one to one into a rise of nominal wage growth[15]. In contrast, labor market slack is negatively associated with nominal wage growth. According to the point estimate, a one percentage point increase in the unemployment rate reduces nominal wage growth by 0.6 percentage points. This is also a common finding in the literature, reflecting that a larger share of job-less people diminishes the bargaining power of workers and puts downward pressure on wages.

In column (2) we add the explanatory variable of main interest, i.e. $Invol.\ Temp_t$. As expected, it is negatively associated with nominal wage growth and statistically significant. A rise in the share of involuntary temporary employees by one percentage point leads to a decrease in nominal wage growth by almost 0.9 percentage points. As we have considered the *unadjusted* wage growth rate so far, the coefficient estimate captures both, potential

[15]This finding likely is linked to the annual context of our estimations and corresponds to the results in Kiss and Van Herck (2019). While it is not very common in the literature using quarterly data, Rusinova et al. (2015) show that if 4 lags of inflation are considered in quarterly estimations the aggregate effect again accumulates to close to 0.9.

*Table 1:* Identifying the competition effect

| | all workers, unadjusted | | | permanent contract workers | | | all workers, adjusted |
|---|---|---|---|---|---|---|---|
| *Dep. var.: wage growth* | work-horse PC | invol. Temp | time dummies | comp. effect | insti-tutions | Vol. Temp | overall effect |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| $Prod_t$ | 0.54*** | 0.56*** | 0.35** | 0.37** | 0.28* | 0.37** | 0.33** |
| | (3.09) | (3.31) | (2.29) | (2.56) | (1.78) | (2.56) | (2.26) |
| $Infl_t$ | 0.99*** | 0.89*** | 0.55 | 0.51 | 0.41 | 0.48 | 0.54 |
| | (3.56) | (3.04) | (1.21) | (1.11) | (0.86) | (1.02) | (1.16) |
| $U_t$ | -0.58*** | -0.62*** | -0.48** | -0.48** | -0.58*** | -0.51** | -0.50*** |
| | (-3.03) | (-3.57) | (-2.70) | (-2.59) | (-3.00) | (-2.57) | (-2.78) |
| $Invol.$ | | -0.88** | -0.88*** | -0.93*** | | -1.00*** | -0.95*** |
| $Temp_t$... | | (-2.70) | (-3.09) | (-3.17) | | (-3.13) | (-2.92) |
| $low\ TUD$ | | | | | -1.54*** | | |
| | | | | | (-3.62) | | |
| $med.\ TUD$ | | | | | 0.42 | | |
| | | | | | (0.76) | | |
| $high\ TUD$ | | | | | -0.14 | | |
| | | | | | (-0.48) | | |
| $Vol.\ Temp_t$ | | | | | | -0.34 | |
| | | | | | | (-1.20) | |
| Cons | 6.02*** | 10.97*** | 10.74*** | 10.96*** | 11.18*** | 12.92*** | 11.34*** |
| | (3.51) | (4.98) | (3.87) | (3.83) | (4.19) | (3.07) | (3.91) |
| Model | FE | FE | FE | FE | FE | FE | FE |
| TimeD | excl. | excl. | incl. | incl. | incl. | incl. | incl. |
| Weights | equal | equal | equal | equal | equal | equal | equal |
| N | 358 | 353 | 353 | 351 | 346 | 351 | 344 |

Two-tailed significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. T-statistics are reported in parenthesis.

composition *and* competition effects. However, before we alter our main dependent variable to isolate the competition effect, we include time dummies in our model to control for common shocks that might have affected wage dynamics equally across countries over time, such as the financial crises. In fact, a test of joint significance shows that the time dummies have high explanatory power. Apart from that, their inclusion reduces coefficient estimates of almost all variables, as we can see in column (3). This is particularly true for inflation, which even becomes statistically insignificant. Obviously, price dynamics across countries have followed a very similar pattern over time. A possible common factor that could have determined prices across countries is certainly the oil price, which is known as being an important driver

of consumer price dynamics.

We will now alter our dependent variable in column (4) by considering the nominal wage growth of employees with permanent contracts only. This will allow us to estimate the competition effect, as we isolate that part of wage growth that cannot be affected by changes in relative weights between temporary and permanent employees. Compared to column (3) all coefficient estimates remain broadly the same. The impact from involuntary temporary employment even increases slightly and remains highly significant. This result has two main implications. First, it strongly supports our thesis that the incidence of a dualized labor market has negative spill over effects on the dynamics of wages of employees with permanent contracts. This is consistent with Bellani and Bosio (2019) who find that the density of temporary contracts within occupation and age-specific groups negatively affects average wages for permanent workers belonging to the same group[16]. In addition to their findings, our results show that competition effects are also relevant in a macroeconomic context, where other important wage growth determinants like labor market slack are accounted for. The second important implication is that *composition* effects seem to be negligible in Europe in the period from 2004 to 2017 as coefficient estimates do not change significantly compared to the (unadjusted wage growth) model (3). As already discussed in previous chapters, a composition effect would be the result of a mechanical deceleration of overall wage growth due to an increasing weight of temporary employees earning less on average. The relatively low contribution of employment composition to the adjusted wage growth variable across countries presented in section 4.1 was already a first indication that composition effects might be rather small. The regression results presented in this section confirm this presumption.

As we have highlighted in section 3, the macroeconomic relevance of the competition effect may depend on a country's labor market institutions. We take account of these considerations in specification (5). Following our country grouping based on trade union density established in section 3.1, we test group-specific differences in the competition effect. In accordance with our expectations, we find the competition effect to be only significant and large in countries

[16] Bellani and Bosio (2019) exploit EU-SILC data for 13 European countries in the period 2003 to 2010. The observation unit is based on 24 occupations and two different age groups. Temporary workers are classified as all individuals who are employed under a fixed-term contract.

with low trade union density, where permanent contract employees are more exposed to pressure by outsiders. This result also holds when we vary the threshold that was set to define the low TUD group of countries as can be seen in the robustness section C (see Table C.1, columns (1)-(2)). According to the coefficient estimate in specifiaction (5), an increase in involuntary employees by one percentage point (measured in % of the labor force) decreases wage growth of permanent employees by 1.5 percentage points. Hence, the impact from dualization on wage growth is more than 60% higher in low-TUD countries compared to the unweighted European country average (depicted in column (4)). Our results, thus, support the hypothesis that competition effects arsing from labor market dualization depend on domestic labor market institutions, such as trade union density.

At the same time, it has to be stressed that the competition effect is not only driven by wage developments in small countries. In fact, the competition effect remains highly significant and increases in magnitude when we put more weight[17] on countries that are larger as we demonstrate in the robustness section C (see Table C.2, column (4)). This is consistent with the observation that low TUD countries have a particular strong competition effect as the countries belonging into this group (comprising 15 out of 30 countries) make up more than 75% of overall employment in Europe and are therefore shaping the aggregate weighted effect.

Unlike in previous literature (Ramskogler, 2021; Bellani and Bosio, 2019), our empirical setting allows us to focus on *involuntary* (rather than on *overall*) temporary employment to measure the degree of labor market dualization. In order to reveal whether this is indeed the relevant measure in our context, we add the share of *voluntary* employees (in % of the active working-age population) as an additional variable explaining wage growth and report the results in column (6). Interestingly, comparing the coefficients of both indicators reveals that it is *involuntary* temporary employees who are driving the wage growth of permanent workers, while the impact of workers, who have voluntarily chosen to have a temporary contract ($Vol.\ Temp_t$), is insignificant. Hence, the crucial aspect in measuring dualization is to quantify those employees who would prefer to be employed on a permanent basis. This

[17] The relative weight of each country is based on the number of employed persons in 2005.

is also supported by the observation that the magnitude of the coefficient estimate (and its statistical significance) would drop substantially, if we were to consider overall temporary employment (instead of $Invol.\ Temp_t$).[18] Our results thus strongly suggest to consider – whenever feasible – *involuntary* rather than *overall* temporary employment to proxy labour market dualization.

Having established the existence of a competition effect, we now can investigate its impact on overall aggregate wage growth. We re-estimate specification (4) employing a wage growth variable net of composition effects potentially arising from changes in the relative share of permanent and temporary employees. The results are depicted in column (7) of Table 1 and show almost unchanged coefficient estimates. In particular, the coefficient estimate of $Invol.\ Temp_t$ is not really different from the one in model (3). This is consistent with our previous observation, namely that composition effects are empirically only of minor importance. Further, our results in specification (7) resemble the findings in Ramskogler (2021), who establishes a significantly negative effect from temporary employment on *aggregate* wage growth in Europe. In addition to his findings, we can confirm that the underlying mechanism behind the observed negative relationship (of wage growth and dualization) arises from a *competition* rather than a *composition* effect, as we have ruled out the presence of the latter by construction (recall section 4.1). Hence, we can conclude that labor market dualization had a significant dampening effect on wage growth in Europe over the 2004 to 2017 period and that it is *competition* of permanent and *involuntary* temporary employees that is driving the result.[19]

Based on this final specification, we conduct several additional robustness checks in Appendix C. In Table C.1, we show that our results are not driven by one particular country by excluding one country at a time from the sample. Moreover, as the estimated sensitivity of wage growth to labor market dualization and unemployment might be affected by a potential

[18] If specification (4) is re-estimated considering *overall* temporary employment (instead of $Invol.\ Temp_t$), the respective coefficient estimate drops by more than 25% and the t-statistic goes down from 3.17 to 2.38. For the sake of space, we do not report this result in the paper. However, it is available from the authors upon request.

[19] Note that the results established in columns (5) and (6) also hold when we employ the adjusted wage growth variable used in column (7).

endogeneity bias, we discuss this issue thoroughly in Appendix D.

### 5.2 The relative importance of dualization for aggregate wage growth

So far we have learnt that competition effects play a statistically significant role in explaining aggregate nominal wage growth. Yet, it is important to assess the economic significance of dualized labor markets for the wage formation process in Europe. Let us put this in form of a question: do involuntary temporary employees dampen aggregate wage growth to an extent that is relevant to macroeconomic developments? In order to tackle this question, we will compare the relative importance of labor market dualization with the usual macroeconomic determinants of nominal wage growth that we have introduced in Table 1. In addition, following up on specification (7) in Table 1, we extend the Phillips curve framework by allowing for a different unemployment parameter after the crisis to take account of the large literature on the Phillips curve flattening (see also section 2). We interact the unemployment rate with a post-crisis dummy that equals 1 for the years 2013 to 2017 and 0 for the period before[20]. The results from this model extension are presented in Table 2 in column (8). Two things stand out. First, the slope parameter of the unemployment rate is statistically different across the two time periods and points to a decreased sensitivity of wage dynamics to labor market slack of more than 50% since the post-crisis period. While a decrease in the unemployment rate boosted wage growth by 0.71 percentage points before 2013, this sensitivity reduced to 0.29 percentage points[21] in the post-crisis period. Our results, thus, add to the debate on the Phillips curve flattening and support the empirical findings in the literature that indicate a lower explanatory power of labor market slack measures in the post crisis period (e.g. Byrne and Zekaite, 2020). Second, the sensitivity of nominal wage growth with respect to involuntary temporary employment remains largely unchanged in the altered setup.

Following up on this extended set of variables, we re-estimate specification (8) based on

[20]Note that we have experimented with other thresholds as well. It turned out that the break in slope parameters is most pronounced when the post-crisis period is defined from 2013 onwards.

[21]The slope parameter of unemployment after 2012 is obtained as follows: -0.71 + 0.42= -0.29.

*Table 2:* labor market slack, Phillips curve flattening and the relative importance of dualization

| | | standardized coefficients | | | |
|---|---|---|---|---|---|
| *Dep. variable:* | headline | headline | broad unemp. | U-5 & invol. | unemp. |
| *adjusted wage growth* | unemp. | unemp. | measure (U-5) | part-time | gap |
| | (8) | (9) | (10) | (11) | (12) |
| $Prod_t$ | 0.36** | 0.15** | 0.14* | 0.12 | 0.12** |
| | (2.27) | (2.27) | (1.81) | (1.43) | (2.13) |
| $Infl_t$ | 0.56 | 0.17 | 0.28** | 0.27** | 0.13 |
| | (1.21) | (1.21) | (2.32) | (2.10) | (0.92) |
| $U_t$ | -0.71*** | -0.48*** | -0.46** | -0.50*** | -0.46*** |
| | (-3.16) | (-3.16) | (-2.71) | (-3.17) | (-4.24) |
| $U_t * post\text{-}crisis$ | 0.42* | 0.35* | 0.46** | 0.42* | 0.30*** |
| | (2.04) | (2.04) | (2.29) | (1.87) | (3.73) |
| $Invol.\ Temp_t$ | -0.89** | -0.50** | -0.43** | -0.51** | -0.65*** |
| | (-2.48) | (-2.48) | (-2.24) | (-2.19) | (-3.17) |
| $Invol.\ Part_t$ | | | | 0.11 | |
| | | | | (0.78) | |
| Cons | 9.42** | -0.28 | -0.44** | -0.44** | 0.12 |
| | (2.74) | (-1.21) | (-2.12) | (-2.17) | (0.80) |
| Model | FE | FE | FE | FE | FE |
| TimeD | incl. | incl. | incl. | incl. | incl. |
| N | 344 | 344 | 310 | 305 | 318 |

Two-tailed significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. T-statistics are reported in parenthesis.

standardized variables, which allows us to rank the independent variables in terms of their strength in explaining nominal wage growth. According to the resulting standardized (beta) coefficient estimates, which we present in column (9), an increase in the rate of involuntary temporary employment by one standard deviation leads to a drop in nominal (composition adjusted) wage growth by half a standard deviation. More importantly though, temporary employment turns out to be the most relevant determinant for wage growth followed by the unemployment rate. The parameter that captures the flattening of the Phillips curve ($U_t * post\text{-}crisis$) ranks third. Taking into account the uncertainty surrounding the parameter estimates, which is particularly pronounced in the case of the Phillips curve flattening (highest confidence intervals), all three mentioned variables are equally meaningful in explaining nominal wage growth in the period 2004-2017[22]. Hence, we can conclude that labor market dualization is at least as important as the flattening of the Phillips curve that caused so much debate in the macroeconomic literature. Furthermore, the unemployment rate, as a

[22]Note that a test on parameter equality is not rejected.

standard predictor for nominal wage dynamics in macroeconomics, is economically not more important than the competition effect caused by involuntary temporary work.

In the remaining specifications (columns 10-12), we aim to look at whether the relative importance of dualization changes when other labor market slack measures are employed. There are various approaches in the literature to account for labor market slack in the economy, as we have highlighted in section 2. Starting from the headline unemployment rate (often referred to as U-3) in specification (9), we extend the unemployment rate concept by additionally considering discouraged as well as marginally attached workers (U-5). Furthermore, in specification (10) we additionally include a variable that accounts for employees, who work part-time but do so involuntarily, to account for labor under-utilization (U-6). Note however, that unlike in Bell and Blanchflower (2019), we are not able to account for labor under-utilization based on desired hours of work but have to stick to headcounts to capture the degree of underemployment (due to data availability). Finally, in the last specification we consider a cyclically adjusted unemployment rate often considered in the literature. We rely on the concept of the non-accelerating wage rate of unemployment (NAWRU) and measure labor market slack as the unemployment gap arising between the headline unemployment rate (U-3) and the NAWRU.

The main take-away from the results presented in specifications (10) to (12) is that our conclusions based on the headline unemployment rate (U-3) do not change. Considering a broader unemployment rate concept like in column (10) shows that the variables are of roughly comparable economic significance. By contrast, employing a cyclically adjusted concept of unemployment (column 12) seems to downgrade the unemployment-based measures. However, despite these small variations, the coefficient on labor market dualization remains of the same magnitude as any of the labor market slack variables (and of higher magnitude compared to productivity and inflation) throughout all specifications. To sum up, our results provided in Table 2 demonstrate that competition between permanent and temporary employees have sizeable macroeconomic effects that are not only statistically but also economically significant.

# 6 Conclusion

In this paper, we have demonstrated that the presence of temporary workers in Europe has slowed down aggregate wage growth. We have synthesised the rag rug of explanations for the period of subdued wage growth in Europe after the GFC. We have brought together the macroeconomic- and dualization literature in a concise graphical exposition that allows to take a bird's eye view on the relevant mechanisms linking unemployment, employment and wage growth. We have demonstrated that competition between temporary and permanent employees in Europe has exerted a substantial downward pressure on aggregate wage growth over recent years. We have also shown that labour market dualization is best measured by involuntary rather that by overall temporary employment, which has been the standard proxy in the literature so far. In particular, it is the presence of a disadvantaged group of workers that is driving the results, i.e. those who would prefer to have a permant contract but were only able to find a temporary one. Findings of the dualization literature, thus, bear important implications for the macroeconomy.

Our analysis has focused on aggregate wage growth at the country level, thereby combining a macro-level framework and an adjustment with micro-level data. This has not only allowed us to test the existence of the competition effect, but to estimate the relative importance of dualized labor markets compared to conventional labor market slack variables. Our results reveal that involuntary temporary employment is at least as important in explaining aggregate wage growth as the unemployment rate, which is the standard proxy for the bargaining power of workers in empirical macro models. This effect only exists in countries with low trade union density, where organized labor does not have sufficient power to shelter insiders from competition by outsiders.

Yet, we only assessed the impact of temporary workers but due to data limitations not of other precarious jobs, such as agency work, multi-party employment or dependent self-employment - all of which may amplify the dampening effect of labor market dualization on overall wage growth. Future research would be well advised to crave out the micro-mechanisms of the competition effect underpinning the aggregate dynamics. Exploiting

variation of labor market dualization on the occupational, sectoral and regional level seems a promising avenue. Policy-changes in the regulation of temporary contracts could be leveraged by quasi-experimental designs to further identify the causal impact of temporary workers on wage growth.

Extrapolating the given trend of growing temporary employment since the GFC allows us to point out some implications for the outlook of wage growth in Europe. As long as involuntary temporary employment continues to increase and labor market dualization continues to prevail, wage growth is likely to remain depressed. Past labor market recoveries have pushed up involuntary temporary employment above the pre-crisis level, thereby fuelling competition between outsiders and insiders, which resulted in depressed wage developments. Whether the Covid-19 pandemic has induced a structural break in these dynamics still needs to be seen.

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# A Appendix: EU-SILC data

## A.1 Wage growth aggregated vs published (net)

EU-SILC has been the established standard for cross-country income comparisons in Europe. A large effort is put on harmonisation of definitions and variables across countries, although some caveats apply due to national differences in data collection. The income reference period for most countries is the calendar year previous to the survey year with two exceptions: Ireland and the UK. In Ireland the income reference period is the last twelve months. In the United Kingdom the current income is annualised and aims to refer the current calendar year, i.e. weekly estimates are multiplied by 52, monthly by 12 (Eurostat, 2018). Since its start in 2004, an increasing number of countries have shifted to rely on national registries to construct or correct the wage variables strengthening accuracy and reliability (for a detailed overview see Goedeme and Trindade (2020) and Lohmann (2011)). We carefully examine national particularities in our data cleaning and aggregation procedure following Trindade and Goedeme (2019) on the income variables and GESIS (2021) in addition to the EU-SILC methodological guidelines and national quality reports to ensure a maximum of cross-country comparability. However, processing and aggregating individual level data always entails a series of small decisions that can affect the outcome and research should be transparent about them. We document our aggregation procedure in detail in our annotated Stata code. Eurostat does not publish sufficient details on their procedure for data processing and aggregation that we could follow. For a detailed discussion of representativity, in particular sampling design errors related to EU-SILC see Goedeme (2013); Zardo Trindade and Goedeme (2016).

To assess the validity of our aggregation, we compare the published aggregate of wages by Eurostat based on EU-SILC to our country aggregation of the individual level data. Since Eurostat does not publish an aggregate series for *gross* wages from EU-SILC but only for *net* wages, we use *net* wages (*net employee cash or near cash income (PY010N)* in EU-SILC) for comparison. Our aggregated series aligns closely with the officially published time series across Europe (appendix figure A.1 and figure A.2), although with two limitations. First, in 2009, several countries changed from survey to register data for documenting wages in EU-SILC resulting in some differences prior to the adjustment, most notably in the year of change (2009). As a result, alignment of the two series is substantially improved from 2010 onwards. Second, wage growth for Cyprus has an unreliable profile in *net* terms, although our series for *gross* wages in Cyprus is smoother (figure A.2).[23] Excluding both, the year

[23] Goedeme and Trindade (2020) indicate that Cyprus relies on surveys to collect income data but matches

2009 and Cyprus, we obtain a correlation coefficient of 0.91 between our aggregated series and the officially published Eurostat data.

*Figure A.1:* Net wage growth EU-SILC aggregated vs published by Eurostat

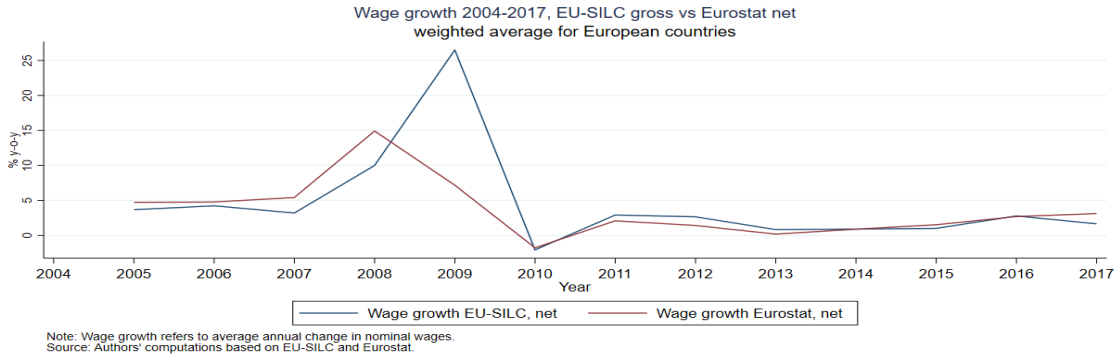
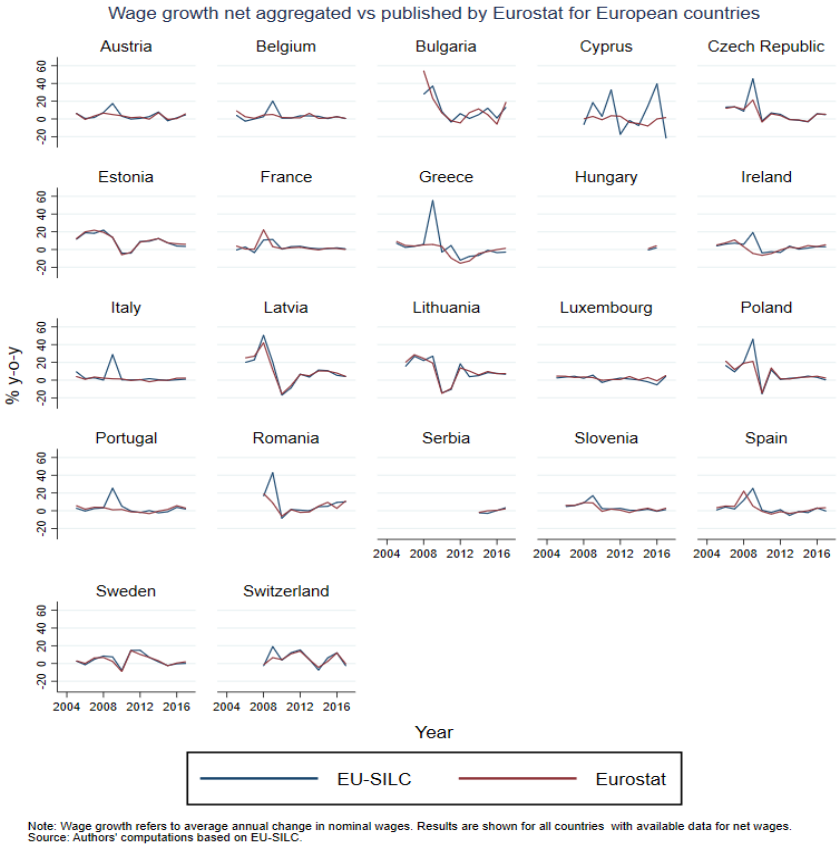


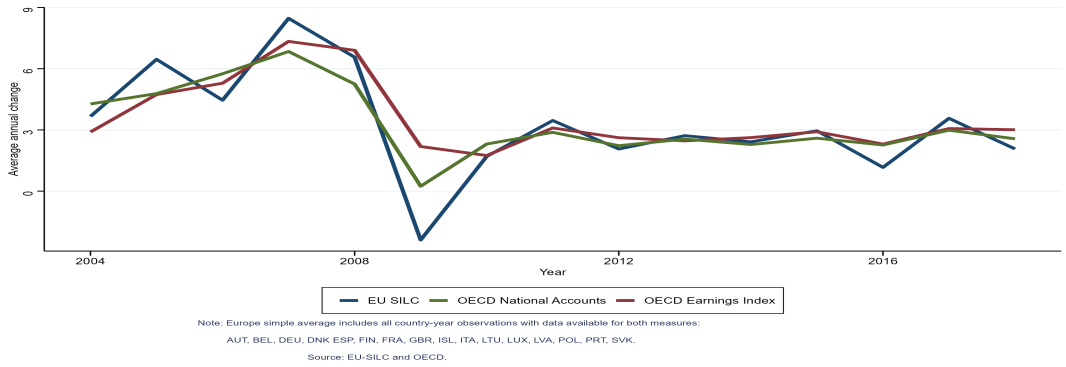

*Figure A.2:* Net wage growth EU-SILC aggregated vs published by Eurostat for countries with available data for net wages




it with register data to correct for apparent mistakes and keeps extreme or outlying values in the data if they have been verified.

Figure A.3 compares our baseline wage growth measure from EU-SILC (PY010G) to established wage data from national accounts as well as surveys and registries. While our measure aligns closely with both series for the 2010-2015 period, some differences occur in the earlier and later years. However, differences between wage measures of different sources are rather common: a correlation analysis reveals that EU-SILC data still aligns closer to each of the two OECD series than the two series align between each other. Our measure aligns closest with the national accounts measure for average annual wages per full-time equivalent dependent employee (CPNCU). It is computed by dividing the total wage bill by the number of employees multiplied by the ratio of average usual weekly hours per full-time employee to average usually weekly hours for all employees. This approach is rougher compared to ours since we compute hourly wage growth based on respective hours worked on an individual basis. Our measure also conforms the OECD Earnings Index (MEI) that aggregates wage developments (LCEAPR IXOBSA). Differences are likely because the MEI only includes private sector employees based on survey and administrative data.

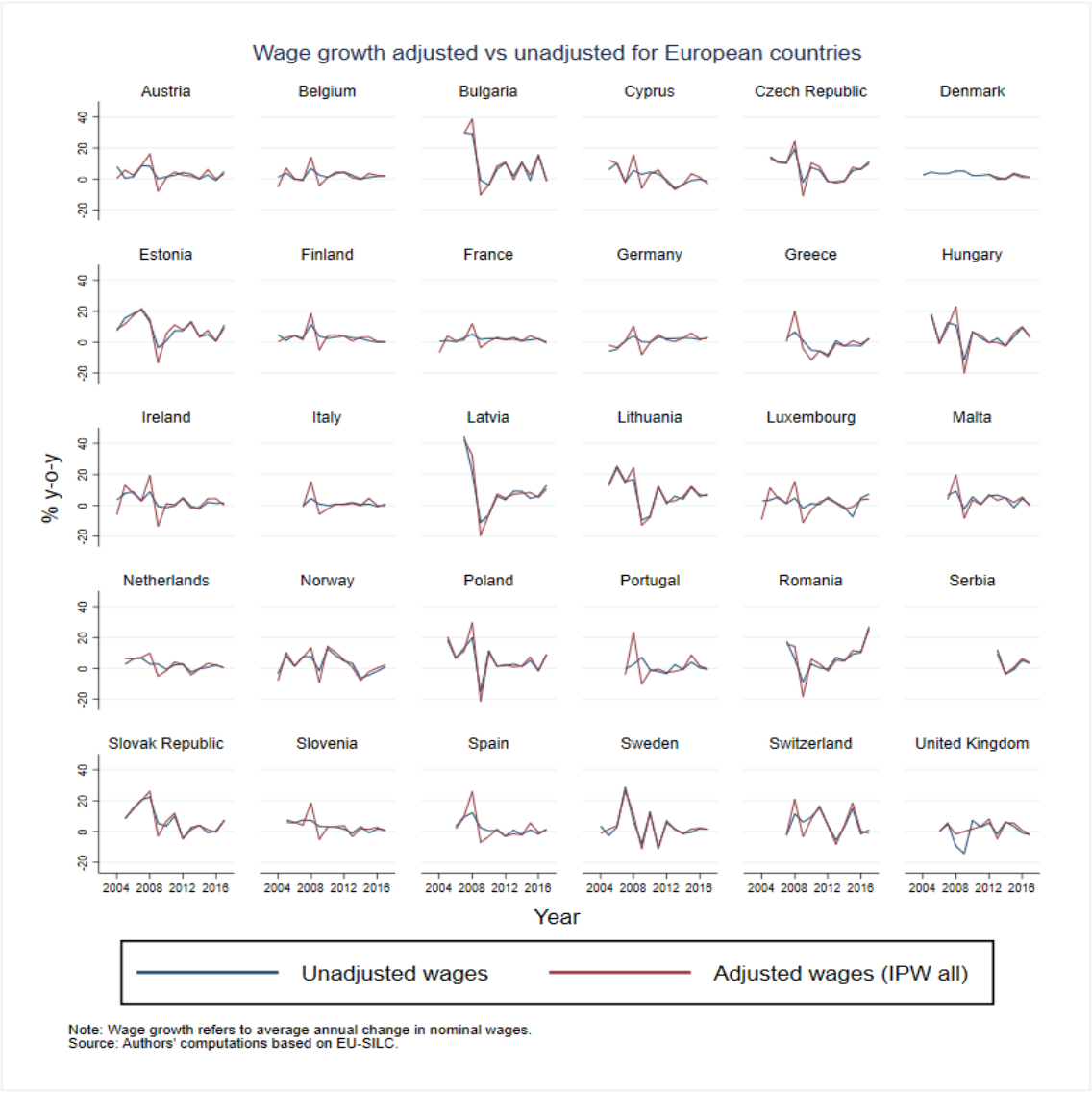
*Figure A.3:* Wage growth EU SILC (gross) vs OECD National Accounts vs OECD Earnings Index



# B Appendix: Micro Adjustment

## B.1 Adjusted vs unadjusted wage growth

*Figure B.1:* Wage growth adjusted vs unadjusted for European countries




Note: Wage growth refers to average annual change in nominal wages.
Source: Authors' computations based on EU-SILC.

# C Appendix: Robustness

In Table C.1 we check the sensitivity of the competition effect when countries are excluded one at a time from the sample. In Table C.2 we present several robustness checks with respect to the country grouping along the degree of trade union density (columns 1-3) and weighting (column 4). All robustness checks are based on our main estimation results discussed in section 5.1 and are modifications of columns (4) and (7) in Table 1.

*Table C.1:* Sensitivity of labor market dualization to country exclusion

| Country | Invol. Temp. | T-stat. | Country | Invol. Temp. | T-stat. |
|---|---|---|---|---|---|
| AT | -0.96*** | -2.96 | IT | -0.98*** | -2.95 |
| BE | -0.97*** | -2.84 | LT | -1.06*** | -3.30 |
| BG | -1.00*** | -3.11 | LU | -1.00*** | -3.10 |
| CH | -0.96*** | -3.01 | LV | -0.87** | -2.70 |
| CY | -1.04*** | -3.09 | MT | -0.97*** | -2.92 |
| CZ | -0.94*** | -2.81 | NL | -0.97*** | -2.95 |
| DE | -0.91*** | -2.80 | NO | -1.01*** | -3.07 |
| DK | -0.94*** | -2.87 | PL | -0.81** | -2.26 |
| EE | -1.00*** | -3.00 | PT | -0.92*** | -2.78 |
| EL | -0.86** | -2.43 | RO | -0.83** | -2.67 |
| ES | -0.93** | -2.52 | RS | -0.91** | -2.55 |
| FI | -0.90** | -2.75 | SE | -0.98*** | -2.85 |
| FR | -0.94*** | -2.85 | SI | -0.94*** | -2.88 |
| HU | -1.08*** | -3.31 | SK | -0.81** | -2.62 |
| IE | -1.05*** | -3.09 | UK | -0.95*** | -2.89 |

Notes: Two-tailed significance levels: $*$: 10% $**$: 5% $***$: 1%. The regression is based on specification (7) of table 1. Dependent variable: adjusted wage growth, i.e. counterfactual overall aggregate wage growth assuming a constant share of temporary employees in total employees over time (base year: 2004).

*Table C.2:* Robustness analysis: country grouping and weighting

| | permanent contract workers | | | all workers, adj. |
|---|---|---|---|---|
| *Dep. variable: wage growth* | low TUD $< 28\%$ | low TUD $< 20\%$ | TUD from OECD only | weighted country sample |
| | (1) | (2) | (3) | (4) |
| $Prod_t$ | 0.28* | 0.31* | 0.24 | 0.04 |
| | (1.79) | (1.90) | (1.26) | (0.15) |
| $Infl_t$ | 0.41 | 0.42 | 0.42 | -0.25 |
| | (0.87) | (0.87) | (0.95) | (-0.38) |
| $U_t$ | -0.58*** | -0.53** | -0.60** | -0.45** |
| | (-2.98) | (-2.64) | (-2.71) | (-2.08) |
| $Invol.\ Temp_t$ | | | | -1.13*** |
| | | | | (-3.39) |
| $...low\ TUD$ | -1.52*** | -1.38*** | -1.49*** | |
| | (-3.60) | (-3.21) | (-3.71) | |
| $...med.\ TUD$ | 0.37 | -0.37 | 0.44 | |
| | (0.67) | (-0.41) | (0.71) | |
| $...high\ TUD$ | -0.15 | -0.22 | -0.22 | |
| | (-0.49) | (-0.74) | (-0.83) | |
| Cons | 11.23*** | 10.98*** | 11.34*** | 14.33*** |
| | (4.20) | (4.11) | (7.33) | (3.91) |
| Model | FE | FE | FE | FE |
| TimeD | incl. | incl. | incl. | incl. |
| Weights | equal | equal | equal | empl. |
| N | 346 | 346 | 302 | 344 |

Two-tailed significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. T-statistics are reported in parenthesis. The dependent variable in specifications (1) to (3) is wage growth of permanent contract workers. Specification (4) is based on overall (contract) adjusted wage growth. In columns (1) to (2) the country grouping along the degree of trade union density (TUD) is altered. In specification (1), the group of low trade union density countries are countries with a TUD below 28%, whereas this threshold is set at 20% in column (2). In specification (3), the country grouping is formed based on only one data source (i.e. on OECD data), which reduces the sample by four countries (BG, RO, MT and CY). The last column presents estimates from a weighted sample regression, where countries are weighted based on the number of employed persons in 2005.

# D Appendix: Endogeneity

Simultaneity bias arising from reverse causality between nominal wage growth and labor market slack can be a concern in our specification. Usually, this issue is approached by inserting the slack variable in its one-period lagged form into the model (see e.g. Ramskogler, 2021; Byrne and Zekaite, 2020; Nickel et al., 2019). While this is certainly a valid approach when using quarterly data, it is not feasible in our case given the annual frequency of the data. Fortunately, in the case of reverse causality, the fixed-effect estimate of the impact from unemployment on wage growth would be downward biased

rather than upward, as higher wage growth should cause higher labor market slack (IMF, 2017; Wooldridge, 2009). The same logic applies to the dualization measure. If wage growth accelerates, it is presumable that employers increasingly demand temporary employees as they are cheaper and are associated with lower firing costs. Hence, it is very likely that our findings concerning the importance of temporary employment for wage growth are not mistaken even in the presence of reverse causality.

A standard approach to account for a potential simultaneity bias is to use instrumental variable techniques. As exogenous instruments are not at hand, neither for labor market slack nor for temporary employment, we use internal instruments, i.e. time lags of the variables in the model. In particular, we employ the difference GMM estimator[24] (Arellano and Bond, 1991; Blundell and Bond, 1998) and treat both variables as endogenous (by using the lagged levels of the variables as instruments).

We summarize our results in Table D.1, which also includes a memo item recalling our baseline results from section 5.1 (Table 1, column (7)). As displayed in column (1) involuntary temporary employment and unemployment have the expected negative signs and are statistically significant. However, compared to the fixed effect estimation (see column (7)) we observe an increase in the coefficient estimate for both variables, which is more pronounced for $Invol.\ Temp_t$. Obviously, controlling for simultaneity has an effect on the estimates in the direction that we expected, i.e. labor market variables seem to be underestimated in a fixed-effects setting. A very similar result can be found in Bellani and Bosio (2019), who report an increase in the impact of temporary employment after controlling for reverse causality. Yet, the most relevant conclusion from the results presented in this robustness section is that the relative importance of labor market dualization does not change. More specifically, a test on parameter equality reveals that the coefficients of $U_t$ and $Invol.\ Temp_t$ are of the same magnitude. This result also holds in a setting with standardized variables[25]. Hence, we can confirm our baseline results that competition effects play a significant role in a macroeconomic context and that they are at least as relevant as unemployment in driving wage growth in Europe.

In column (2) we add inflation to the set of endogenous variables. If firms increase prices as a result of increasing labor costs, reverse causality from wage growth to price inflation may occur. As our results show, controlling for potential endogeneity with respect to inflation does not have any significant influence on the estimation outcome. This might be related to the fact that a large part of consumer price dynamics is already captured by time dummies.

[24]Note that our dependent variable is not persistent. This is why we choose a static representation and the difference rather than the system GMM estimator.

[25]Note that re-estimating the same specification on standardized variables yields coefficient estimates of -0.43 and -1.12 for $U_t$ and $Invol.\ Temp_t$ respectively, which are statistically not different from each other.

*Table D.1:* Robustness analysis: controlling for potential endogeneity

| *Dep. variable:* | memo Table 1 | reverse causality | | ommitted vars | |
|---|---|---|---|---|---|
| *adjusted wage growth* | (7) | (1) | (2) | (3) | (4) |
| $Prod_t$ | 0.33** | 0.35** | 0.35*** | 0.15 | -0.07 |
| | (2.26) | (2.51) | (2.61) | (0.84) | (-0.36) |
| $Infl_t$ | 0.54 | 0.47 | 0.44 | 0.70* | -0.02 |
| | (1.16) | (1.08) | (0.85) | (1.76) | (-0.06) |
| $U_t$ | -0.50*** | -0.57*** | -0.65*** | -0.54** | -0.39** |
| | (-2.78) | (-3.59) | (-4.18) | (-2.44) | (-2.60) |
| $Invol.\,Temp_t$ | -0.95*** | -1.67** | -1.87** | -0.85** | -0.76** |
| | (-2.92) | (-2.06) | (-2.29) | (-2.68) | (-2.26) |
| $TUD_t$ | | | | 0.42*** | 0.63*** |
| | | | | (3.29) | (3.25) |
| $EPL_t$ | | | | | -1.49 |
| | | | | | (-0.67) |
| $CBC_t$ | | | | | -0.10** |
| | | | | | (-2.37) |
| Cons | 11.34*** | 14.52*** | 16.28*** | -0.96 | 2.65 |
| | (3.91) | (3.00) | (3.33) | (-0.23) | (0.30) |
| Model | FE | GMM | GMM | FE | FE |
| AR1 | | -2.81*** | -2.78*** | | |
| AR2 | | -0.72 | -0.71 | | |
| Hansen | | 12.83 | 14.74 | | |
| Hansen p-val | | 0.80 | 0.97 | | |
| TimeD | incl. | incl. | incl. | incl. | incl. |
| N | 344 | 344 | 344 | 293 | 248 |

Two-tailed significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. T-statistics are reported in parenthesis. Specifications (1) and (2) are estimated by first difference GMM (using orthogonal deviations). We use the Stata command xtabond2 and employ the second level lag (up to 11 lags) of the endogenous variables as instruments. As the cross-section dimension is rather small (i.e. 30 countries), we use standard IV instruments rather than GMM-type instruments in order to limit the instrument count (by using the collapse option, see also Roodman (2009)). Specification (2) treats only $U_t$ and $Invol.\,Temp_t$ as endogenous, while specification (3) assumes that all variables are endogenous except $Prod_t$. Columns (3) and (4) are based on specification (7) and include institutional variables: employment protection legislation (EPL), trade union density (TUD) and collective bargaining coverage (CBC). As CBC time series have a lot of gaps, we impute missing values with lagged available values.

Finally, a potential source of endogeneity in our setting might occur due to omitted variables. So far, we have mainly controlled for the cyclical drivers of wage dynamics. However, institutional factors are likely to influence bargaining power and thus, could have had an influence on our dependent and independent variables, wage growth and – more importantly – also on the development of labor market dualization. Generally, fixed effects models already tackle the problem of omitted variables to the extend that they capture time-invariant determinants of the independent variable. Hence, the influence from a country's individual institutional setting on the process of wage formation should to a large extend be captured by the so far presented model estimates. Still, although institutional

changes evolve only slowly over time, these changes nevertheless could have had an influence on wage dynamics and on temporary employment. In order to control for changes in institutional settings, we consider the three labor market institutions with the most likely effect on worker bargaining power and thus, wages and labor market dualization, namely employment protection legislation (EPL), trade union density (TUD), and collective bargaining coverage (CBC). We use the most-established measures provided by the OECD (see Appendix E), with the drawback that they are not available for the non-OECD member countries in our sample[26] and that they are not collected annually.

The resulting gaps in the available time series for the three institutional variables would cut our sample size in half. Therefore, in a first step, we complement the TUD series with data from the ICTWSS database (Visser), which saves 22 observations[27]. Re-estimating specification (7) by including TUD as the only institutional variable leaves us with a sample size of 293 (compared to 344). As shown in column (3), considering TUD has only a modest impact on labor market dualization. The coefficient estimate of $Invol.\,Temp_t$ remains negative and significant, but decreases slightly compared to specification (7). This might be related to the fact that in countries, where union density is rather low, the incidence of involuntary temporary employment is higher, which seems to dampen the effect from labor market dualization on wage growth. This is in line with the theoretical expectation that weak trade unions are unable to prevent the replacement of permanent with temporary workers (see section 3). In turn, stronger worker bargaining power may reduce part of the negative competition effect of temporary workers on wage growth. At the same time, stronger trade unions are associated with higher wage growth as our specification (4) indicates. However, trade unions may pursue different strategies with regard to permanent and temporary workers: trade unions of medium strength will be insider-oriented to the detriment of outsiders, while stronger trade unions pursue an outsider encompassing strategy and weaker trade unions are unable to exert substantial influence. Indeed, our earlier results (Table 1) indicate that countries with a low trade union density experience a sizeable competition effect, while countries with medium and high trade union density do not.

In a second step, we add the remaining two institutional variables into the model, i.e. EPL and CBC. As the CBC series has the largest gaps but is a slow moving variable, we impute the missing values in the CBC series (with lagged available values), which saves 82 observations. We display our results in the final column of Table D.1. Regarding the impact of employment protection legislation on wage dynamics, it is interesting to point out, that the strictness of EPL has a negative though insignificant

[26] There is no data for Malta, Cyprus, Bulgaria, Serbia and Romania.

[27] The ICTWSS database includes TUD data for various years in Malta, Cyprus, Bulgaria and Romania, which we can make use of.

effect on wage growth. While a negative sign seems counter-intuitive to the political-economy expectation of EPL as a factor for worker bargaining power, it is in line with the economics literature. EPL is identified as the main source of labor market rigidity preventing job-to-job transitions, which is arguably one of the most important drivers of wage growth. Finally, we find a small negative effect of collective bargaining coverage on wage growth. Further research could take these findings as a starting point to investigate the relationship of labor market institutions and wage growth on a more fine-grained level as the effects are likely to vary between different groups of workers.

# E Appendix: Variable measurement and sources

*Table E.1:* Variable measurement and sources

| Abbrev. | Variable | Measurement | Source |
|---|---|---|---|
| Wage growth | Annual average change in nominal wages | Gross employee cash or near cash income (PY010G)/months employed (PL073+PL074)/hours worked (PL060) (separated for full time and part time) aggregated with personal cross-sectional weights (PB040) | EU-SILC |
| Prod. | labor productivity growth | Nominal GDP/employment*100, annual change | Eurostat (naida_10_pe, naida_10_gdp) |
| Infl. | HICP Inflation | Annual average change of HICP | Eurostat (prc_hicp_aind) |
| Exp. Infl. | Inflation expectations | Monthly consumer survey asking for price trends over the next months, yearly average over 12 months | European Commission |
| U | Unemployment rate (U-3) | Unemployed (ILO definition) in % of active working age population (aged 15-74) | Eurostat (lfsa_urgan) |
| Invol. Temp | Involuntary temporary employment | Employees with a temporary contract who could not find a permanent job, in % of active working age population (aged 15-74) | Eurostat (lfsa_etgar, lfsa_eegais, lfsa_agan) |
| Temp | Temporary employment | Employees with a temporary contract, in % of active working age population (aged 15-74) | Eurostat (lfsa_etgadc, lfsa_agan) |
| Vol. Temp | Voluntary temporary employment | Temp − Invol. Temp | |
| U-5 | U-5 Unemployment rate | Unemployed incl. discouraged (not seeking, but available) and marginally attached workers (available, but not seeking) | Eurostat (lfsa_urgan, lfsa_sup_age) |
| NAWRU | Non-accelarating wage rate of unemployment | Estimates from a model-based approach, European Union, 2017. | European Commission |
| Invol. Part | Involuntary part-time employment | Share of involuntary part-time employees in labor force, in % | OECD Statistics |
| EPL | Employment protection legislation | Strictness of employment protection − individual and collective dismissals (regular contracts) | OECD Statistics |
| TUD | Trade union density | Union members in % of employees (administrative and survey data) | OECD, ICTWSS |
| CBC | Collective bargaining coverage | Percentage of employees with the right to bargain | OECD Statistics |