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Temporary contracts and Okun's law in Poland

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Abstract

Research background: The share of temporary workers in Poland is one of the largest of any EU country, which may affect the output unemployment relationship. The Polish case seems to be a natural experiment. Contrary to many advanced European countries, the spread of temporary contracts in Poland was not caused by labor market reform but instead resulted mainly from spontaneous processes.

Purpose of the article: This paper investigates the effect of the widespread use of temporary contracts on the relationship between output and unemployment in Poland.

Methods: The analysis is based on the 'dynamic' version of Okun's law and uses OLS regression, OLS split-sample regression and OLS rolling regression. The sample period is 1996–2018.

Findings & Value added: The study found that unemployment's sensitivity to output increased over time and was related to the greater use of temporary contracts, particularly among young people and women. Initially, at the turn of the 21st century, the expansion of temporary jobs changed the employment composition and had an insignificant effect on unemployment since firms mainly replaced permanent contracts with temporary contracts. Then, starting around 2006, temporary contracts began affecting unemployment levels and unemployment's responsiveness to output. During this period, firms used temporary contracts as the main workforce adjustment device during the business cycle.

Introduction

Poland experienced high unemployment rates (about 20%) at the turn of the 21st century, but, by 2018, the unemployment rate had fallen to 4%. At the

same time, the number of temporary employees in Polish dependent employment rose significantly, from 8% in 2001 to 25–26% in 2005. This number continued to grow after 2005 with temporary employees accounting for 25–28% of employment in the following years (see Figure 1). As a result, Poland had the highest percentage of temporary employees in the European Union (EU) from 2009 to 2016.

The share of temporary contracts may affect the unemployment rate and unemployment's responsiveness to output. Temporary employees are 'cheaper' than permanent employees due to a gap in employment protections (e.g. a short notice period and no right to severance payment). These lower labour costs may encourage employers to create temporary jobs and to replace permanent workers with temporary workers. The impact on the unemployment rate depends on which of these effects prevails. At the same time, the gap in protection may also reduce the cost of employment adjustment to business cycles and increase unemployment volatility.

This paper investigates the effect of the widespread use of temporary contracts on the relationship between output and unemployment in Poland. The analysis employed the distributed lag version of the 'dynamic' Okun's law (Okun, 1962) and covered the period from 1996 to 2018. The effect of temporary contracts on the relationship is examined using split-sample OLS regression, the CUSUM test and OLS rolling regression. The analysis also investigated the stability of Okun's relationship to the business cycle and its time-variability across gender and age groups using split-sample OLS.

This paper contributes to the empirical literature re-examining Okun's law in a transitioning economy, specifically Poland, taking into account the role of temporary contracts. Earlier Polish studies on the effect of temporary contracts on unemployment mainly utilised a micro approach and focused on how temporary contracts affect the risk of unemployment (e.g. Pilc, 2015, pp. 400–424). In other countries, studies have focused mainly on the two-tier (or asymmetric) labour market reforms introduced in several advanced European economies in the 1990s. To increase employment and reduce unemployment, these reforms maintained existing protections for permanent workers while liberalising the use of temporary contracts (e.g. Bentolila *et al.*, 2002, pp. F155–F187; Costain *et al.*, 2012, pp. 1–67; Jimenez-Rodriguez & Russo, 2012, pp. 430–448). However, the Polish case is different because the increase in temporary employment resulted from a change in the interpretation and enforcement of labour laws.

The rest of this article is organized as follows: section two presents the literature review, section three describes the research methodology and data utilised in the study, section four reports on the empirical research, section

five discusses the results and section six presents the conclusions of this research.

Literature review

The two-tier reforms and the spread of temporary contracts in advanced European countries resulted in a large body of research, both theoretical and empirical. Theoretical models suggest that temporary contracts may increase the volatility of unemployment, but their impact on the unemployment rate is unclear. For example, Blanchard and Landier's (2002, pp. F214–F244) model implies *the perverse effect*, i.e. that two-tier reforms increase turnover in entry-level jobs and increase unemployment. On the other hand, Boeri and Garibaldi's (2007, pp. 357–385) model implies *the honeymoon effect*, i.e. that the introduction of temporary contracts transitionally reduces unemployment and increases its volatility throughout the business cycle.

Many researchers agree that two-tier reforms of labour markets increase the sensitivity of unemployment to the business cycle. For instance, there are many papers based on labour demand or the search and matching model (Bentolila & Saint-Paul, 1992, pp. 1013–1047; Bentolila *et al.*, 2002, pp. F155–F187; Costain *et al.*, 2012, pp. 1–67; Jimenez-Rodriguez & Russo, 2012, pp. 430–448), as well as studies based on Okun's law, including those published by the International Monetary Fund (2010), Banerji *et al.* (2015, pp. 1–38), and Dixon *et al.* (2017, pp. 2749–2765), who conducted cross-country analyses.

Despite this consensus, the evidence regarding the effect of increased temporary contracts on unemployment rates is inconclusive. For instance, Cappellari *et al.* (2012, pp. 55–62) argued that the introduction of temporary contracts in Italy reduced youth unemployment. In contrast, according to Banerji *et al.* (2015, pp. 1–38), an increase in the percentage of youth with temporary employment contracts led to an increase in youth unemployment in 22 advanced European countries. Also, in Kahn (2010, pp. 1–15), Cahuc *et al.* (2016, pp. 533–572) and d'Agostino *et al.* (2018, pp. 178–189), the gap in protection between temporary and permanent employees only changed the employment composition and had a negligible effect on total employment.

In Poland, the high percentage of temporary jobs encouraged much research. For example, Gatti *et al.* (2014, pp. 1–40) showed that temporary workers are a heterogeneous group under many types of contracts (e.g. under the Labour Code and different types of civil contracts), and that tem-

porary contracts are most common among young people, women and low-skilled workers in the industry and private sectors. Lewandowski and Magda (2007, pp. 147–150) showed that, between the late 1990s and 2010, changes in labour law, particularly in employment protection, were minor and none of the regulations significantly increased the gap in protection between permanent and temporary contracts in Poland. According to Baranowska and Gebel (2008, pp. 1–25), in Poland (and other CEE countries), weak representation of outsiders in trade unions and negotiations leads to temporary employment, while employment protection has no significant effect on temporary employment. Lewandowski *et al.* (2016, pp. 1–28) suggested that the contract of mandate negatively affects expected retirement benefits compared with employment contracts. To reduce the number of temporary jobs, Wojciechowski (2011, pp. 16–18) suggested making permanent contracts more flexible (e.g. allowing for a shorter notice period) and reducing the tax wedge. In turn, Arak *et al.* (2014, pp. 1–23) proposed a single contract with similar regulations for both permanent and temporary contracts, a separate labour code for small businesses and cutting the tax wedge of low wage earners.

There is another group of studies analysing the effect of temporary contracts on employment and unemployment in Poland that utilised different methods. For instance, Cichocki *et al.* (2015, pp. 96–116) used an Impulse Reaction Function (IRF) and found no impact on employment responsiveness to economic growth caused by the widespread use of atypical contracts (including temporary contracts) in 1995–2012. Using the labour demand model, Lewandowski *et al.* (2017, pp. 23–26) found that, between 2002 and 2015, permanent contracts were substituted with ‘cheaper’ temporary contracts and that the spread of temporary contracts could increase net dependent employment by 0 to 19% (between 0 and 0.51 million jobs out of 2.7 million). Pilc (2015, pp. 400–424) investigated how the type of contract (temporary or permanent) affects future career prospects. He employed a variety of methods, including binomial logistic, multinomial logistic and OLS regression and used *Social Diagnosis* microdata from 2009, 2011, and 2013. His main finding was that a temporary contract increases the risk of unemployment and decreases the probability of transition from temporary to permanent employment. Kiersztyn (2016, pp. 881–894) revealed that the chances of transitioning from temporary to permanent employment depended on the occupation. For instance, from 2005 to 2008, having a high-status job (e.g. a managerial or professional job) positively affected the probability of transition. On the other hand, low-status jobs (e.g. a manual occupation) may have the opposite effect.

Research methodology and data

According to Okun's law, an inverse relationship exists between unemployment and output growth, where economic expansion decreases unemployment and economic slowdown increases unemployment. The starting point is the basic 'dynamic' version of Okun's law:

$$\Delta u_t = \beta_0 - \beta_1 \Delta y_t + \varepsilon_t \quad (1)$$

where Δu is the change in the unemployment rate in percentage points, Δy is the rate of real gross domestic product (GDP) growth in per cents, the subscript t is the index of the period and ε is an error term. The coefficient β_0 can be interpreted as a change in the unemployment rate when output growth is equal to zero. The coefficient β_1 is Okun's coefficient, or output unemployment elasticity. This coefficient relates the change in the unemployment rate in percentage points to the change in GDP growth in percentage points. The ratio $-\beta_0/\beta_1$ can be interpreted as the output growth needed to keep the unemployment rate constant.

This study detected time lags between changes in the unemployment rate and output fluctuations in Poland (see next section). Consequently, the analysis utilised the distributed lag version of the specification:

$$\begin{aligned} \Delta u_t &= \beta_0 - \beta_1 \Delta y_t - \beta_2 \Delta y_{t-1} + \varepsilon_t \\ &= \beta_0 - \beta_1 \Delta^2 y_t - (\beta_1 + \beta_2) \Delta y_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

where the coefficient β_1 represents short-term effect, and $(\beta_1 + \beta_2)$ refers to the total effect of the changes in growth rate on the changes in unemployment rates (Sögner & Stiassny, 2002, pp. 1776). In accordance with the literature, changes in unemployment are measured as the change in the unemployment rate from the first quarter to the same quarter of the previous year (in percentage points). Rates of GDP growth are computed from the first quarter to the same quarter of the previous year (in per cents). This approach addresses seasonal problems.

As is common in country case studies, this paper adapted a model similar to the basic version of Okun's law by only including economic growth as the explanatory variable.¹ Many studies examining output–

¹ Additional estimations incorporating control variables that could affect the output–unemployment relationship (e.g. reflecting changes in regulation, such as the share of self-employed and part-time contracts, or reflecting changes in labour supply by education attainment and age) caused the collinearity problem. In turn, some potentially important struc-

unemployment time-variability use economic growth as the sole explanatory variable, measured both as the rate of GDP growth and the output gap, for instance, Knotek (2007, pp. 73–103), Beaton (2010, pp. 5–13), Boeri (2011, pp. 1205–1207), Ball *et al.* (2012, 1–40), Cazes *et al.* (2013, pp. 2–18), Meyer and Tasci, (2012, pp. 3–6), and D’Apice (2014, pp. 2–8).

This study uses quarterly series data for unemployment and employment taken from the Polish Labour Force Survey (LFS) and Eurostat database. For the period 1995–2009, the analysis relies on data revised by the National Bank of Poland (Saczuk, 2014). Missing data for two quarters in 1999 were interpolated. The quarterly data on GDP growth were obtained from the Statistics Poland (*Główny Urząd Statystyczny*) database. The terms *temporary employment* and *permanent employment* refer to employees with temporary and permanent contracts, as defined by the Polish LFS. For the period 1995–2000, the number of casual workers is used as an approximation of temporary workers, and permanent employment was estimated as the difference between dependent employment and temporary employment. Due to a lack of available data for the period 1996–2000, the calculation of female and male temporary employment growth relies on Polish LFS data, while the 2001–2018 data was taken from the Eurostat database.

Results

Relationship between output and unemployment

The analysis begins with a presentation of the time-variability of the changes in unemployment rates (in percentage points) and real GDP growth (in per cents). Figure 2 suggests that, as Okun’s law assumes, there is an inverse relationship between unemployment and output. Pearson’s correlation between variables confirms this. The contemporaneous coefficient is negative (–0.45) and is statistically significant at one per cent. Note that Poland did not experience a recession over the sample period; however, the Polish economy experienced fluctuations in GDP growth, which influenced unemployment. Growth rates in the period 1996–2018 ranged from 0.1 to 8.1%, and the average growth rate was 4.1%. There is an inverse correlation between changes in unemployment rates and the range of positive growth rates.

tural variables (e.g. the OECD Employment Protection Legislation index) have low explanatory power because of low variability over time.

The effect of output changes on unemployment is delayed. The highest correlation (−0.47) is between changes in the unemployment rate and GDP growth, lagged one quarter. The time lag suggests the adjustment of employment to the business cycle. Likely, a firm's first reaction to an economic slowdown is to adjust the number of working hours and later to adjust the size of the workforce.

According to Okun's law, output affects unemployment through changes in employment. In fact, unemployment depends both on labour demand and labour supply. Over the sample period, changes in labour supply occurred that could affect unemployment in Poland (e.g. emigration to EU countries). To determine the role of labour demand and labour supply, a decomposition of changes in unemployment rates into labour supply and employment components is conducted. The changes in unemployment rates (in log points) into labour supply and employment components are split:

$$\Delta u = (1 - u)\Delta \ln(lfpr) - (1 - u)\Delta \ln(e) \quad (3)$$

where u is the unemployment rate, $lfpr$ is the labour force participation rate, e is the employment rate, $(1 - u)\Delta \ln(lfpr)$ is the supply component and $(1 - u)\Delta \ln e$ is the employment component (e.g. see Elsby *et al.*, 2010, pp. 5–6).

Figure 3 shows the time-evolution of the demand and labour components over the sample period. The results suggest that labour demand had a significantly larger effect on the unemployment rate than labour supply and that labour demand contribution changed over time. For the full sample, the average change in the unemployment rate is −0.44 log point, and the average values of the supply and demand components are −0.08 and 0.35, respectively. In other words, on average, 19% of the change in unemployment rates can be attributed to the supply component, while 81% of the change can be attributed to the demand component.

Output growth influences unemployment through changes in employment. If there are permanent and temporary contracts, then the effect on unemployment depends on the extent to which temporary contracts increase employment or change employment composition. Table 1 compares GDP growth, permanent and temporary employment growth rates (in per cents) and changes in the unemployment rate (in percentage points) over select periods. The sample period was divided into subsamples, taking into account the level of temporary employment (see Figure 1). The findings suggest that the effect of the extensive use of temporary contracts on unemployment changed over time. At the turn of the 21st century, the expansion of temporary jobs mainly changed employment composition as permanent contracts were substituted with temporary contracts. From 2001–2005,

temporary and permanent employment contributed to a dependent employment growth rate of 3.6 and –3.6 percentage points, respectively. This was accompanied by stabilization of the total employment (growth rate –0.2%) and stabilization of the unemployment rate (change in percentage points –0.5). On the other hand, from 2006–2018, both temporary and permanent employment contributed to the dependent employment growth rate (0.45 and 1.55 percentage points, respectively), which coincided with a significant decline in the unemployment rate by ten percentage points.

Next, this section estimates the distributed lag version of Okun's 'dynamic' law using OLS. To account for autocorrelation present in the model, the Newey-West procedure is used when calculating the variance matrix for estimators. Coefficients were estimated for the period 1996q2–2018q4 and for subperiods 1996q2–2005q4 and 2006q1–2018q4 to examine the stability of the coefficients. As before, the sample was divided into low and high temporary employment periods (see Figure 1). This analysis confirms that Okun's law holds for Poland, suggesting increased unemployment responsiveness to output over time.

Table 2 presents the results of this analysis. As expected, the estimated coefficients are negative and statistically significant. Estimated unemployment to output elasticity, as specified by Equation 2, is –0.49 over the period 1996q2–2018q4. A one percentage point increase in GDP growth caused about a 0.49 percentage point decrease in the unemployment rate. The current impact of GDP on unemployment is negative (–0.14) but is statistically insignificant. The analysis also found that the growth rate required to keep the unemployment rate constant ($-\beta_0/(\beta_1 + \beta_2)$) was 3.2%.

To investigate the stability of Okun's coefficient, this section estimates the regression for two subperiods (Chow test) and conducts a CUSUM test. The split-sample estimations suggest increased unemployment responsiveness to output. The estimated coefficient for the period before 2006 is lower (–0.33) than the estimated coefficient for the period after 2005 (–0.71). Over the first period, GDP growth accounts for 16% of the variation in unemployment changes, as measured by the coefficient of determination (R^2); over the second period, GDP growth accounts for about 50% of the variation in unemployment changes. Also, the growth rate required to keep the unemployment rate constant falls from 5.6 to 2.5%. The CUSUM test for parameter stability in the regression model (see Figure 4) is in line with these findings, suggesting that the parameter's stability could have broken down around 2006.

The analysis is completed by allowing for interactions between output fluctuations and the growth rate of temporary employment. To examine the

effect of temporary contracts on the relationship between unemployment and output, equation 2 is extended:

$$\Delta u_t = \beta_0 - \beta_1 \Delta^2 y_t - (\beta_1 + \beta_2) \Delta y_{t-1} - \beta_3 it_t + \varepsilon_t \quad (4)$$

where it is the interaction term of lagged GDP growth and the current temporary employment growth rate. The inverse relationship between the interaction term and changes in unemployment ($-\beta_3$) is expected, and greater use of temporary workers amplifies unemployment's responsiveness to the output. This study uses the 'dynamic' version of Okun's law and a consistently 'dynamic' interaction between growth rates as explanatory variables. Variability in the growth of temporary employment reflects how firms mainly use temporary workers to adjust the workforce to output fluctuations.

The analysis found that a large share of temporary employment amplified the effect of the output fluctuations on unemployment during the period 2006–2018. The results presented in Table 2 show that unemployment's responsiveness to output increased during this time. Okun's coefficients, estimated using interactions with temporary employment growth, are almost equal to the estimate of Equation 2, excluding the period 2006–2018, when interaction was statistically significant and Okun's coefficient fell lower.

The coefficient before the interaction term with temporary employment growth is statistically insignificant over the 1996–2005 period when the expansion of temporary contracts altered employment composition and had a negligible effect on employment levels. In contrast, the coefficient is statistically significant (at one per cent) over the 2006–2018 period. A negative sign indicates that a large share of temporary employment amplified the effect of output on unemployment.

To investigate the variation of Okun's relationship over time, Equation 2 and 4 were performed using the rolling regression procedure anchored at the start with one step size. This procedure covers the entire period of analysis, both from 2001–2005 when temporary contracts began increasing and from 2006–2018 when temporary contracts were most prevalent. The analysis confirms the time-variability of Okun's coefficient.

Figure 5 presents the estimated parameters. The results show the time-variability of unemployment responsiveness to output. For instance, over the sample period, Okun's coefficient, based on Equation 2, varied between -0.3 and -0.8 . The responsiveness decreased between 2000–2006, coinciding with the increased substitution of permanent contracts with temporary contracts. The responsiveness increased after 2006, coinciding with em-

ployment growth. Then, between 2008 and 2012, the rolling coefficient oscillated around -0.6 . The declining trend started around 2013. At the end of the sample period, responsiveness returned to the full sample value.

The business cycle and Okun's law

The changes in Okun's coefficient can be caused by structural changes, such as widespread use of temporary contracts, or by asymmetric changes in unemployment over the business cycle.² In such a case, unemployment responds differently to output during expansion and recession. This section examines the stability of Okun's coefficient over the business cycle. The results are ambiguous and are sensitive to the identification of business cycle phases.

As mentioned previously, Poland did not experience negative GDP growth over the sample period, so it was not possible to study the effect of a recession on unemployment. To study the changes in the unemployment rate throughout the business cycle, three business cycle measures were used: output gap, estimated by the Hodrick-Prescott (HP) filter with smooth parameter $\lambda=1600$; the difference between current and long-term averages of GDP growth; and upward and downward trends in GDP growth. Upward and downward trends in GDP growth were considered because increases in the unemployment rate corresponded with downward trends in GDP growth (Figure 6).

To investigate whether Okun's law exhibited asymmetric behaviour, Equation 2 is rewritten according to Lee (2000, pp. 345–346):

$$\Delta u_t = \beta_0 - \beta_1 \Delta^2 y_t - I^+ \beta_2 \Delta y_{t-1} + I^- \beta_2 \Delta y_{t-1} + \varepsilon \quad (5)$$

where:

$$\begin{aligned} I^+ &= \begin{cases} 1, & \text{if cyclical component} \geq 0; \text{ if } \Delta y \text{ above average; if } \Delta y \text{ in upward trend,} \\ 0, & \text{if cyclical component} < 0; \text{ if } \Delta y \text{ below average; if } \Delta y \text{ in downward trend.} \end{cases} \\ I^- &= \begin{cases} 1, & \text{if cyclical component} < 0, \Delta y \text{ below average} < 0, \text{ if } \Delta y \text{ in downward trend,} \\ 0, & \text{if cyclical component} \geq 0; \Delta y \text{ above average} \geq 0; \text{ if } \Delta y \text{ in upward trend.} \end{cases} \end{aligned}$$

² Many researchers agree that Okun's coefficient changes throughout the business cycle, for instance Lee (2000, pp. 331–356), Harris and Silverstone (2001, pp. 1–13), Virén (2001, pp. 253–57), Cuaresma (2003, pp. 439–451), Knotek, (2007, pp. 73–103) and Cazes *et al.* (2013, pp. 2–18).

The difference between (β_2^+) and (β_2^-) suggests that changes in the unemployment rate depend on the phase of the business cycle.

The parameters of the OLS estimation model are presented in Table 3. There is mixed evidence to indicate the effect of the business cycle on Okun's law. For instance, an estimation with cyclical components indicates a stable relationship between output and unemployment, particularly throughout the 2006–2018 period. An estimation with a difference between current and long-term averages of GDP growth suggests that the effect on unemployment rates was slightly larger for slowdown than for expansion. Furthermore, estimations of upward and downward trends suggest higher unemployment sensitivity to output for upward trends in GDP growth than for downward trends.

Analysis by age and gender

This section examines the time-variability of Okun's coefficient across different gender and age groups. Using split-sample OLS regression, Equations 2 and 4 are estimated for both females and males, and Equation 2 is estimated for five age-range subgroups (total, 15–24, 25–34, 35–44 and 45+). This analysis confirms that Okun's law is age- and gender-specific, and that, after 2005, young and female workers' responsiveness to output increased. This suggests that an increase in unemployment sensitivity to output was mostly associated with an increase in young and female workers' unemployment sensitivity to output.

Firstly, this section estimates the basic model, as specified by Equation 2. Tables 4 and 5 present the regression results. The estimated coefficients did not alter the main findings; they are similar to those in Table 1. For instance, throughout the sample period, the average Okun's coefficient for female and male workers (0.475) is almost the same as the coefficient for total employment. The split-regressions confirm the time-variability of Okun's coefficients. For both genders, Okun's coefficients are the highest for the 15–24 subgroup and the lowest in the 45+ subgroup. This indicates that unemployment's sensitivity to output depends on age. A possible explanation is that there is a higher proportion of temporary contracts among younger workers than older workers.

There are also differences between female and male workers in Okun's coefficients. The differences are substantial throughout the 1996–2005 period, where the coefficients for females are low and statistically insignificant. In contrast, throughout the 2006–2018 period, coefficients are statistically significant and the same for both genders. This may be explained by the differences in temporary jobs' dynamics.

Next, this section estimates Equation 4, which shows how the interaction term affects the relationship between output and the unemployment of females and males. Table 6 displays these results, which highlight the differences between the periods 1996–2005 and 2006–2018. In 1996–2005, as well as in 1996–2018, Okun's coefficients are almost the same as in Equation 2, excluding the 2006–2018 period when the interaction is statistically significant and Okun's coefficient fell lower for both females and males.

Discussion

The reasons for the spread of temporary contracts in Poland are different than in advanced European countries. Nevertheless, the spread of temporary jobs has had similar effects, contributing to labour market segmentation and increasing the sensitivity of unemployment to the business cycle. A large number of temporary employees have limited labour rights and are more likely to become unemployed than permanent employees, particularly young and female workers. This is in line with some theoretical predictions and earlier empirical research.

Unsurprisingly, this study confirmed that unemployment is driven mainly by output growth. On the one hand, the decomposition of changes in the unemployment rate into labour demand and labour supply components suggests that GDP growth was a more important determinant than changes in labour supply (including emigration to the EU). Also, there is more consistent evidence for the output impact on unemployment. For instance, Bukowski *et al.* (2007, pp. 7–36) argued that, after Poland's accession to the EU, the main factor shaping unemployment in Poland was the business cycle and job creation and destruction, while immigration to the EU had only a small impact. On the other hand, OLS estimations confirm that Okun's law holds for Poland. The estimated Okun's coefficient (–0.49) is close to that obtained by earlier works (between –0.4 and –0.46) using the 'dynamic' approach (Gajderowicz *et al.*, 2014, p. 44; D'Apice 2014, p. 5; Soylu *et al.*, 2018, p. 103).

Notably, unemployment sensitivity to output has increased over time. This may be related to the increased use of temporary contracts and the difference in the cost of adjusting temporary and permanent jobs to demand fluctuation, rather than asymmetric reactions of Okun's coefficient over the business cycle. It seems that changing in employers' behaviour played a crucial role. Initially, employers replaced permanent workers with temporary workers to reduce costs. Consequently, the employment composition changed, but the effect on employment and unemployment rates was negli-

gible. Then, starting around 2006, employers used temporary contracts as a means to adjust the size of the workforce throughout the business cycle. As a result, unemployment sensitivity to output increased.

Asymmetric unemployment reactions throughout the business cycle could provide an alternative explanation, however, the business cycle's impact on unemployment in Poland is ambiguous. Several studies have explored this problem, but the evidence is limited and unclear. Majchrowska *et al.* (2013, pp. 84, 87–88) suggest that the effect on the unemployment rate is larger during expansion than during recession, while Cazes *et al.* (2013, p. 7) provide opposing evidence. A study conducted by Cevik *et al.* (2013, pp. 569, 577) suggests that the results of such analyses are influenced by which version of Okun's law researchers use.

The analysis by age and gender attributed a rise in Okun's coefficient to a rise in young and female workers' unemployment sensitivity to output, which is also related to an increase in temporary contracts among these groups. These results suggest that firms adjusted employment to economic fluctuation using mainly young and female workers. These findings correspond with the results of earlier analyses of the structure of temporary employment in Poland (see Gatti *et al.*, 2014, pp. 1–40) and analyses that focused on Okun's law across different ages and genders (Hutengs & Stadtmann 2014, pp. 1–16; Dunsch, 2016, pp. 34–57; Zanin, 2014, pp. 243–248).

Conclusions

This study analysed the effects of the increased use of temporary contracts on the relationship between output and unemployment in Poland. The analysis suggested that unemployment sensitivity to output has increased over time as a result of the widespread use of temporary contracts. Okun's coefficient was relatively low at the turn of the 21st century when permanent contracts were substituted with temporary contracts, employment composition changed and the employment growth rate was close to zero. Unemployment responsiveness to output increased in the following years, which witnessed an increased use of temporary contracts. Okun's coefficients rise particularly for young and female workers, related to the greater use of temporary contracts among these groups.

Many Polish empirical studies have analysed Okun's law and the effect of temporary contracts on labour market outcomes. Nevertheless, much remains to be studied. The stability (asymmetry) of unemployment reactions to output during times of expansion and recession require greater at-

tention, as well as the unemployment reaction to demand and supply shocks. These issues are important for unemployment policy. Using more disaggregated data, such as examining several types of temporary contracts, can help better understand the channels by which output affects unemployment. Since the category ‘temporary employment’ adopted by the Polish LFS includes several types of contracts (e.g. those under the Labour Code and the Civil Code) that differ significantly in terms of labour law, they may have different effects on Okun’s law.

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Annex

Table 1. GDP growth, employment growth and changes in unemployment rates (in %, select periods)

Change in unemployment rate ^a	1996–2000	2001–2005	1996–2005	2006–2018	1996–2018
	3.7	-0.5	5.4	-10	-8.6
GDP	5.4	3.0	4.2	4.0	4.1
Employed persons	-0.20	-0.42	-0.31	1.45	0.68
Dependent employment	0.44	0.0	0.24	2.02	1.24
in which					
Permanent	0.42	-3.6	-1.60	1.55	0.19
Temporary	0.02	3.6	1.84	0.45	1.06

Note: quarterly data; a/ in percentage points.

Source: own calculations based on LFS, Statistics Poland.

Table 2. OLS estimations for Equation 2 and 4

	1996q2–2018q4		1996q2–2005q4		2006q1–2018q4	
const	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.01*** (0.00)
$\Delta^2 y_t$	-0.14 (0.24)	-0.16 (0.23)	-0.01 (0.32)	-0.17 (0.24)	-0.33 (0.22)	-0.17 (0.21)
$\Delta y_{(t-1)}$	-0.49*** (0.16)	-0.47*** (0.15)	-0.33** (0.15)	-0.33** (0.15)	-0.71*** (0.13)	-0.55*** (0.08)
it		-0.40 (0.63)		-0.85 (0.62)		-2.25*** (0.45)
$-\beta_0/(\beta_1+\beta_2)$	0.032		0.056		0.025	
N	91	91	39	39	52	52
R ²	0.23	0.24	0.16	0.21	0.50	0.62

Note: Newey-West standard errors in parentheses, statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own calculations based on LFS, Statistics Poland.

Table 3. Okun's coefficient and business cycle

	Estimation with											
	cyclical component				difference between current and long-term average				upward and downward trends in output growth			
	1996q2– 2018q4	1996q2– 2005q4	2006q1– 2018q4	1996q2– 2018q4	1996q2– 2005q4	2006q1– 2018q4	1996q2– 2018q4	2006q1– 2018q4	1996q2– 2018q4	2005q4– 2018q4	2006q1– 2018q4	
const	0.01 *** (0.01)	0.02 *** (0.00)	0.02 *** (0.01)	0.02 *** (0.01)	0.02 *** (0.00)	0.02 *** (0.01)	0.02 *** (0.00)	0.02 *** (0.01)	0.02 *** (0.00)	0.02 *** (0.00)	0.02 *** (0.01)	
$\Delta^2 y_t$	–0.15 (0.24)	0.06 (0.32)	–0.33 (0.22)	–0.12 (0.25)	0.01 (0.32)	–0.32 (0.22)	0.09 (0.23)	–0.11 (0.20)	0.16 (0.28)	0.16 (0.28)	–0.11 (0.20)	
$\Delta y_{(t-1)}^+$	–0.47 *** (0.15)	–0.38 *** (0.12)	–0.70 *** (0.14)	–0.53 *** (0.15)	–0.39 *** (0.13)	–0.73 *** (0.16)	–0.66 *** (0.14)	–0.80 *** (0.13)	–0.55 *** (0.10)	–0.55 *** (0.10)	–0.80 *** (0.13)	
$\Delta y_{(t-1)}^-$	–0.41 ** (0.20)	–0.60 *** (0.17)	–0.70 *** (0.26)	–0.65 *** (0.21)	–0.56 ** (0.21)	–0.81 *** (0.27)	–0.29 (0.18)	–0.53 (0.16)	–0.18 (0.20)	–0.18 (0.20)	–0.53 (0.16)	
N	91	39	52	91	39	52	91	52	39	39	52	
R ²	0.24	0.18	0.50	0.24	0.17	0.50	0.41	0.50	0.38	0.38	0.60	

Note: Newey-West standard errors in parentheses, statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own calculations based on LFS, Statistics Poland.

Table 4. Okun's coefficient for females by age

	1996q2–2018q4					1996q2–2005q4					2006q1–2018q4				
	Total	15-24	25-34	35-44	45+	Total	15-24	25-34	35-44	45+	Total	15-24	25-34	35-44	45+
const	0.01** (0.01)	0.03** (0.01)	0.01* (0.01)	0.01** (0.01)	0.01** (0.00)	0.01** (0.01)	0.04*** (0.01)	0.01 (0.01)	0.01* (0.01)	0.01*** (0.00)	0.02*** (0.01)	0.02** (0.01)	0.02*** (0.01)	0.02*** (0.00)	0.01*** (0.00)
$\Delta^2 y_t$	-0.07 (0.25)	-0.32 (0.57)	-0.18 (0.28)	-0.18 (0.20)	0.09 (0.20)	0.14 (0.31)	0.05 (0.78)	0.17 (0.33)	-0.03 (0.23)	0.20 (0.21)	-0.37* (0.22)	-0.85* (0.50)	-0.63** (0.27)	-0.38** (0.19)	-0.10 (0.19)
$\Delta y_{(t-1)}$	-0.40** (0.18)	-0.94*** (0.29)	-0.40** (0.20)	-0.41** (0.17)	-0.26* (0.13)	-0.17 (0.16)	-0.83** (0.33)	-0.09 (0.20)	-0.15 (0.14)	-0.09 (0.10)	-0.71*** (0.14)	-1.15*** (0.28)	-0.80*** (0.18)	-0.74*** (0.14)	-0.51*** (0.10)
$-\beta_0/(\beta_1+\beta_2)$	0.029	0.031	0.027	0.030	0.033	0.071	0.049	0.079	0.068	0.128	0.023	0.022	0.025	0.026	0.022
N	91	91	91	91	91	39	39	39	39	39	52	52	52	52	52
R ²	0.15	0.17	0.11	0.19	0.13	0.06	0.17	0.02	0.05	0.08	0.46	0.25	0.39	0.54	0.45

Note: Newey-West standard errors in parentheses, statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own calculations based on LFS, Statistics Poland.

Table 5. Okun's coefficient for males by age

	1996q2–2018q4					1996q2–2005q4					2006q1–2018q4				
	Total	15-24	25-34	35-44	45+	Total	15-24	25-34	35-44	45+	Total	15-24	25-34	35-44	45+
const	0.02*** (0.01)	0.05*** (0.01)	0.02*** (0.01)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.01)	0.05*** (0.02)	0.03*** (0.01)	0.02*** (0.01)	0.02*** (0.00)	0.02*** (0.01)	0.05*** (0.01)	0.02*** (0.01)	0.02*** (0.00)	0.01*** (0.00)
$\Delta \hat{y}_t$	-0.18 (0.24)	-0.45 (0.53)	-0.21 (0.25)	-0.21 (0.19)	-0.08 (0.18)	-0.13 (0.33)	-0.43 (0.77)	-0.09 (0.31)	-0.18 (0.29)	-0.06 (0.20)	-0.27 (0.22)	-0.56 (0.45)	-0.41 (0.28)	-0.27 (0.17)	-0.15 (0.20)
$\Delta y_{(t-1)}$	-0.55*** (0.15)	-1.31*** (0.32)	-0.61*** (0.15)	-0.44*** (0.11)	-0.35*** (0.12)	-0.46*** (0.14)	-1.10*** (0.36)	-0.55*** (0.16)	-0.33*** (0.12)	-0.24** (0.09)	-0.70*** (0.13)	-1.63*** (0.32)	-0.71*** (0.12)	-0.58*** (0.11)	-0.51*** (0.10)
$-\beta_0/(\beta_1+\beta_2)$	0.034	0.035	0.035	0.034	0.035	0.052	0.049	0.051	0.048	0.066	0.026	0.028	0.026	0.028	0.025
N	91	91	91	91	91	39	39	39	39	39	52	52	52	52	52
R ²	0.30	0.31	0.30	0.28	0.22	0.25	0.26	0.32	0.19	0.18	0.51	0.48	0.44	0.52	0.45

Note: Newey-West standard errors in parentheses, statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own calculations based on LFS, Statistics Poland.

Table 6. Okun's coefficient by gender with interaction

	Female				Male			
	1996q2-2018q4	1996q2-2005q4	2006q1-2018q4	1996q2-2018q4	1996q2-2005q4	2006q1-2018q4		
const	0.01** (0.01)	0.01*** (0.00)	0.01** (0.00)	0.02 (0.01)	0.03*** (0.01)	0.02*** (0.00)		
$\Delta^2 y_t$	-0.11 (0.23)	0.06 (0.24)	-0.16 (0.20)	-0.18 (0.24)	-0.23 (0.26)	-0.14 (0.22)		
$\Delta y_{(t-1)}$	-0.39** (0.18)	-0.18 (0.14)	-0.37*** (0.08)	-0.56*** (0.15)	-0.48*** (0.14)	-0.62*** (0.10)		
it	-0.27 (0.53)	-0.23 (0.47)	-3.20*** (0.53)	0.05 (0.51)	-0.33 (0.46)	-1.51*** (0.34)		
N	91	39	52	91	39	52		
R ²	0.16	0.07	0.72	0.30	0.26	0.58		

Note: Newey-West standard errors in parentheses, statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own calculations based on LFS, Statistics Poland.

Figure 1. Percentage of temporary workers and unemployment rate in Poland (in %, 1995–2018)

Note: quarterly data.

Source: own calculations based on LFS, Statistics Poland.

Figure 2. GDP growth and changes in unemployment rates (1996–2018)

Note: quarterly data; changes in unemployment rates in percentage points, GDP growth in per cents.

Source: own calculations based on LFS, Statistics Poland.

Figure 3. Decomposition changes in employment rate into labour supply and employment components (1996–2018, in log points)

Note: quarterly data.

Source: own calculations based on LFS, Statistics Poland.

Figure 4. QUSUM tests for structural stability of Equation 2

Source: own calculations based on LFS, Statistics Poland.

Figure 5. Rolling regression (anchored at start)

Source: own calculations based on LFS, Statistics Poland.

Figure 6. Changes in unemployment rates and trends in GDP growth

Note: the grey bands cover downward trends in GDP growth. changes in unemployment rates in percentage points, GDP growth in per cents.

Source: own calculations based on LFS, Statistics Poland.