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Structural and cyclical drivers of unemployment rate

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Abstract

The study presents main structural and cyclical drivers most likely driving unemployment rate developments in the period of the recent labour market expansion in Slovakia in 2014 – 2019. It presents estimates of the impact of individual drivers on structural unemployment rate using panel regression methods. The contributions of drivers to unemployment developments are presented for V4 countries. We also provide a hint as to likely future drivers of unemployment in the Slovak Republic in coming years. The 2014 – 2019 period in Slovakia was characterised by both a structural and cyclical decline in unemployment. The structural decline was driven by active labour market policies, demography, workforce mobility, to some extent higher quality of human capital and labour productivity. The current pandemic crisis causes an upward adjustment of unemployment unwinding previous imbalance. This is accompanied by efforts to increase efficiency of production processes due to general automation drive as well as potential lagged impacts of dynamic growth of labour costs. These factors could potentially offset other opposite structural forces, namely demography and potential output growth.

1. Introduction

This study deals with unemployment rate[1] developments in Slovakia and to some extent also the other V4 Central European countries (Czech Republic, Poland, Hungary). The main aim is to identify the main driving forces of declining unemployment rates in V4 countries in the recent post-crisis recovery period 2014 – 2019. The approximate magnitudes of the impact of each of the main drivers is estimated for each of the four countries. To this end, a fixed effects regression model is fitted with subsequent verification using the Arellano-Bond estimator. We also provide a brief outlook of likely influences on unemployment rate in Slovakia in the coming years.

The inspiration for this work comes from the literature on panel estimation of unemployment drivers in OECD countries. The dependent variable is typically the unemployment rate or its structural version[2]. Orlandi (2012) finds similar estimates regardless of which one of the two is used as the dependent variable. This implies that structural drivers' impacts on unemployment rates could be interchangeably estimated using either the standard unemployment rate or the structural one. Explanatory drivers of unemployment from other studies are summarised in table 1. The dominant type of regression is a levels specification, while a minority of studies applies specifications in first differences (an overview is provided by Heimberger (2019)). The estimation procedure typically relies on panel regressions methods using fixed effects. In some cases, a cointegration test is also applied to show that the estimated relationship is stable and reliable. Further robustness tests are also often based on Arellano-Bond estimation, which is a dynamic panel estimation method based on the generalised method of moments. This method can improve the reliability of estimated coefficients, as it helps to eliminate endogeneity and autocorrelation in the regression. The above methods are being utilised e.g. in the studies by Orlandi (2012) or Bassanini and Duval (2009). Results based on data for Slovakia are obtained by Habrman and Rybák (2016).

The current paper makes a number of contributions to the existing literature. It provides up-to-date estimates based on data for most EU countries, which is not common especially for the more recent EU member states. A new feature is also the inclusion of the level of structural output as one of the main drivers of unemployment. This variable exhibits a potentially important role in the observed long-term decline in a number of countries. The results obtained are validated by a number of cointegration tests and additional equation specifications. We show an important role of demography and active labour market policies in shaping unemployment. In some of the presented equations, we observe a significant upward impact of labour cost shocks on unemployment (keeping country level economic performance unchanged) and labour market hysteresis effects[3]. We aim to explain the drivers of the sharp unemployment decline in the central European region (V4 countries, i.e. SK, CZ, PL, HU) in recent years.

Section 1.1 provides an overview of some of the main recent labour market developments in Slovakia and abroad. Section 2 presents some factors that could have been behind the structural improvement in the Slovak labour market in the 2014 – 2020 period based on a simple look at some statistical indicators. Section 3 applies the panel estimation with fixed effects to quantify the effects of main unemployment drivers on the unemployment rate. The estimates are then verified using the Arellano-Bond estimator. Using this estimated relationship, Section 4 then analyses what factors were behind the sizeable declines of unemployment rates in V4 countries lately. Section 5 then sketches some of the main likely influences on unemployment rates in the coming years.

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[1] The focus lies on unemployment rate, as defined by the Labour force survey (Eurostat).

[2] The terms structural or equilibrium unemployment and NAIRU are being used synonymically in this study. Some studies, e.g. Orlandi (2012) make a distinction between NAIRU as a measure that can vary to some extent with significant boom-bust episodes and long-term equilibrium unemployment as a more stable level given by structural features of the economy that crystallizes in the long-run, after cyclical boom-bust fluctuations fade.

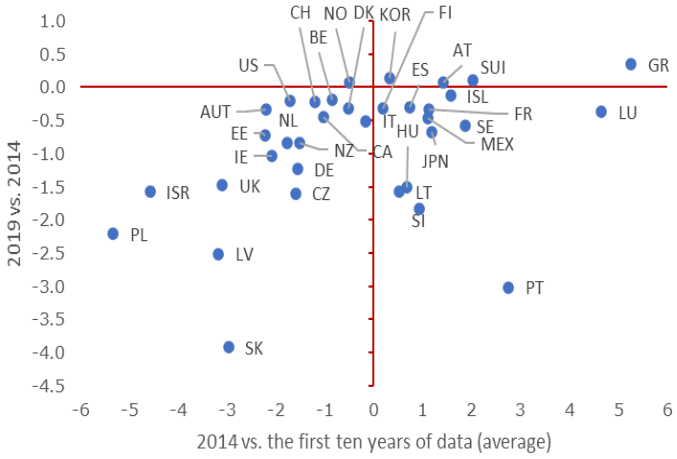
[3] The term hysteresis means that short-term cyclical developments can become at least temporarily reflected also in structural measures of unemployment, due to e.g. skills deterioration or difficult transition to different sectors after job loss.

1.1. Unemployment rate developments in 2014 – 2020

From 2014 onwards, the labour market in Slovakia recovered from the previous Great recession quickly, with the number of persons employed increasing by 258 ths. until 2019. This was largely reflected also in the decline in the number of unemployed by 228 ths. The unemployment rate has been brought down from 14.2 to only 5.8 % in 2019, which is a Slovak historical minimum.

Part of the improvement within this period seems to be of a structural, i.e. more permanent nature, as documented e.g. by OECD NAIRU estimates for several countries (Chart 1). In most countries, structural unemployment declined within the more recent period, while in the prior period, there were both positive and negative developments.

Chart 1 Equilibrium unemployment rate changes in OECD countries (change in p.p.)

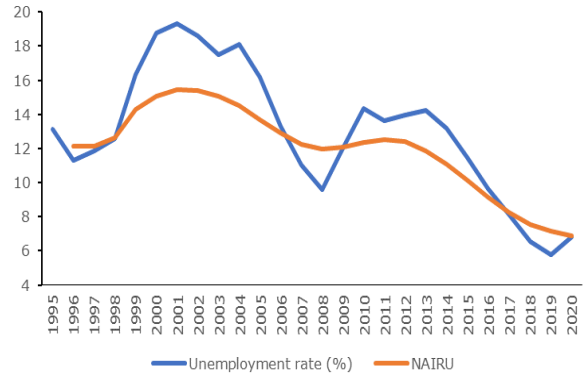


Source: OECD, author's calculations
Note: the first year in the OECD database is 1985.

Indicators, such as the one presented in Chart 2, also signalled labour market overheating, i.e. unemployment rate temporarily below its structural level. This was accompanied by companies' efforts to hire even more workers than the number available, resulting in rapid wage growth above the rate of labour productivity growth. More workers were temporarily integrated into the labour market than the number that can be sustained in the long run.

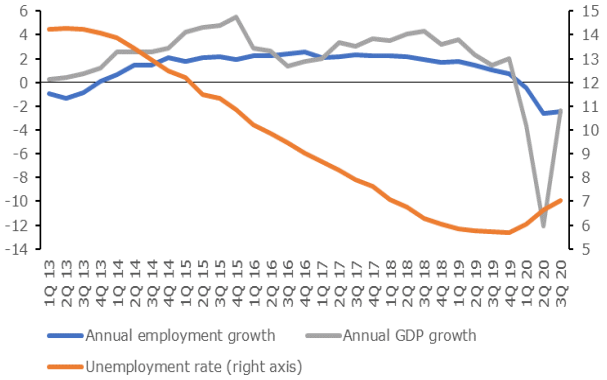
The overheating and generally very benign labour market developments started moderating somewhat around the turn of 2018 and 2019 due to global trade tensions and Brexit risks. At the same time the labour market started being limited by its capacity to support an ever-increasing labour input expansion which contributed to the decline in the robustness of employment growth and unemployment decline. The subsequent coronavirus outbreak had an immediate adverse impact, which meant an end to overheating and a start to a year-long upward tendency of unemployment.

Chart 2 Actual and equilibrium unemployment rate in Slovakia (%)



Source: SO SR, NAIRU by OECD

Chart 3 Labour market and economic performance following the Great recession (%)



Source: SO SR

2. Which structural factors could have supported the decline in the structural unemployment rate?

There are several potential drivers which could contribute to long-term changes in unemployment rates. A summary of significant ones found in the literature is presented in Table 1. Sections 2.1 to 2.6 are discussing those drivers, which could have contributed to the downwards adjustment of the equilibrium unemployment rate in Slovakia in the 2014 -2019 period based on descriptive statistical indicators. Together with the estimates in Section 3, this will enable us to assess which drivers most likely affected structural unemployment after the Great Recession and could do so possibly also going forward.

Table 1 Which factors cause changes in the structural unemployment rate?

Driving factor	Detail
Upward phases of the economic cycle	Could help secure a more permanent employment presence for labour force previously unable to find permanent jobs (and vice versa for opposite phases)
Active labour market policy	Active support of population groups excluded from permanent employment due to their missing qualifications and skills
Demography	The youth spend more time looking for optimal employment, therefore their average unemployment rate is higher than for the rest of the population; an older population with fewer young persons could compositionally record lower unemployment; departures of large ageing population groups from the labour market could at least transitionally result in increased hiring of previously excluded groups in the labour market; however, overall, ageing and a decline of working-age population is an adverse economic phenomenon
Improvements in education and human capital aspects	This could bring about a structural increase in employment and decline in unemployment
Labour mobility and other aspects of efficient labour market matching	Higher labour mobility results in an easier and faster matching of vacancies with currently unemployed persons, which results in a lower unemployment rate
Labour productivity growth	Higher labour productivity helps generate wealth and can succeed in foreign competition; unemployment could fall via resulting higher aggregate and labour demand

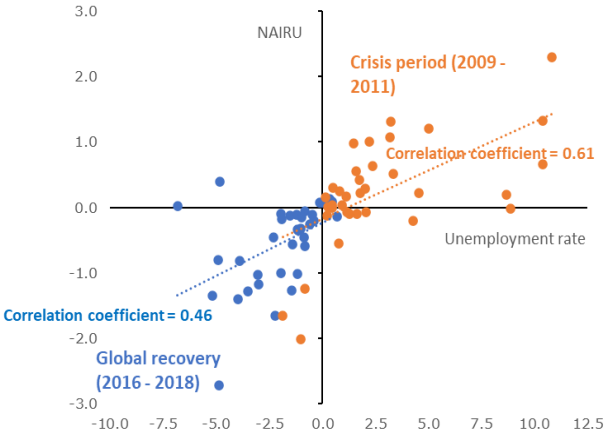
Driving factor	Detail
Tax wedge burden	Higher taxes and social contributions reduce incentives to create jobs and vice versa
Labour cost shocks	Wage growth higher than labour productivity growth reduces labour demand
High and long-lasting unemployment benefit replacement rates	Reduce motivation to look for employment; literature however also mentions positive effects stemming from the existence of unemployment benefits, as they help find suitable jobs matching the skills and qualifications of the unemployed with positive productivity impacts; a balance is therefore required
Collective bargaining coverage	High wage demands by the union representatives could result in unit labour cost increases and thus limit job creation; however, as above, some balance could be beneficial, as bargaining could have positive productivity effects via a stronger firm-employee relationship and fair bargaining conditions
Strictness of employment protection legislation	Excessive employee firing costs could drive unemployment rates higher; as above, some reasonable level of protection could be beneficial in terms of supporting aggregate productivity growth
Barriers to competition	Limiting market competition results in higher costs, prices, lower investment and as a result higher unemployment; similarly to the three previous factors, some regulations have beneficial impact upon the economy and society in general
Business environment quality	Leads to higher investment, higher competition and lower unemployment
Production Automation	A high rate of automation without a timely shift of labour force to other sectors could result in higher unemployment
Skills mismatch	Skill mismatches make hiring more difficult and result in a higher unemployment rate

Source: mainly Habrman, Rybák (2016) and other studies in the bibliography section

2.1. Upward phase of the economic cycle

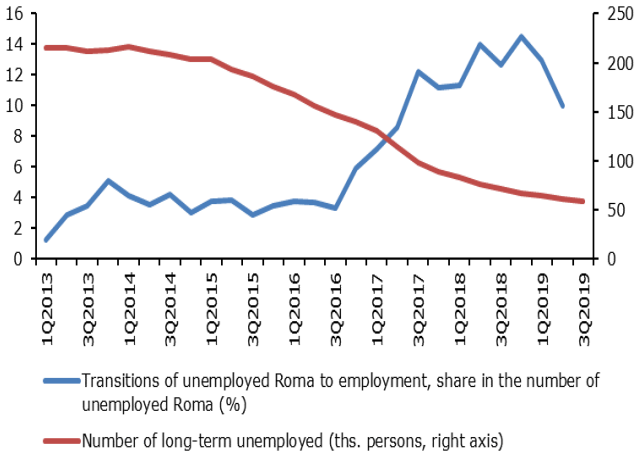
The recent period of labour market expansion provided the opportunity of entering the labour market on a more permanent basis also to disadvantaged groups, which previously struggled to enter formal employment. This could have positively impacted their skills and working habits, contributing to their structural integration into the labour market. Such beneficial impacts of temporary cyclical swings on structural unemployment outcomes is supported in the literature by e.g. Ball (2009). Chart 4 aims to demonstrate this relationship using official OECD NAIRU estimates and actual unemployment rates. To demonstrate a potential structural impact in the Slovak labour market, Chart 5 shows a marked reduction of long-term unemployment during the recent long upswing in the labour market accompanied by increased chances of finding a job for the Roma population, previously largely perceived to be standing outside of the labour market. Similarly positive developments were recorded also within the weakest regions of Slovakia in terms of unemployment rates.

Chart 4 Comovement between actual and structural unemployment rates in OECD countries (3 year average vs. previous 3 years change)



Source: OECD

Chart 5 Long-term unemployed and Roma in the labour market



Source: LFS (SO SR microdata), long-term unemployed from Labour offices

Note: the number of Roma approximated as persons with Roma nationality or speaking Roma language. Transitions Expressed as a 4-quarter moving sum and its share in the average number of unemployed Roma.

2.2. Active labour market policy

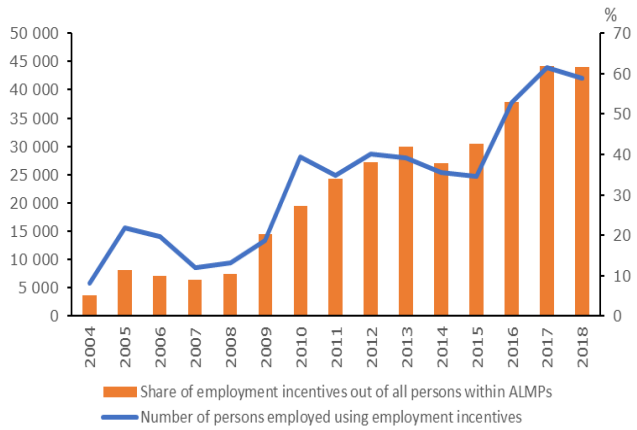
Active labour market policy includes measures actively helping the unemployed to improve their position in the labour market via mainly job-search assistance and guidance, retraining or incentivising employers to hire long-term or other unemployed persons. Typically, these measures have been found to improve the labour market status of participants (Card et al. (2017)). Some positive impact of youth employment incentives has been shown by Hidas (2016). Petráš (2018, 2019) shows a favourable impact of job creation subsidies in the public sector and retraining programmes.

Recently, hiring incentives for disadvantaged unemployed have gained prominence in Slovakia (Chart 6). This also holds for retraining programmes. At the same time, the overall volume of expenditure per one unemployed person increased significantly[4]. This suggests active labour market policy could have contributed to the observed reduction in structural unemployment rate.

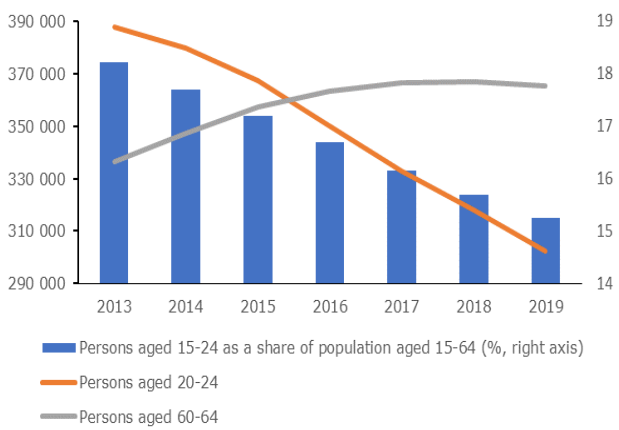
Chart 6 Use of selected active policy measures (persons, %)

Chart 7 Population ageing in Slovakia

[4] Source: DG Employment and Social Affairs, SO SR.



Source: EC



Source: SO SR

2.3. Demography

Since 2013, the number of working-age (15 – 64) inhabitants is declining. The number of persons nearing the age of retirement has been growing and now significantly exceeds the declining number of youths entering working age (Chart 7). As a result, the share of youth in working-age population is declining. As youth typically have a higher unemployment rate (this is a natural phenomenon across countries, as they are more prone to search for optimal employment). Their declining share therefore compositionally reduces the overall unemployment rate. The ageing and high exit into retirement also creates transitional conditions favourable to employment of some groups of population previously thought as hard to employ. More generally, a demographic and labour force decline is in the first place an adverse phenomenon from an economic perspective due to potentially adverse output, productivity and competitiveness effects which over the long run should affect also the labour market adversely.

2.4. Improvements in human capital quality

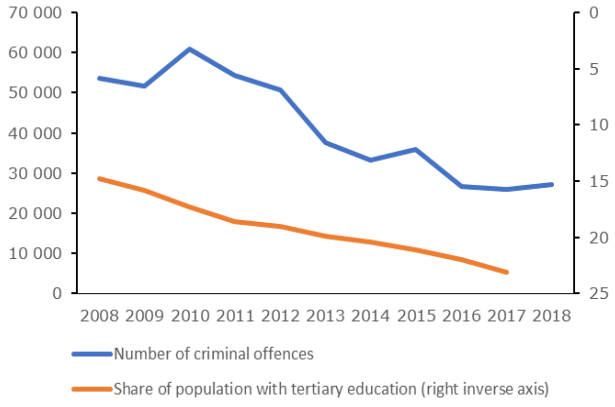
Human capital (education level, the level of criminality, social responsibility etc.) entails attributes which could positively affect an individual's propensity to participate in employment[5]. There have been some positive developments taking place over the recent years which could have supported employment outcomes, namely a higher rate of participation in tertiary education and a lower crime rate (Chart 8)[6]. A higher rate of university education attainment at the same time helped the development of some specific sectors in Slovakia, such as corporate shared service centres and other skilled services. The increased employment in these sectors can be regarded as a structural phenomenon.

Chart 8 Human capital quality indicators potentially affecting the unemployment rate (number, %)

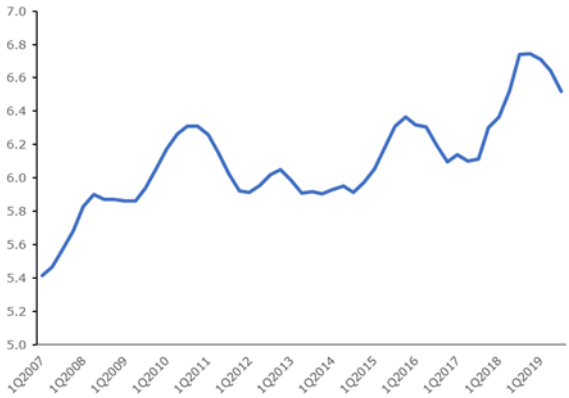
Chart 9 Persons working outside their region of residence (% of employment)

[5] E.g. Ridell, Song (2011), Liu, Fraumeni (2020)

[6] Relatively weaker educational outcomes in previous years, such as PISA results of Slovak pupils are at the same time an important policy issue to be taken into account.



Source: Eurostat
Note: population aged 25 – 64.



Source: SO SR, LFS microdata
Note: the chart shows a 4-quarter moving average.

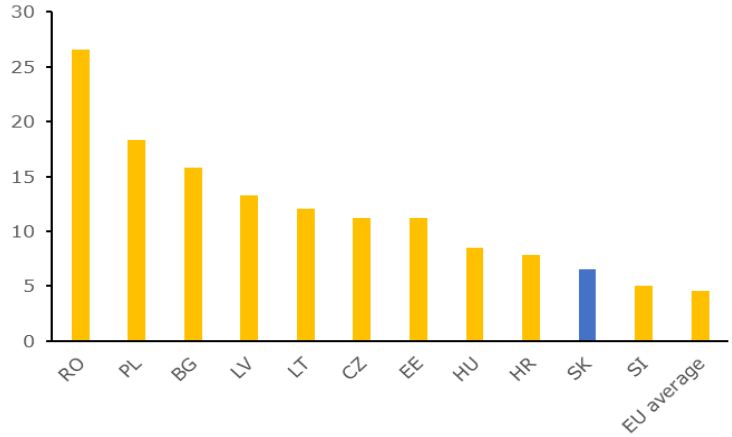
2.5. Increased labour mobility

Higher wages and labour demand over time led to a higher number of more attractive employment opportunities, which could have been increasingly considered also by people from more distant regions and from regions with fewer employment options. Chart 9 shows that inhabitants have become more willing to consider employment outside of their region of permanent residence. The number of those working in regions other than their permanent residence increased by around 30 % (or approximately 40 ths. persons) between 2007 and 2018. This increase suggests that higher labour mobility could be an important factor behind the observed structural unemployment decrease.

2.6. Higher labour productivity

Within the 2014-2019 period, labour productivity increased overall by 6.5 % (Chart 10), enabling workers to achieve higher earnings over time. This in turn allowed greater spending on services, supporting employment in the sector. Higher productivity also goes hand in hand with firm profitability and turnover, which incentivises investment potentially leading to higher labour demand. Overall, it is likely that permanently higher labour productivity has potential to pull down unemployment rates. The increase in labour productivity in Slovakia was not negligible and above EU average, but more moderate than most other countries in the CEE region.

Chart 10 Cumulative labour productivity increase in 2014 - 2019 (%)



Source: Eurostat

3. Quantifying the impacts of main drivers on the unemployment rate

This section presents a panel regression model and its modifications providing estimates of some of the above indicators' impacts on the structural unemployment rate.

3.1. Method of estimation and variables

The model equation is estimated primarily by OLS panel regression using fixed effects[7]. The estimation period spans the years 2002 to 2018 for all EU countries and the UK. The variables enter the equation as level quantities. If the resulting residuals exhibit stationarity, the estimated equation can be considered as an equilibrium relationship. We focus on the relationship in levels of the variables, as some important data patterns (e.g. a potential relation between the level of economic performance and the level of unemployment) may be neglected if we only focus on changes.

The model of interest has the following form and the expected signs of the impacts of individual variables are as follows:

(1) $unemployment\ rate_{it} = f\ (cycle_{it}\ (-),\ labour\ costs_{it}\ (+),\ almp_{it}\ (-),\ ub\_rr_{it}\ (+/-),\ structural\ economic\ performance_{it}\ (-),\ wap\_rel_{it}\ (+))$

We use a number of versions of the variables in equation (1) in order to verify robustness of our results showing the reaction of structural unemployment to a number of explanatory variables. Three variants of the economic cycle (*cycle*) are being utilised: an OECD output gap measure (*ygap)*, output gap calculated by an HP-filter (*ygap_hp*) and economic sentiment indicator (*esi*). Labour costs are also being represented by 3 different indicators (unit labour costs (*ulc*), ratio of compensation per employee to nominal labour productivity (*l_cost*)) and an indicator of tax and social security burden on labour incomes (*tax_wedge*))[8,9]. The *almp* indicator represents the ratio of the volume of expenditure on active labour market policies to GDP divided by the unemployment rate to obtain an *almp* intensity measure, inspired by a number of studies, e.g. Heimberger (2019). The *ub_rr* variable represents the net unemployment benefit replacement rate. The economic performance is included via 2 alternatives. The first one is GDP per capita in constant prices and purchasing power parity (*gdp_cap*). It is being applied in equations with *ygap* and *esi* as the cyclical indicators. The second one is the trend GDP per capita in constant prices and purchasing power parity (*gdp_cap_trend*) obtained via the HP-filter. This latter indicator is being applied together with the *ygap_hp* variable. The fact that we use one cycle indicator in each estimated equation helps us to interpret the impacts of the remaining variables as impacts on the structural unemployment rate, i.e. the cyclical position is taken as given. The *wap_rel* variable measures the number of persons of working age divided by the total population above age 15 in the base period 2002. The dependent variable is either the standard unemployment rate *ur* (Eurostat) or *nairu* (OECD). An overview of the data sources is provided in Appendix 1.

The model aims to consider the most important aggregate country-level unemployment drivers. A very high number of drivers could reduce the reliability of the estimated parameters. Moreover, some more

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[7] The Hausman test statistic was not statistically significant, enabling the use of both fixed effects and random effects models. The random effects estimates are not substantially different from fixed effects, therefore they are not presented here. We apply cluster-robust estimation of residual variance, which should control for serial correlation at the individual country level.

[8] A broader set of labour cost related indicators could also include employment protection (*epl*) indices or wage bargaining indicators such as union coverage etc. However, the former has limited variability, reducing its usefulness for the type of analysis carried out in this study and bargaining indicators are missing for a number of years and countries.

[9] In this study, we view the tax wedge indicator as an alternative way to measure labour costs and the impacts of changes in the tax wedge as comparable to other random shocks in labour costs not reflecting labour productivity.

detailed structural indicators of an economy with a potential effect on unemployment are not available as long enough time series. The levels of the *gdp_cap* and *gdp_cap_trend* variables are included in the model to proxy some of these structural country features, such as quality of education, innovation levels, quality of the business environment etc. The GDP per capita indicators could potentially proxy favourable social and economic developments, institutional quality and their reforms within a given country with a potential impact on the unemployment rate.

The coefficients of the cycle variables in equations with *nairu* depict the possible hysteresis impacts stemming from cyclical developments, i.e. partial effects of cyclical developments also on structural variables. On the other hand, if standard *ur* is the dependent variable, the cyclical variables' impacts include both typical cyclical and hysteresis effects.

A priori, we expect beneficial impacts stemming from ALMP spending and adverse ones from levels of unemployment benefits which are too high, considering also potential positive productivity effects of the existence of an appropriate level of unemployment benefits. It is also expected that an increase (decrease) in the share of working-age population could result in some transitional increase (decrease) in unemployment rates[10] as additional workforce cannot be perfectly matched to available jobs (or alternatively some of the jobs turning to vacancies due to retirement are available to be filled by the unemployed). There could also be compositional effects in the same direction mentioned earlier in Table 1. Population developments are however more complex than this and there could be serious adverse effects of declining working population in terms of reduced potential output (*gdp_cap* or *gdp_cap_trend*).

In the following section, we estimate these theoretical impacts using variants of Equation 1. Apart from more traditional fixed-effects estimation, we also apply the Arellano-Bond (AB) estimator, which is based on the generalised method of moments (GMM). This method provides an additional robustness test of the fixed-effects results and helps to obtain more reliable estimates as it is likely to reduce problems of endogeneity, autocorrelation and resulting biasedness of results[11]. This method works with first differences of the variables and their lagged values.

Alternative versions of the main equation were also estimated using time fixed effects (year-specific effects on the unemployment rate common for all countries in the sample) and one-year time lags of the individual explanatory variables. An even longer period of impact transmission is possible with the AB estimator, which entails a lagged dependent variable as the regressor.

3.2. Main estimates of the model equation

The estimated variants of equation 1 with unemployment rate as the dependent variable are shown in Table 2 (Table P2 in Appendix 2 is the corresponding version with NAIRU as the dependent variable). The table focusses on those specifications of equation 1 which achieved a high level of coefficient significance and explanatory power (R^2). A full presentation of all combinations of the possible types of regression equations (with lags and/or time fixed effects) and variants of indicators (e.g. *ygap*, *ygap_hp* and *esi*) would be confusing and a large number of the estimated equations would have insignificant parameters. The table shows coefficient values (impact of unit changes in the explanatory variables on the unemployment rate) and R^2 values. It also informs whether time fixed effects or lags of variables have been used for the given estimation variant. Columns 1 to 6 show estimation results from regressions in levels of the variables and the corresponding cointegration test values. All of them confirm the presence of cointegration (i.e. the existence of an equilibrium relationship in levels) supporting consistent estimation outcomes in these cases. To verify the robustness of these results, columns 7 to 10 also show estimation outcomes based on the potentially more reliable AB estimator. Here, the estimation is carried out in first differences[12], but the estimates in Table 2 can be interpreted as the impacts of unit changes in levels on the level of the unemployment rate, similarly to columns 1 to

[10] These transitional effects could take a number of years, as documented by Grabek, Kłos (2013); Fabiani et al. (2001); Balmaseda et al. (2000); Fritsche, Logeay (2002), Mendieta-Muñoz et al. (2020); Jean, Jimenez (2007)

[11] Wolbring (2019), Ullah et al. (2017)

[12] Therefore cointegration is not tested.

6. The coefficients in columns 7 to 10 must be multiplied by a factor of approx. 2 (in Table 2) and 5 (Table P2) to obtain the long-run impact. The reason is the presence of the lagged unemployment rate as an additional explanatory variable in the AB procedure. We also tested for differences in *gdp_cap* and *gdp_cap_trend* coefficient values between new and old EU member states, but these were not significant.

Some of the explanatory variables are characterised by uniformly significant coefficients with the expected sign. This holds especially for *almp, gdp and wap* variables and is also true for the table P2 with NAIRU. The influence of the cycle is also statistically significant, which also holds in most specifications with a somewhat lower magnitude in the NAIRU equations.

The *ub_rr* variable is not statistically significant in any of the estimated cases, which underlines the case for both positive and negative effects, hard to identify with a single regression model.

There was some support for the adverse impact of increased labour cost in excess of productivity growth. Especially the *ulc* and *l_cost* indicators have significant coefficients close to theoretical expectations except for two insignificant cases with NAIRU. The significant expected coefficients were recorded mainly with the AB estimator. The potentially higher reliability of the AB estimator and results from the literature[13] on labour cost shocks support the view that upward labour cost shocks above productivity growth rates can have an adverse impact on unemployment rates. As shown in Table 3, the impact could be approximately 0.2 p.p. after a 1 p.p. increase in the ratio of labour costs to labour productivity.

These results have some further important implications. We can use them to decompose (structural) unemployment rates changes over time into contributions due to individual drivers. This is not typically possible with standard filters commonly used to derive structural unemployment rates (such as HP filter, Kalman filter etc.). The above panel approach can therefore be used to complement these filters. The estimated coefficients suggest that structural unemployment can change significantly over time and that lower or persistently low unemployment can be supported by some economic policy principles: 1) implementing effective active labour market policies, 2) carry out structural reforms capable of durable increases in economic performance, 3) avoid labour cost increases without corresponding labour productivity increases. Any significant improvement in policy areas such as education, research and development, innovation, healthcare, business environment, infrastructure, environment and public services can contribute to higher structural economic performance and thus contribute to a lower unemployment rate.

Results with NAIRU in Table P2 support the idea of labour market hysteresis. Given a cyclical shock in the economy, structural unemployment rate may react in the same direction. An adverse shock can negatively affect the employability of some laid-off employees, resulting in depreciation of skills and work habits. On the other hand, a favourable cyclical shock can result in a more permanent absorption of persons originally outside of structural employment.

Table 3 presents a summary of the unemployment rate impacts of changes in individual drivers. For each variable, the summary measure is calculated as the average of significant coefficients from Table 2.

[13] E.g. employer surveys (Surveys of the Automotive industry association of the SR (2018, 2019)) or literature reviews such as Hamermesh (2014), Lichter et al. (2014).

Table 2 Regression equation estimates with unemployment rate as the dependent variable

	Dependent variable and method of estimation (equation variant number in parentheses)									
	(1) UR	(2) UR	(3) UR	(4) UR	(5) UR	(6) UR	(7) UR	(8) UR	(9) UR	(10) UR
Explanatory variable	FE	FE	FE	FE	FE	FE	AB estimator	AB estimator	AB estimator	AB estimator
lagged unemployment rate	- -	- -	- -	- -	- -	- -	0.459 ***	0.478 ***	0.463 ***	0.460 ***
ygap	-0.515 ***	-0.537 ***	-0.418 ***	- -	- -	- -	- -	- -	-0.223 ***	-0.300 ***
esi	- -	- -	- -	-0.123 ***	- -	- -	- -	- -	- -	- -
ygap_hp	- -	- -	- -	- -	-0.529 ***	-0.378 ***	-0.312 ***	-0.342 ***	- -	- -
tax_w	0.093	0.093	-0.146	-0.177	-0.043	- -	- -	-0.173 **	- -	- -
ulc	- -	- -	- -	- -	- -	0.167 **	0.086 **	- -	0.134 **	- -
l_cost	- -	- -	- -	- -	- -	- -	- -	- -	- -	0.119 *
almp	-20.757 ***	-18.309 **	-17.775 **	-22.487 ***	-24.732 ***	-21.786 **	-15.934 ***	-7.713 **	-12.263 ***	-12.368 ***
ub_rr	0.007	0.002	0.009	0.026	0.020	-0.008	-0.012	0.002	0.027	-0.002
gdp_cap	-10.533 ***	-15.053 ***	-12.146 ***	-13.869 ***	- -	- -	- -	- -	-14.001 ***	-5.920 ***
gdp_cap_trend	- -	- -	- -	- -	-11.281 ***	-19.181 ***	-10.397 ***	-7.708 ***	- -	- -
wap_rel	0.152 ***	0.124 **	0.237 ***	0.130 **	0.123 ***	0.155 *	0.083 *	0.244 ***	0.090 *	0.155 **
N	350	350	350	350	350	391	355	318	355	355
R^2	0.896	0.918	0.842	0.795	0.834	0.797	0.514	0.677	0.506	0.757
R^2 adj	0.887	0.907	0.828	0.777	0.819	0.779	0.504	0.670	0.496	0.752
Time fixed effects	N	Y	N	N	N	N	N	N	N	N
Lagged explanatory variables	N	N	Y	Y	N	Y	N	N	N	N
Cointegration (Kao test, p-value)	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-
Residual stationarity (summay indicator)	Y	Y	Y	Y	Y	Y	-	-	-	-

Source: author's calculations.
Note: gdp_cap and gdp_cap_trend are included in natural logarithm. N in the left column is the number of observations. R^2adj is the adjusted R^2. FE = fixed effects estimator. AB = Arellano-Bond estimator. Abbreviations Y,N = yes, no. The summary indicator of residual stationarity applies 4 indicators available within the Eviews software; in addition, a separate cointegration Kao test is being applied in each level equation. * statistically significant at the 10 % level, ** 5 % level, *** 1 % level. „–" means the indicator has not been included in the given variant. Variants (1) to (6) estimated via robust variance procedures. Variants (7) to (10) are free from residual autocorrelation. AB estimation uses at most 2 lags of explanatory variables as instruments. The Sargan test has not rejected the hypothesis of valid instruments. Time fixed effects inclusion would not substantially change the results in variants (3) to (6).

Table 3 Summary of the significant impacts on structural unemployment rate

Explanatory variable	Change of the explanatory variable	(1) Average impact in p.p.	(2) Impact in p.p. (variant 2, tab. 2)	(3) Immediate impact in p.p. (variant 10, tab. 2)	(4) Long-term impact in p.p. (variant 10, tab. 2)
output gap	+ 1 p.p.	-0.08	-0.54	-0.30	-0.56
labour costs	+ 1 p.p. share in productivity	0.20	-	0.12	0.22
almp	+ 0,1 p.p. of GDP	-0.22	-0.18	-0.12	-0.23
gdp	+ 1%	-0.15	-0.15	-0.06	-0.11
wap_rel	+ 1 p.p.	0.20	0.12	0.15	0.29

Source: author's calculations
Note: the average impacts calculated from the statistically significant indicators in Table 2. The labour cost impact based on variables *ulc* and *l_cost*. The GDP impact based on variables *gdp_cap* and *gdp_cap_trend*. The almp intensity change impact calculated assuming a 10 % initial unemployment rate. When summarising the AB estimates (included in columns 1 and 4), the short-term coefficient from Table 2 is divided by number (1-x), where x is the lagged unemployment rate coefficient. The average output gap impact uses data from Table P2 (output gap impact on the structural unemployment rate). The output gap impact on the structural unemployment rate can be found in column 1 (columns 2 to 4 include cyclical effects of output gap).

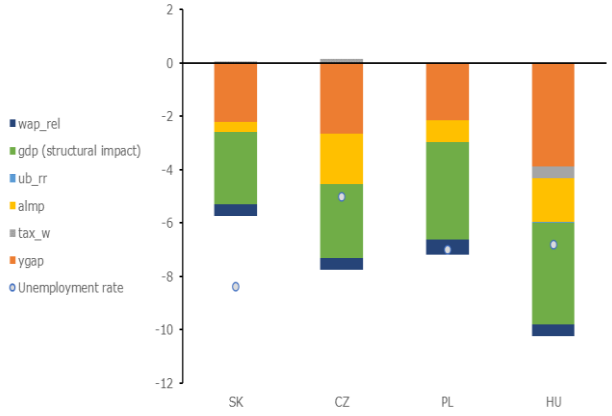
4. Drivers of unemployment declines in V4 countries during the 2014 – 2019 recovery

In this section, the equation variant (2) with the highest explanatory power (R^2) will be used to provide contributions of individual drivers to the recent unemployment decline in V4 countries. A second version of the contributions will also be presented using the AB estimates with the highest explanatory power (variant 10). The cumulative decline in unemployment rate and the contributions are shown in Charts 11 and 12.

Variant 2 explains 67 % (5.7 p.p.) of unemployment rate decline in Slovakia. In Poland, the model estimate explains more or less the whole decline (7.2 p.p.). On the other hand, in Hungary and Czech Republic, the actual decline amounted to only two thirds of the estimated decline (estimates amounted to 10.2 and 7.6 p.p. respectively). The upward cyclical phase of the economy explained a substantial part

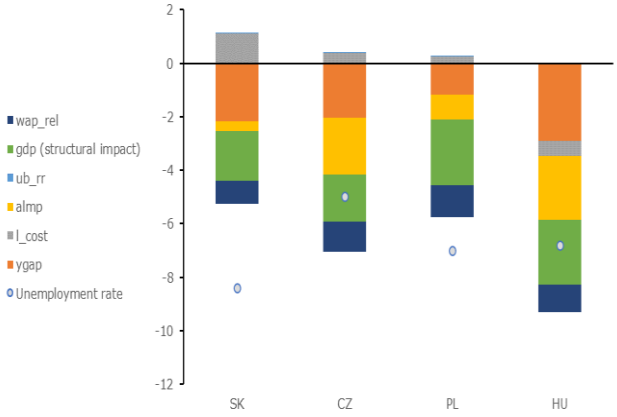
of the unemployment decline, suggesting a likely subsequent correction. A smaller part of this cyclical decline could also be of a more permanent structural nature due to hysteresis (see Table 3, column "Average impact"). The improvement in structural (permanent) economic performance also had a downward effect. A non-negligible role was also played by active labour market policies and the decline in working-age populations. These two factors most likely enabled some unemployed individuals to permanently exit long-term unemployment. The AB estimates result in similar contributions to the above described ones. However, they also assign a significant impact to labour costs. In Slovakia, the increase in average labour costs as a ratio to labour productivity was the highest in V4 and therefore partially hampered the unemployment decline. The unexplained residuals are determined by other country specific factors which cannot be captured by the models.

Chart 11 Decomposition of unemployment declines in V4 in 2014-2019[14] (contributions in p.p, fixed effects estimate, variant 2)



Source: author's calculations

Chart 12 Decomposition of unemployment declines in V4 in 2014-2019 (contributions in p.p., AB estimate, variant 10)



Source: author's calculations

Some relevant data is available to provide evidence on the factors that might have contributed to the large residual in case of Slovakia. In Slovakia, labour mobility increased since 2007 and is potentially an additional driver not captured by the model above due to data unavailability. Eurostat data however suggests that the mobility increase was not larger in Slovakia than in other V4 countries[15]. More importantly, active labour market policies underwent some efficiency enhancement in the given period (Hidas et al. (2016)), which could have resulted in a somewhat larger impact than the expenditure intensity implied in the models above. Another potential reason is that in Slovakia, the economic recovery and related aggregate demand growth was to a smaller extent met by technological improvements and to a larger extent by simple extension of the employed labour force. This argument seems relevant, as Slovakia in comparison with the other V4 countries recorded a smaller increase in investment, capital intensity and labour productivity, as well as the rate of innovation and research and development[16]. One potential reason of these less dynamic developments could stem from stagnation in the quality of business environment in the country.

[14] = difference between the average number in 2019 and the average number in 2013

[15] We measure mobility in this case as the share of persons employed who usually work outside their NUTS2 region of residence. The data source is Eurostat LFS microdata obtained on the basis of the research project RPP n°185/2018-LFSEU-SILC-SES.

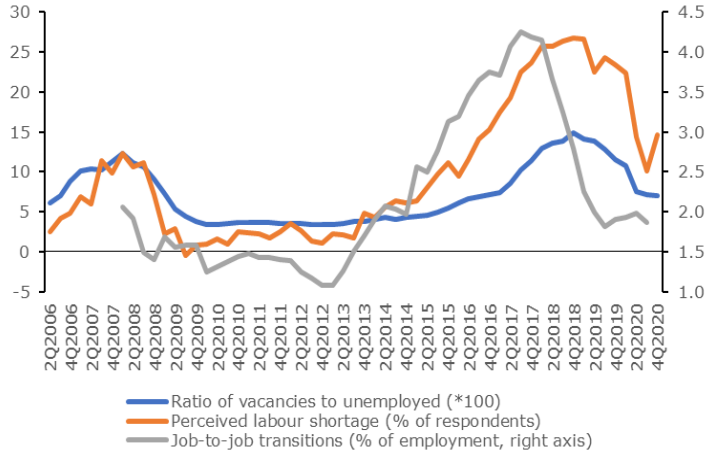
[16] The sources of the indicators mentioned in this paragraph are as follows: capital intensity, productivity, investment and research and development from Eurostat; innovation data from the OECD Innovation indicators; business environment quality data from the World Bank, Ease of Doing Business.

5. Current and expected structural unemployment rate developments in Slovakia

5.1. The coronavirus crisis eliminated the labour market overheating

As previous evidence and Chart 13 indicate, the Slovak labour market was overheated prior to the coronavirus crisis. This means that employers were aiming to employ a larger number of persons than is feasible in the long-term. Indicators such as high numbers of vacancies, labour shortages and the number of job-to-job flows strongly indicated overheating[17]. With the onset of the pandemic, the labour market situation deteriorated and unemployment increased to 7 %[18] towards the end of 2020. Correspondingly, the overheating indicators moderated. The labour market is stabilising and there are signs of recovery, but some risks related to the crisis persist even in mid-2021.

Chart 13 Labour market tightness indicators



Source: SO SR, Labour offices, profesia.sk, author's calculations

5.2. The impact of the cycle on NAIRU turned opposite

The above mentioned upward cycle in the economy in the pre-pandemic period supported also structural employment and unemployment. But the pandemic and the worsening in the cyclical conditions most likely acted to increase structural unemployment to some extent. According to NBS estimates, there was a worsening of the output gap in 2020[19] by 7 p.p. Given the elasticity -0.08 from Table 3, this could have meant an increase in structural unemployment rate by 0.6 p.p. This impact can decline in subsequent years, as the labour market recovers.

5.3. Strong labour cost growth and automation

Chart 14 shows that labour cost growth recently significantly exceeded productivity. This was brought about by the labour market tightness and some legislative measures. As a result, labour costs became the main barrier to future firm level growth (Chart 15). Consequently, firms had to consider more intensively options of increasing efficiency of individual production units. It is likely that these efforts are still present, as labour costs relative to productivity have not adjusted downwards during the most recent period. Empirical studies (e.g. Hamermesh (2014)) and the empirical results above suggest that employment can be adversely affected by labour cost shocks and that an adverse influence on unemployment due to this factor can persist in the near future. The legislative labour cost increases

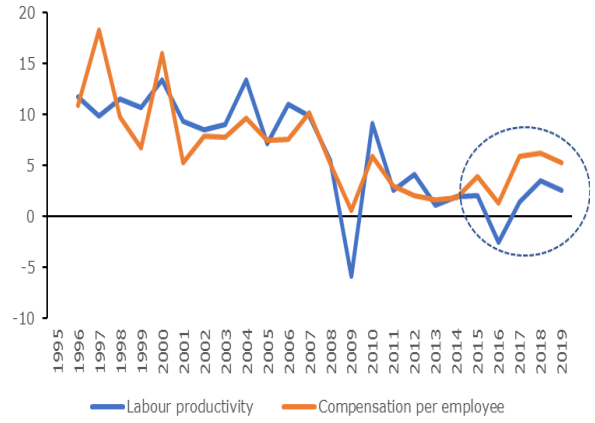
[17] Karšay (2018)

[18] In LFS methodology. The registered unemployment rate from the Labour offices recorded 7.4 %.

[19] Based on the NBS P4Q-2020 forecast.

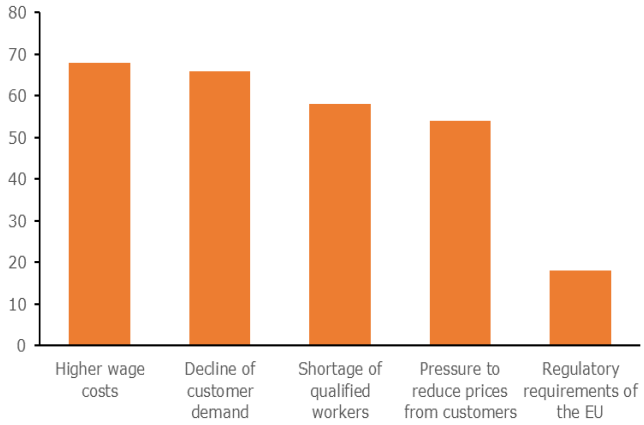
from 2018 until early 2020 could have amounted to approximately 1.3 % of labour costs[20]. Using the elasticity from Table 3 suggests that this could result in an upward influence on structural unemployment rate of about 0.3 p.p., mainly if the reaction takes place with a lag. On top of this direct legislative impact, labour costs increased cumulatively by 10 p.p more than labour productivity within the 2017 to 2019 period. Part of this increase can be permanent and result in additional upward pressure on structural unemployment rate.

Chart 14 Labour costs and productivity (growth in %)



Source: SO SR
Note: nominal variables, economy without public administration, education and health

Chart 15 Wage costs as a risk to future automotive growth (% of respondents, 2019)



Source: ZAP SR, PWC.
Note: % of respondents marking the given factor as risky regarding future growth prospects of the company

Apart from these specific effects, there is a general worldwide automation drive. Studies by OECD and PWC show that automation might significantly affect broad areas of the economy, such as manufacturing, transport, financial sector, and other services. These studies also show that Slovakia might be among the OECD countries affected the most due to its higher share of automatable sectors and somewhat lower current technological sophistication levels. This could result in some structural unemployment increase due to the automation process if redundant labour is not immediately employable in other sectors. However, the studies also stress that the automation process is typically gradual and takes decades, while the related jobs lost are over time replaced by expanding employment in other sectors, e.g. services, as automation also contributes to higher global wealth and related labour demand. Thus, automation might only be a gradual force not causing abrupt changes in unemployment.

5.4. Active labour market policies

It is unclear how the volume of expenditure or efficiency of labour market policies will evolve in the future. But in case of an increase by 0.1 % of GDP, one could expect a downward impact on structural unemployment rate by around 0.2 p.p. based on the results in Table 3. At present, the volume of ALMP expenditure as a proportion of GDP in Slovakia is among the lowest ones in the EU[21].

5.5. Increasing retirement rate and resulting vacancies

The adverse demographic developments, as described in Part 2.3, are affecting the Slovak potential output growth negatively. However, technically, the lower proportion of youth puts some downward compositional pressure on the unemployment rate and some vacancies due to increased retirement might be filled by persons previously in long-term unemployment. Table 3 suggests that if the ratio of

[20] The surcharges for public holiday, night and weekend work and above average minimum wage increases are considered herein. Author's calculations.

[21] Source: EC, DG Ecfin, 2018 data.

working-age to total population decreases by around 2 p.p. in the next 3 years[22], the unemployment rate might decline by around 0.4 p.p.

5.6. Increased hiring due to structural economic growth

Potential output of the Slovak economy has been growing in the past and is likely to continue to do so, although it will to a greater extent depend also on the presence of productivity enhancing reforms. The potential for growth stemming from lower labour costs is quickly declining. Other likely sources of potential growth in the future will include public investment (e.g. EU structural funds) and continuing domestic and global demand growth in the foreseeable future resulting in growing labour demand. Employment is likely to grow because of growing labour demand in services and growing investment and capital stock, which might be complementary to higher labour inputs.

6. Conclusion

The recovery period after the Great recession (2014-2019) witnessed a sharp unemployment rate decline partly driven by cyclical and partly by structural factors. The labour market temporarily absorbed a larger number of workers than it was able to employ in the long run. The overheating was eliminated with the onset of the coronavirus crisis.

Prior to the pandemic, some important structural (more permanent) factors were also driving unemployment downwards. The favourable cyclical phase helped to integrate some previously long-term unemployed persons back into the labour market. Higher ALMP spending and some efficiency enhancing changes helped improve the labour market status of participants. Even though the demographic developments are rather adverse from an economic perspective, they technically supported the decline in unemployment rate by enabling employment of some persons outside of permanent employment and compositionally reducing the share of youth with a higher unemployment rate. There were signs of rising quality of human capital (higher educational attainment, lower crime rate) with potentially favourable employment effects, despite some shortcomings in the quality of the education process. The labour force became more willing to move to other regions due to a higher overall wage level and more employment opportunities and this could have helped with reducing the structural unemployment rate. In addition, there was continuous structural economic growth accompanied by growing productivity, wages and investment with favourable effects on structural unemployment.

The econometric analysis of the drivers of unemployment confirmed statistically significant impacts of most of the abovementioned influences. It also hinted at the adverse effects of increases in labour costs above the level of labour productivity.

These findings were applied to decompose the unemployment rate declines across V4 countries. The decomposition showed both cyclical and structural drivers important for each country. The model can capture most of the decline in unemployment within the given period. But in Slovakia, the unexplained residual is sizeable. The potential explanations stem from more efficient active labour market policies focussed more on job creation subsidies and retraining, as well as a lower technological and capital intensity of the economic expansion in Slovakia. Related to the above factors, such as higher mobility or higher structural performance of the economy, a higher level of job-matching efficiency could have been behind the favourable structural unemployment developments, but its identification is outside the scope of the present study.

Beyond the 2014-2019 period, one can expect the repercussions from the coronavirus crisis, increasing production efficiency and automation to put an upward pressure on structural unemployment. These factors could be offset by a more favourable impact of structural economic growth and some reduction in unemployment stemming from the current demographic decline.

[22] Author's calculation

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Appendix 1 Statistical sources used in the regression analysis

Abbreviation	Name and description	Source
ur	Unemployment rate, % of economically active persons	Eurostat
nairu	Non-accelerating inflation rate of unemployment (structural unemployment rate, %)	OECD, Economic Outlook, Dec. 2020
ygap	Output gap, % of the level of potential GDP	IMF WEO, OECD, AMECO
ygap_hp	Output gap, % of the level of potential GDP, own calculation based on the HP-filter	author's calculations
esi	Economic sentiment indicator	European Commission (EC)
almp	Expenditure on active labour market policy as % of GDP (measures 1-7 of the EC classification) divided by the unemployment rate in the given country and period; indicator of expenditure intensity per unit of unemployment	EC, DG Employment and Social Affairs
tax_w	Tax and social contribution burden on labour; % difference between the cost of an employee to a firm and his/her net earnings	OECD
ulc	Unit labour costs; the share of nominal labour costs per employee and real labour productivity (%)	Eurostat
l_cost	Share of nominal compensation per employee in nominal labour productivity (%)	Eurostat
ub_rr	Net unemployment benefit replacent rate; average % of previous earnings valid for up to 2 years	OECD
gdp_cap	Gross domestic product per capita in PPP (in 2017 constant prices)	World Bank
gdp_cap_trend	Gross domestic product per capita in PPP (in 2017 constant prices); HP-filter trend; λ=100	Author's calculations
wap_rel	Population aged 15-64 as % share in population aged 15+; the denominator fixed in year 2002	Eurostat

Appendix 2 (Table P2) Estimated regression equations with NAIRU as the dependent variable

	Dependent variable and method of estimation (equation variant number in parentheses)									
Explanatory variable	(1) NAIRU FE	(2) NAIRU FE	(3) NAIRU FE	(4) NAIRU FE	(5) NAIRU FE	(6) NAIRU FE	(7) NAIRU AB estimator	(8) NAIRU AB estimator	(9) NAIRU AB estimator	(10) NAIRU AB estimator
lagged unemployment rate	- -	- -	- -	- -	- -	- -	0.804 ***	0.802 ***	0.728 ***	0.794 ***
ygap	-0.057 ***	-0.111 ***	-0.037 **	- -	- -	- -	- -	- -	-0.004	-0.004
esi	- -	- -	- -	-0.008	- -	- -	- -	- -	- -	- -
ygap_hp	- -	- -	- -	- -	-0.070 ***	-0.051 ***	-0.020 ***	-0.022 ***	- -	- -
tax_wedge	-0.005	-0.007	-0.049	-0.053	-0.019	- -	- -	-0.029 ***	- -	- -
ulc	- -	- -	- -	- -	- -	0.030	0.019 ***	- -	0.005	- -
l_cost	- -	- -	- -	- -	- -	- -	- -	- -	- -	0.033 *
almp	-4.927 **	-4.414 **	-4.493 ***	-4.990 ***	-5.915 ***	-5.403 ***	-1.074	-1.370 ***	-1.460 *	-2.278 ***
ub_rr	0.005	0.004	0.005	0.006	0.006	0.002	-0.002	0.004	-0.005	0.001
gdp_cap	-6.062 ***	-6.266 **	-6.930 ***	-7.193 ***	- -	- -	- -	- -	-2.628 ***	-1.701 ***
gdp_cap_trend	- -	- -	- -	- -	-6.803 ***	-8.690 ***	-3.104 ***	-2.376 ***	- -	- -
wap_rel	0.085 ***	0.089 ***	0.099 ***	0.090 ***	0.074 **	0.073 ***	0.027 ***	0.075 ***	0.032 ***	0.048 **
N	350	350	350	350	350	350	319	319	319	319
R^2	0.936	0.944	0.941	0.939	0.931	0.940	0.888	0.926	0.890	0.952
R^2 adj	0.931	0.936	0.936	0.934	0.925	0.934	0.886	0.925	0.888	0.951
Time fixed effects	N	Y	N	N	N	N	N	N	N	N
Lagged explanatory variables	N	N	Y	Y	N	Y	N	N	N	N
Cointegration (Kao test, p-value)	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-
Residual stationarity (summay indicator)	Y	Y	Y	Y	Y	Y	-	-	-	-

Source: author's calculations.

Note: gdp_cap and gdp_cap_trend are included in natural logarithm. N in the left column is the number of observations. R^2adj is the adjusted R^2. FE = fixed effects estimator. AB = Arellano-Bond estimator. Abbreviations Y,N = yes, no. The summary indicator of residual stationarity applies 4 indicators available within the Eviews software; in addition, a separate cointegration Kao test is being applied in each level equation. * statistically significant at the 10 % level, ** 5 % level, *** 1 % level. „–" means the indicator has not been included in the given variant. Variants (1) to (6) estimated via robust variance procedures. Variants (7) to (10) are free from residual autocorrelation. AB estimation uses at most 2 lags of explanatory variables as instruments. The Sargan test has not rejected the hypothesis of valid instruments. Time fixed effects inclusion would not substantially change the results in variants (3) to (6).