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Article

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Does Okun's law suffer from COVID-19? Evidence from Europe and the US – A research note

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Abstract

We analyse the effect of COVID-19 on the Okun's law relationship for several EU countries and the US. Results are based on regressions and a systematic DF-Beta analysis. Our results indicate that the year 2020 is an outlier in the Okun relationship. However, the direction of change is different in the European countries compared to the US.

Keywords: Okun's law, Covid-19, outliers
JEL Classification Codes: E30, J60

1. Introduction

The Covid pandemic has influenced economic activity worldwide. In 2020, the real GDP growth rate was negative in all industrialized countries and the unemployment rate in the US increased within three months from 3.5 % in Jan. 2020 to 14.7 % in Apr. 2020. However, the effects on international labor markets were heterogeneous: While the increase of the unemployment rate in the US economy was quiet dramatic (Cajner et al. 2020), the effect in European economies was only moderate (Ando et al. 2022).

Okun (1962) was the first who showed that business-cycle developments are negatively correlated with the change in the unemployment rate: This implies that positive business-cycle developments lead to a reduction in unemployment and vice versa. Much research has been conducted and almost all studies confirm this negative relationship (Knoester, 1986; Paldam, 1987; Kaufman, 1988; Moosa, 1997; Lee, 2000; Freeman, 2001; Silverstone and Harris, 2001; S¨ogner and Stiassny, 2002; Holmes and Silverstone, 2006; Knotek, 2007). Therefore, Blinder (1997) argues that Okun's law is a core element of practical macroeconomics.

Touching on previous results on the sensitivity of unemployment over the business cycle, we analyze whether the development of the unemployment rates in 2020, the year of the Covid-19

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pandemic, was in line with Okun's law. This analysis is not only important to understand how the Corona shock was digested, but also has far-reaching implications for future research.

The reminder is structured as follows: Section 2 provides a short literature overview, Section 3 lays out the empirical analysis and presents the results. Section 4 concludes.

2. Literature review

There exists a large variation of the Okun coefficient across countries. Ball et al. (2017) examine Okuns's law for the US and for 20 advanced economies. They confirm the Okun relationship for most of the countries and conclude that the relationship is fairly stable over time. However, they also highlight substantial variations in the slope coefficient across countries. For instance, the Okun coefficient, in its absolute terms, is only 0.17 in Japan, but relatively large in Spain (0.82). Ball et al. (2019) find that the absolute value of the slope coefficient is smaller in developing economies. They estimate an average Okun coefficient of 0.2 for the developing economies and a coefficient of 0.4 for advanced economies.

Other studies concentrate on the variation of the coefficient by age cohorts and gender (Hutengs and Statdmann, 2013; Dixon et al., 2017; Marconi et al., 2016). An et al. (2021) compare the relationship between aggregate demand and unemployment for advanced economies, emerging markets and developing economies as well as for different demographic groups. They show that the sensitivity of unemployment is larger during economic downturns. Wang and Huang (2017) derive similar results. Using a threshold in regression quantiles approach to investigate Okun's law, they find that the effect of differenced output on differenced unemployment is asymmetric in nature, and is more pronounced in recessions than in expansions. However, their study is limited to the US.

3. Data, empirical methodology, and results

To assess the effect of the Covid-19 crisis on the Okun relationship, we use annual data from AMECO for the US and the five largest EU countries. Hence, we focus on Germany, France, Italy, Spain and the Netherlands. This covers about 70 % of EU GDP in 2020.

For each country we run the following OLS regression:

$$\Delta u_t = \alpha + \beta \cdot \Delta GDP_t + \epsilon_t \quad (1)$$

where Δu_trepresents the change in the unemployment rate in period *t*, and ΔGDP_t represents the change in real GDP in period *t*. α is the constant term, β represents the Okun coefficient, and ϵ_t the error term in period *t*.

Although a lot of research efforts on Okun's law are based on quarterly data analyses, our analysis is based on a yearly data frequency for three reasons: First, when we switch to a quarterly structure, we need to incorporate Newey West standard errors to control for autocorrelation. This, however, would not allow for a adequate interpretation of the DF-Beta analysis, which represents the core of our methodology. Second, we would not only have to switch to robust standard errors, but also incorporate lags of the GDP growth rates. In case of i.e. the US, we would need to include two lags. That would again lead to misleading DF-Beta results. Third, given different degrees of labor market rigidity in considered countries, the implied lag structure would have to be different on a cross-sectional level. This would destroy the symmetry of our paper.

In a first step, we run the regression for the period 1992-2019, excluding the economic developments associated with the Covid-19 crisis. Afterwards, we also include the year of the Covid-19 crisis and run the regressions for the period 1992-2020. The regression results are displayed in Table 1.

Table 1. Estimation results.

Country		1992 – 2019 T_1	1992 – 2020 T_2	Δ $T_2 - T_1$
DE	α - coefficient	0.19	0.16	-0.03
		(0.16)	(0.15)	
	β - coefficient	-0.20***	-0.19***	0.01
		(0.07)	(0.06)	
	R^2	0.24	0.26	
FR	α - coefficient	0.55***	0.12	-0.43
		(0.14)	(0.13)	
	β - coefficient	-0.34***	-0.09*	0.25
		(0.07)	(0.05)	
	R^2	0.50	0.11	
IT	α - coefficient	0.25*	0.06	-0.19
		(0.13)	(0.15)	
	β - coefficient	-0.29***	-0.10	0.19
		(0.06)	(0.06)	
	R^2	0.41	0.09	
ES	α - coefficient	1.85***	0.79*	-1.06
		(0.35)	(0.40)	
	β - coefficient	-0.93***	-0.49***	0.44
		(0.11)	(0.11)	
	R^2	0.74	0.43	
NL	α - coefficient	0.53***	0.38**	-0.15
		(0.17)	(0.16)	
	β - coefficient	-0.30***	-0.24***	0.06
		(0.06)	(0.06)	
	R^2	0.45	0.40	
US	α - coefficient	0.98***	1.33***	0.35
		(0.26)	(0.22)	
	β - coefficient	-0.42***	-0.54***	-0.12
		(0.09)	(0.07)	
	R^2	0.47	0.66	

Note: Standard errors are given in paranthesis. ***, **, * indicate the statis- tical significance at 1 percent, 5 percent, and 10 percent levels, respectively.

For all countries under consideration, the Okun coefficient is negative and in most cases significantly different from zero for both periods under consideration. Hence, the results represent a negative relationship between economic growth and unemployment and are, therefore, in line with Okun's law.

Focusing on the 1992-2019 regression, the absolute value of the Okun coefficient is the largest for Spain (0.93) confirming the results of Ball et al. (2017). However, including the observation for 2020 leads to a dramatic decrease of the absolute value of the Okun coefficient towards 0.49. The change in the slope coefficient is largest for Spain (see last column of Table 1). Furthermore, in all cases but Germany the goodness-of-fit measure (R2) decreases, if 2020 is included. This holds particularly for Spain, France and Italy.

For the US, the Okun coefficient also changes. However, in contrast to the European economies the absolute value of the Okun coefficient increases from 0.42 to the level 0.54, so that the Okun relationship becomes steeper. Hence, the findings of Wang and Huang (2017, p. 1533)

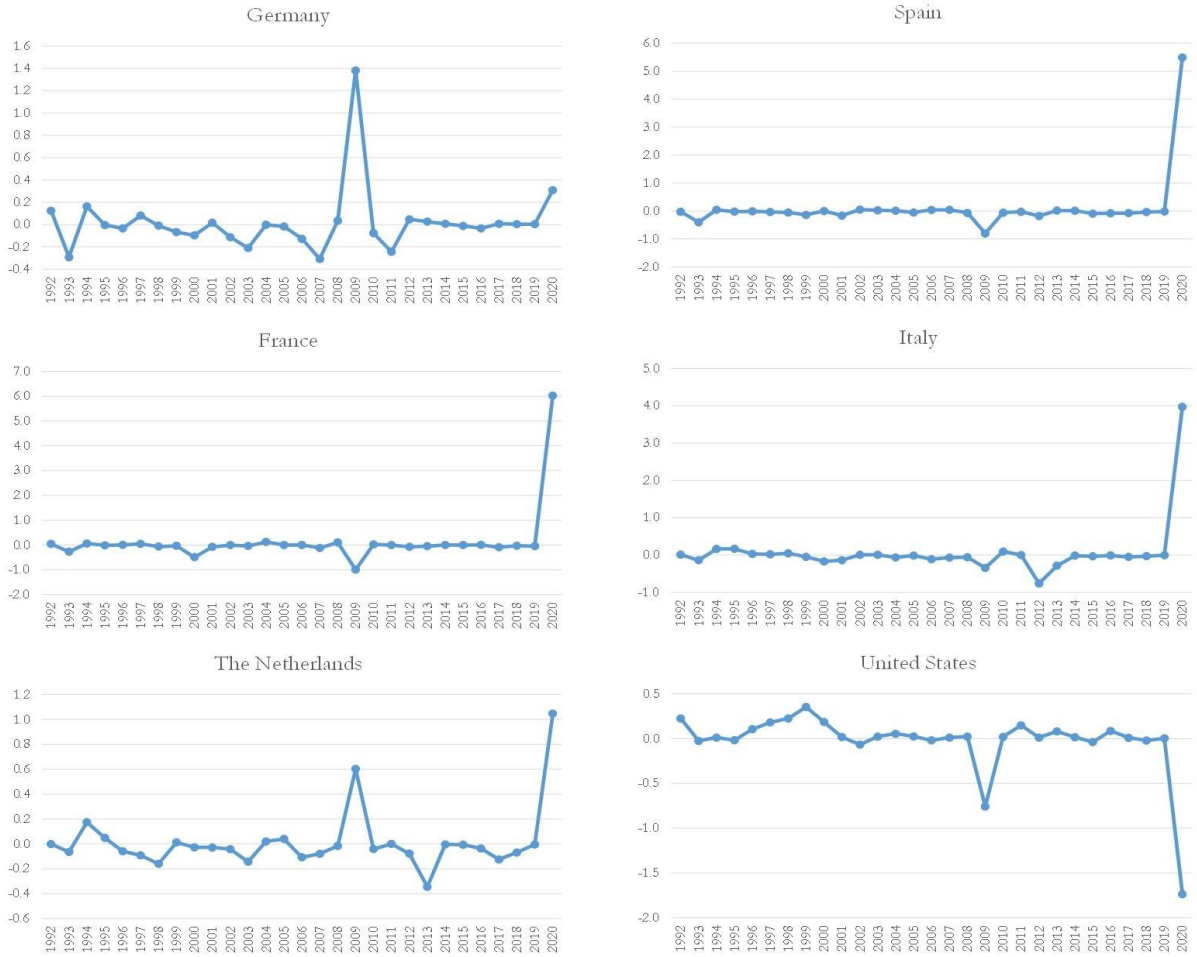
are confirmed that – for the US – "the effect of differenced output on differenced unemployment is asymmetric, and is more pronounced in recessions." However, this result does not hold for the European economies.

In a next step, we perform a so called DF-Beta analysis to check the regression for influential observations (outliers). Therefore, we successively exclude one observation from our sample and examine, how the estimated coefficients change due to the omission of one observation.

To be in a position to identify an influential observation, one has to determine a critical value to operationalize the analysis. Some authors regard an observation as an influential observation, in case that an omission of this observation changes the estimated coefficient by more than one standard error (Bollen/Jackman 1990). It seems to be common practice to use this critical value (Stata 2022, p. 15).[1]

The results of the analysis are plotted in Figure 1. It becomes clear that – with the exception of Germany – the year 2020 is an influential variable for all countries. However, the effects go in opposite directions: Omitting the observation for the year 2020 reduces the absolute value of the Okun coefficient in the European countries while it increases the absolute value of the Okun coefficients for the US. The overall size of these effects are clearly higher than the threshold mentioned above.

Figure 1. Influential observations: Output of a systematic DF-Beta analysis.



Note: The vertical axis displays the change in the Okun coefficient, in case that the respective year is excluded from the data set. Measurement: Units of standard errors. The threshold is one standard error.

[1] Other authors use a tighter critical value which depends on the number of observations (n). The formula to compute this critical value is given as $2/\sqrt{n}$ (Belsley/Kuh/Welsch 1980).

Examining the overall time series for all countries, one can detect that also the year 2009 is an influential point in time for Germany, and – to a lesser extend – for the US and The Netherlands. The different results for European countries compared to the US could possibly be caused by the different ability of firms to dismiss workers. According to the OECD Employment Protection Legislation Database[2] all European countries under consideration are among the countries with high or middle regulatory protection against individual dismissals of regular workers while the US provides only low regulatory protection. Further, the regulation of collective and mass dismissals is also less strict in the US compared to the European countries in our sample (OECD, 2020). Additionally, France, Italy and Spain have taken further measures to increase protection against job dismissal during the COVID-19 crisis (OECD, 2020). In the wake of COVID-19, however, all countries under consideration introduced massively fiscal measures to support the labor market.[3] Further research would be needed to determine the effect of the implemented measures on the Okun coefficient.

4. Concluding remarks

From the macroeconomic perspective the Covid-19 crisis revealed a world-wide economic downturn. The growth rate of real GDP was negative and unemployment rates in the US increased to a large extend. However, the effects on labor markets were heterogeneous. While the increase of the unemployment rate in the US economy was quiet dramatic, the effect in European economies was only moderate.

Using annual data for several European economies and the US for the period 1992-2020 we analyze the effect of the pandemic on the relationship between the change in unemployment and the change in real GDP. For all countries under consideration our results confirm the Okun's law relationship. Further, our results show that observation in year 2020 has a tremendous influence on the estimations: While including the year 2020 results in a decline of the Okun coefficient in absolute terms for several European countries, it results in an increase for the US.

In the future, empirical studies have to be aware of this aspect and should examine, whether the old relationship will reestablish. In this case the year 2020 should be treated as an outlier. In case of a new lasting Okun relation- ship, empirical researchers should consider using a structural break in their time series analysis.

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[2] https://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection.htm

[3] See for example the Fiscal Monitor Database of Country Fiscal Measures in Response to the COVID-19 Pandemic of the IMF. https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19

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