Testing for Hysteresis in Unemployment in the Belgian Regions

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Abstract

As a consequence of the economic crisis, unemployment figures are soaring. Given the history of Belgian unemployment, it is a concern that these unemployed people will be lost for the labour market in the future. Albeit this observation on the Belgian level, the question is whether this persistence is also found in the three Belgian regions. In this paper regional unemployment series are analysed using different tests for the presence of hysteresis.

Keywords: hysteresis, regional economics, unit root tests

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1. Introduction

As a consequence of the present economic crisis, unemployment figures are soaring. Given the history of Belgian unemployment, it is a concern that these unemployed people will be lost for the labour market in the future. If one looks at a graphical representation of the Belgian unemployment rate, one can only conclude that there is a certain degree of hysteresis in the past, i.e. cyclical unemployment tends to evolve in structural unemployment. In the eighties, for example, the unemployment rate failed to return to the lower levels experienced before the oil shocks.

This is observed in many European countries as opposed to e.g. the United States of America. A common explanation for this persistence is that the European labour markets show more rigidities, especially compared to the American more flexible one. The concept of hysteresis in unemployment was introduced by Blanchard and Summers (1986) denoting situations where cyclical shocks have permanent or very persistent effects on the unemployment rate.

Albeit this observation on the Belgian level the question is whether this persistence is also found at the regional level. Again, a simple graphical inspection shows us that there is probably some degree of unemployment persistence in the three Belgian regions. In the Walloon Region and the Brussels Capital Region, however, the persistence seems worse than in the Flemish Region.

The goal of this paper is to analyse regional unemployment series using different methodologies to test for the presence of hysteresis. Since full hysteresis is defined as cyclical shocks having permanent effects on the unemployment level, an obvious methodology for this purpose is to use unit root tests. The most commonly known test to this end is the (augmented) Dickey-Fuller test, which tests the null hypothesis of non-stationarity (Dickey and Fuller, 1979). A second test applied in the paper is the Phillips-Perron test (Phillips and Perron, 1988), which, just like the augmented Dickey-Fuller test, improves on the ordinary Dickey-Fuller test because it corrects for serial correlation. Given the low power of these tests in case of a near unit root process, other tests are also used in this paper. The Kwiatkowski-Phillips-Schmidt-Shin (KPSS)-test (Kwiatkowski et al., 1988) is a test of the null hypothesis of stationarity, and thus complements in a way the two previous tests.

To address the aforementioned power problem further, some panel unit root tests are carried out. The aim of these panel unit root tests is to combine information from the time dimension with the information obtained from the cross-sectional dimension, in the hope that inference about the existence of unit roots is more precise by taking into account the latter. The Im-Pesaran-Shin (IPS)-test (Im et al., 2003) tests the null hypothesis that all series in the panel are non-stationary against the alternative hypothesis that some series are stationary and other contain a unit root. The Hadri-test (Hadri, 2000) is a generalisation of the KPSS-test, and tests the null hypothesis that all series in the panel system are stationary.

This paper continues as follows. Section 2 first gives some background information on hysteresis. Next, Section 3 contains a descriptive analysis of the unemployment rate of Belgium and its regions. In Section 4 different unit root tests are carried out to test for the presence of hysteresis. Section 5 concludes.

2. Hysteresis

Hysteresis in unemployment postulates that cyclical fluctuations have permanent effects on the level of unemployment, rather than that the unemployment returns to a kind of equilibrium level. In an influential article, Blanchard and Summers (1986) point out the possible danger of permanent effects that recessions can have on unemployment. They also provide some arguments why this could be the case.

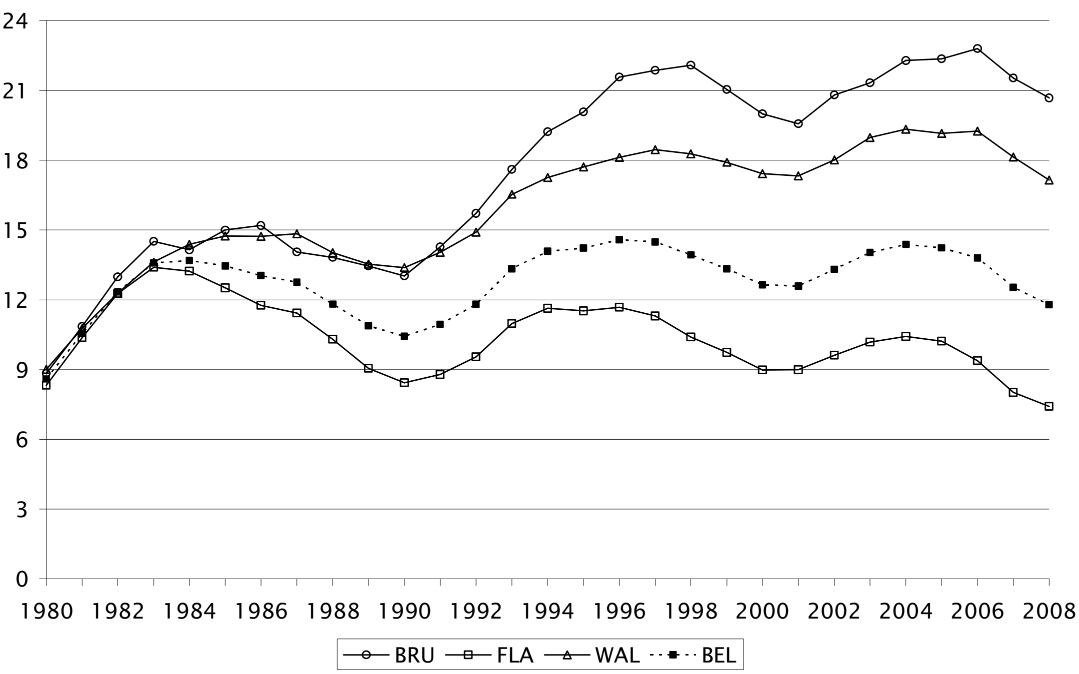
There are at least two channels through which negative economic shocks can have permanent effects on the unemployment rate (see Blanchard and Summers, 1986). A first one is the effect of unemployment on human capital, or, more in particular, the negative effects of unemployment duration on human capital. The argument goes as follows. The unemployed worker loses the opportunity and motivation to maintain his skills (broadly defined, including e.g. self-image and attitude). In particular when unemployment benefits are high and long-lasting, the probability of negative duration effects is higher. Also early retirement schemes, a prime example of the Belgian labour market, are comprised herein.

A second theory to explain hysteresis effects on unemployment is the insider-outsider theory (see e.g. Lindbeck and Snower, 1986). According to this theory, the workers, or insiders, are only concerned about their position, and not about the position of the unemployed, or outsiders. After a negative shock, some insiders become outsiders. If then the insiders (or unions) negotiate a new wage with the companies, they will defend a lower level of employment (since they don't care about their former colleagues, which became outsiders), and thus negotiate higher wages which are consistent with this new and lower level of employment.

3. Unemployment evolution

Before the actual tests are carried out, a graphical analysis of the unemployment evolution can be informative. Figure 1 displays the unemployment rates of the Belgian regions (Brussels Capital Region, Flemish Region and Walloon Region) and Belgium as a whole fot the period 1980-2008. The source of the unemployment rate series is the HERMREG-database, which is a database for modelling purposes, developed by the Federal Planning Bureau and the three regional statistical institutes[2]. The unemployment rate series in this database are based on administrative sources and the unemployment rate is rather broadly defined, including elderly unemployed.

Figure 1: Unemployment rates of the Belgian regions (1980-2008)



Source: HERMREG

[2] BISA, IWEPS and SVR.

In 1980 the unemployment rates were more or less equal in the three regions: 8.3% in the Flemish Region, 8.8% in the Brussels Capital Region and 9.0% in the Walloon Region. The Belgian unemployment rate equalled 8.6% in 1980.

Due to, amongst other factors, the second oil crisis (1979-1981) and the devaluation of the Belgian franc in 1982, there was an economic downturn in the beginning of the eighties. Unemployment rates increased considerably in this period. The Flemish unemployment rate was more resistant to the economic recession compared to the unemployment rates of the other regions. It reached a maximum of 13.4% in 1983. Both the Brussels and Walloon unemployment rate still increased a few years: the Brussels unemployment rate mounted to 15.2% in 1986 and the Walloon unemployment rate attained its maximum only in 1987 (14.8%).

With the reverse oil shock of 1986, there was a period of economic boom. The effects on the unemployment rate are clear: it dropped in all regions. The decrease in the unemployment rate was most pronounciated in the Flemish Region. In that region unemployment reverted more or less to the level of 1980 (namely 8.4% in 1990 vs. 8.3% in 1980). In the two other regions the unemployment rate did not catch up totally. In 1990 the Brussels unemployment rate amounted to 13.0% (vs. 8.8% in 1980) and the Walloon unemployment rate came down to only 13.4% (vs. 9.0% in 1980).

In the following years the Belgian economic growth was less dynamically. This can partly be blamed on the restrictive budgettary and monetary policies in these years for meeting the Maastricht-norms for joining the European Monetary Union. The impact on the unemployment rate was highest in the Brussels Capital Region: the unemployment rate reached a high of 22.1% in 1998. The Walloon unemployment rate peaked in 1997 with a maximum of 18.4%; the Flemish unemployment rate increased to 11.7% in 1996..

The end of the millennium is again a period of economic prosperity, with Belgian economic growth reaching more than 3% (GDP) in 1999 and 2000. In the Flemish Region, the unemployment rate dropped to a level barely higher than in 1980 and 1990 (namely 9.0% in 2000, vs. 8.4% in 1990 and 8.3% in 1980). Again, in the two other regions a part of the unemployment rate increase is not made up for. In the Brussels Capital Region it decreased to 19.3% in 2000 (vs. 13.0% in 1990 and 8.8% in 1980) and in the Walloon Region the unemployment rate dropped to only 17.3% in 2000 (vs. 13.4% in 1990 and 9.0% in 1980).

After some years of economic downturn in 2001-2003 (Belgian GDP growth between 0.8% and 1.5%), unemployment peaked in 2004 in the Flemish and Walloon Region (respectively 10.4% and 19.3%). In the Brussels Capital Region, the unemployment rate reached a maximum of 22.8% in 2006. The following years, 2005 to a lesser extent (GDP-growth amounts to only 1.8% in Belgium), were once more characterised by an economic boom with a GDP growth around 3.0% in 2004-2007. In 2008, the year in which the credit crisis started, the unemployment rates reached bottom again. The Flemish unemployment rate dropped below the level of 1980 (namely 7.4%). Also in the Walloon Region, the unemployment rate now made up its increase and decreased a little below the level of 2000 (17.1% in 2008 vs. 17.3% in 2000). The Brussels unemployment rate did not catch up totally and decreased to 20.7% (vs. 19.6% in 2001).

4. Testing for hysteresis

4.1. Unit root tests

To test the regional unemployment series for the presence of hysteresis, different unit root tests are available. In this paper a limited choice of them is used. Both time series unit root tests and panel unit root tests are applied to determine whether hysteresis is present or absent. Moreover, correctly speaking, also both unit root tests and stationarity tests are used, i.e. tests for which the null hypothesis is non-stationarity (eg. augmented Dickey-Fuller test) and tests for which the null hypothesis is stationarity (eg. the KPSS-test).

The first test which is applied is the augmented Dickey-Fuller test. To give some intuition behind unit root testing, the Dickey-Fuller test is explained in some more detail. Consider the following AR(1)[3]:

$$(1) \quad y_t = \alpha + \rho y_{t-1} + \varepsilon_t \ ,$$

where y_t is our series of interest (i.e. the unemployment rate), α and ρ are parameters, ε_t the error term and $t = 1,...,T$. The series y_t has a unit root if $\rho = 1$. Rewriting equation (1) gives

$$(2) \quad \Delta y_t = \alpha + \delta y_{t-1} + \varepsilon_t \ ,$$

where δ equals $\rho - 1$. So, testing the null hypothesis of non-stationarity, i.e. the presence of a unit root, boils down to testing the significance of δ, or

[3] See e.g. Johnston and Dinardo (1996).

(3) $H_0 : \delta = 0,$

against the alternative hypothesis of stationarity

(4) $H_1 : \delta < 0.$

Under the null hypothesis the series y_t is a random walk (with drift in this case), and, thus, non-stationary. If the series is stationary this means that, eventually, it will return to a constant. Or, large values of y_t should, to return to the constant, be followed by smaller values (or negative changes), which explains why the test is left-tailed. The speed of return depends on the value of the parameter ρ.

The Dickey-Fuller test statistic equals the standard t-statistic:

(5) $\text{DF - stat} = \frac{\hat{\delta}}{\hat{\sigma}_\delta},$

where $\hat{\delta}$ is the coefficient estimate and $\hat{\sigma}_\delta$ the coefficient standard error. The distribution of the DF-statistic under the null hypothesis is non-standard due to the non-stationarity of y_t. Most statistical programs, however, offer critical values from either Dickey and Fuller (1979) or, more recently, MacKinnon (1996). To tackle serial correlation problems, the original DF-test is extended to the augmented Dickey-Fuller test (ADF). The AR(1) scheme is then replaced by a AR(*p*) scheme. The appropriate lag length is chosen by using information criteria such as the Akaike information criterion or the Bayesian information criterion (BIC, or Schwarz criterion). Cheung and Lai (1998) show that the use of information creteria improves the power properties of the test. Throughout this paper the latter information criterion (i.e. Schwarz information criterion) is used to choose the lag length for the augmented Dickey-Fuller test and other testing procedures.

The second unit root test which is applied is the Phillips-Perron test. Phillips and Perron (1988) proposed another testing procedure to test the null of non-stationarity, based on the ADF-test. Whereas the ADF-test controls for serial correlation by adding higher order terms to the AR-scheme, Phillips and Perron (1988) start from the original DF-test equation (2), but they change in a semi-parametric way the DF- statistic such that serial correlation does not affect the asymptotic distribution of it.

The ADF test and the Phillips-Perron test are widely used methods of investigating the presence of a unit root in single time series. Unfortunately, in finite samples these tests suffer from limited power against near unit root alternatives (Maddala and Kim, 1998). DeJong et al. (1992), for example, report evidence that the Dickey-Fuller test has low power against autoregressive alternatives with near unit roots.

In this paper this problem is tackled by using two different approaches. First, by applying a third unit root test for single time series, namely the KPSS-test. Second, by using panel unit root tests. By combining different (related) time series, unit root tests can considerably gain in power. Not surprisingly then, several panel unit root tests have been suggested. Overviews of panel unit root tests can be found in e.g. Banerjee (1999) and Phillips and Moon (2000).

So, as mentioned above, a third test is implemented to look for hysteresis in the unemployment rate series, namely the KPSS[4] -test (Kwiatkowski et al., 1992). The main difference between this test and the previous ones (ADF and Phillips-Perron) is the null hypothesis. Whereas the ADF-test and the Phillips-Perron test are tests for unit roots (or non-stationarity), the null hypothesis of the KPSS-test is the absence of a unit root (or stationarity of the series). So, in a way, the KPSS-test complements the ADF-test and Phillips-Perron test. Kwiatkowski et al. (1992) conclude that by testing both the unit root hypothesis and the stationarity hypothesis, one can distinguish series that appear to be stationary, series that appear to have a unit root, and series for which the data (or the tests) are not sufficiently informative to be sure whether they are stationary or integrated.

In order to address the aforementioned power problem further, the unemployment series are checked for the presence of unit root by applying some panel unit root tests. The hope of the econometrics of non-stationary panel data is to combine the best of both worlds: the method of dealing with non-stationary data from the time series and the increased data and power from the cross-section (Baltagi and Kao, 2000). Several panel unit root tests exist, but in this paper the IPS-test and the Hadri-test are applied to the Belgian regional unemployment serie. To introduce unit root tests in a panel data setting, the presentation starts with the Levin-Lin-Chu (LLC) test (Levin et al., 2002).

The LLC-test is a panel generalization of the Dickey-Fuller test. The null hypothesis of this test is thus non-stationarity. Consider the following extension of (1) to a panel setting:

(6) $$y_{it} = \alpha_i + \rho_i y_{it-1} + \varepsilon_{it} \; ,$$

[4] Kwiatkowski-Phillips-Schmidt-Shin

where y_{it} are our series of interest (i.e. the regional unemployment rates), α_i and ρ_i are parameters, ε_{it} the error terms, $t = 1,...,T$ and $i = 1,...,N$ (i.e. the cross-section units). Again, rewriting equation (6) delivers

$$(7) \quad \Delta y_{it} = \alpha_i + \delta_i y_{it-1} + \varepsilon_{it} \, ,$$

where δ_i equals $\rho_i - 1$. The LLC-test tests the null hypothesis of non-stationarity

$$(8) \quad H_0 : \delta_i = 0 \quad i = 1,...,N \, ,$$

against the alternative hypothesis of stationarity

$$(9) \quad H_1 : \delta_i = \delta < 0 \quad i = 1,...,N.$$

So, under the null hypothesis all series in the panel are assumed to be non-stationary (or to contain a unit root). Levin et al. (2002) assume homegenous first-order autoregressive coefficients (both under the null and the alternative hypothesis). This is considered to be a major limitation of the LLC-test: the alternative hypothesis is too strong to hold in empirically relevant cases.

The test developed by Im et al (2003), the Im-Pesaran-Shin (IPS) test, is a test which relaxes the alternative hypothesis. The null hypothesis is the same as with the LLC-test, i.e. all series of the panel are non-stationary. The alternative hypothesis of the IPS-test, however, allows for both stationary and non-stationary series:

$$H_1 : \begin{cases} \delta_i < 0 \text{ for } i = 1,...,N_1 \\ \delta_i = 0 \text{ for } i = N_1 + 1,...,N \end{cases} \text{ where } 0 < N_1 \le N.$$

Hadri (2000) extends the KPSS-test to the panel data setting. In contrast to the two previous tests, the null hypothesis of this test assumes stationarity of all series in the panel.

4.2. Empirical results

To determine whether the Brussels, Flemish and Walloon unemployment rate is or is not characterised by hysteresis, the unit root tests presented in the previous paragraph are implemented. Both the time series unit root tests – ADF, PP and KPSS – and the panel unit root tests – IPS and Hadri are used to that respect. The tests are applied on the unemployment rates[5] of the three Belgian regions for the period 1980-2008. Data were obtained from the regional database HERMREG[6].

The results of the individual unit root tests for the Belgian regions are presented in Table 1. The lag order was chosen to maximise the Schwarz (or Bayesian) information criterion. For reasons of continuity, this same choice was made for every test that was performed. In the auxiliary test regression an intercept was always included. Although a visual examination does not exclude the possibility of a deterministic trend in the unemployment rate series (see Figure 1), a deterministic trend is not included, due to a lacking of economic significance.

For the calculation of the PP-test statistic and the KPSS-test statistic one needs to specify an estimation method of the residual spectrum at frequency zero. Again, to guaranty continuity, for all tests the autoregressive spectral density OLS-estimator was selected.

[5] As in Section 3, the unemployment rates are broadly defined (including elderly unemployed).
[6] HERMREG-version 2009.

Table 1: ADF and PP unit root tests and KPSS stationarity test

	ADF	PP	KPSS
Brussels Capital Region	-2.274	-2.066	15.695***
Flemish Region	-4.961***	-4.068***	0.340
Walloon Region	-3.065**	-2.519	11.106***

Rejection of the null hypothesis at 10%: *, 5%: ** and 1%: ***.

Looking at the augmented Dickey-Fuller test results, the null hypothesis (of non-stationarity) is strongly rejected in the Flemish Region (*p*-value smaller than 1%) and rejected at the 5%-level in the Walloon Region. So, according to the ADF-test there is no hysteresis in the Flemish and Walloon Region, whereas there is hysteresis in unemployment in the Brussels Capital Region.

The Phillips-Perron test strongly rejects the null hypothesis of a unit root in the Flemish Region. The PP-test, however, can not reject the null for the Walloon Region. Also in the Brussels Capital Regions the PP-test can not reject the hypothesis of non-stationarity of the unemployment rate.

By inverting the null hypothesis and the alternative hypothesis, the KPSS-test gives a complementary view. This test firmly rejects the null hypothesis of stationarity of the unemployment rate in the Walloon Region and the Brussels Capital Region. In both regions the null is rejected at the 1%-level. In the Flemish Region the null hypothesis can not be rejected.

For both the Flemish Region and the Brussels Capital Region the test results are rather clear-cut. In the former regions the test results tend to indicate the absence of hysteresis in the unemployment rate, i.e. the unemployment rate tends to move back towards an equilibrium rate after a period of high unemployment. In the Brussels Capital Region, however, the test results indicate the opposite: the Brussels unemployment rate is characterised by hysteresis, or cyclical increases of the unemployment rate tend to become structural. For the Walloon Region the test results are somewhat ambiguous. Two tests (PP and KPSS) tend to indicate that there is a hysteresis effect on the Walloon unemployment rate, whereas one test (ADF) rejects the hypothesis of hysteresis.

As mentioned above, two panel unit root tests are carried out, namely the IPS-test and the Hadri-test. Table 2 shows the results of applying these tests on the panel consisting of the three Belgian regions, i.e. the Brussels Capital Region, the Flemish Region and the Walloon Region.

Table 2: IPS unit root test and Hadri stationarity test for the Belgian regions

	Belgian regions
IPS	-3.626***
Hadri	4.192***

Rejection of the null hypothesis at 10%: *, 5%: ** and 1%: ***.

Although both the IPS-test and the Hadri-test (which have inverted null hypotheses) reject the null hypothesis, this results need not be conflicting, since the alternative hypothesis of the IPS-test states that some series are stationary and other are non-stationary. So, the IPS-test rejects the null hypothesis that all series have a unit root in favour of the alternative hypothesis that at least one series is stationary. The Hadri-test rejects the null hypothesis that all series are stationary in favour of the alternative hypothesis that at least one series is non-stationary. Of course, these panel tests do not give an indication about the identity of the relevant series.

5. Conclusion

Due to the current economic crisis, the number of unemployed people increases in many countries. In the past, in periods after economic crises the Brussels and Walloon unemployment rates showed signs of non-mean reverting behaviour, whereas this was less the case for the Flemish unemployment rate. Blanchard and Summers (1986) defined hysteresis as the tendency of cyclical unemployment to become structural.

Pure hysteresis (i.e., no mean reverting at all) is statistically described as the presence of a unit root. Hence, unit root tests are an obvious candidate to test for the presence of hysteresis. In this paper the Belgian regional unemployment rate series are investigated on hysteresis. Several unit root tests were carried out to that respect.

The time series unit root tests, namely the ADF-, PP- and KPSS-test, at the individual level gave unambiguous results for the Brussels Capital Region and the Flemish Region. In the former region, the test results indicate the presence of a unit root, and hence a hysteresis effect on the unemployment rate during the sample period. For the Flemish Region the tests report the opposite: there was no hysteresis during the sample period.

Concerning the Walloon Region, the test results were more ambiguous, although the majority of the tests point to the presence of hysteresis. The panel unit root tests confirm that there is at least one region with hysteresis and at least one without. The panel tests, however, do not give an indication about the identity of the relevant regions.

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