Erasmus School of Economics

Is Europe an optimum currency area?

Wage rigidity comparison across countries

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Bachelor Thesis

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Abstract

Europe has been trying to form an optimum currency area (OCA) since the introduction of the euro. However, many claimed it failed in doing so. The purpose of this thesis is to investigate whether Europe can be called an OCA or not. This is done by comparing the labour flexibility throughout Europe after certain macroeconomic shocks, which were normally processed by the exchange rates. Four countries have been chosen to represent the European Union: Greece, the Netherlands, Spain and the UK. The tests are performed using the ordinary least squares technique. We show that Europe cannot be defined as an OCA, because it fails to respond to shocks as a Union. A significant effect of wages on employment is found, however this alone is not enough. Currently, member states solely react to shocks. Hence, there is still a long way to go to create an optimum currency area.

Keywords: *optimum currency area (OCA), nominal/real wage rigidity, employment*

1. Introduction

With the recently announced Brexit coming up, the call from other countries wanting to leave the European Union (EU) has become stronger. Populists in different countries (e.g., Geert Wilders in the Netherlands and Marie Le Pen in France) are claiming that their countries would also be better off if they leave the Union (Financial Times, 2016). This would just be a first step in the renewed nationalistic view of some countries, because some are willing to go further and return to their old currency. In the past decades, research has been conducted to check whether there is anything like an optimal currency area (OCA) (e.g., in case of the EU).

According to Krugman (2013), the purpose of the Eurozone is to further economic integration and political stability. However, he claims the following: “that the euro has become an economic trap, Europe a nest of squabbling nations and that economists should have seen it coming” (Krugman, 2013, p. 439). Furthermore, Krugman (2013) acknowledges that an OCA has some major advantages (e.g., lower interest rates, reducing transaction costs, elimination of currency risk, greater transparency and greater competition as prices are more easily to compare), but they come at a high cost, since the option of devaluation is ruled out in times of trouble. Moreover, implementing an OCA implies giving away the influence to adjust the currency if needed, because

the currency is not governed by central banks in the member states but by the European Central Bank (ECB) (see e.g., Frankel & Rose,1998; Copeland,2014).

In order to maintain parity in such an area, after certain macroeconomic shocks, especially when devaluation is impossible, there are three options policy makers can use: (i) an expansionary fiscal policy, (ii) wage and labour flexibility and (iii) labour migration. The first is beyond the scope of this research and the latter does not always work due to the existence of a language barrier. The focus in this study is on the second option.

According to Mundell (1961), wage flexibility and labour mobility play a crucial role in an OCA. He states that if the currency cannot depreciate, labour has to be mobile. The theory behind this is straightforward: workers who cannot find jobs domestically move abroad, where they join the employment, and where, because of lower prices and wages, production has become relatively profitable (Copeland, 2014). Hence, according to Mundell (1961), an OCA is not performing optimally if there is no full labour mobility across this area.

One does not become a member of such an OCA relatively easy. In the 1992 Maastricht Treaty, some convergence criteria have been established that a country must fulfil before it can join the EU (ECB, 2017) (Appendix 1). However, recent history has shown that many countries that joined the Union failed to meet (one of) these criteria (Brouwer, Paap & Viaene, 2008). Despite their willingness, Goldberg (1999) claims that for countries in transition it might be better to have an independent flexible exchange rate. Furthermore, strong opposition from countries already part of the Union exists, because some of the economic more stable countries (e.g., the Netherlands, Germany and Belgium) have to cover the budget deficits of the economic less stable countries (e.g., the GIIPS[1] countries). This is costing them billions and they feel that if new countries joined the Union, it might cost them even more (Economist, 2012). Moreover, some countries feel that the Union would lose competitiveness vis-à-vis the U.S. and the Asian countries.

These are just some of the reasons why an OCA should work optimally and this bachelor thesis investigates whether the EU can be defined an OCA by looking into the wage patterns and employment across countries, especially after macroeconomic shocks. If an OCA is working properly, wages and employment adjust and labour mobility occurs. Therefore, one can make conclusions by comparing how wages and employment adjusted over time across the Union.

[1] GIIPS is an abbreviation for the peripheral countries Greece, Ireland, Italy, Portugal and Spain. These countries were unable to refinance their government debt during the crisis (Cuestas and Kaehr, 2015).

Dellas and Tavlas (2005) performed a similar study on wage rigidity. They found that countries with a high degree of nominal wage rigidity benefit from a monetary union, but only if the other countries are highly rigid as well, whereas if countries with relatively more flexible wages join such a union, they would be worse off (Dellas & Tavlas, 2005). Since not all countries can be specified in this thesis, a select number is chosen to represent the Union. More specifically, this research addresses Greece and Spain (to represent the GIIPS countries), the Netherlands (a stable West-European economy) and the United Kingdom (UK) (a stable economy in Europe, but without the euro). To study whether the EU is an OCA or not, the following research question has been set up:

''To which extent is Europe an optimum currency area regarding labour flexibility?''.

The remainder of this thesis is structured as follows. Section 2 contains the literature review. Following, in Section the data collection and adjustments are described. Moreover, the empirical methods applied on this particular data are explained. Thereafter, the results acquired from this study are presented in Section 4. Consequently, some economic implications will be made to give these results some value. Finally, this paper concludes, in Section 5, by summing up the results, mentioning the caveats of this research and giving some policy implications and recommendations.

2. Literature Review

In this section, the most commonly used theories about OCAs and wage rigidity are explained briefly. These theories are crucial for understanding the mechanisms needed to answer the research question and to make conclusions.

2.1 Optimum currency area

The first person to come up with a theory about an OCA was Mundell in 1961, who argues that the, at that time present, Bretton-Wood system is not working properly and some countries would be better off if they switched to a system in which the national currencies are connected by a flexible exchange rate regime. Next, he asked himself, how large this OCA should be (Mundell, 1961). According to Mundell (1961), OCAs should be as small as possible and preferably vertical instead of horizontal (e.g., West-Europe and East-Europe versus all the European countries together). This is, because industries and the exchange rate would then have a better opportunity to adjust. Besides this, he claims that there are different effects to be found intraregional and internationally of a random macroeconomic shock (Mundell, 1961). Finally, he states that an OCA

can exist only when the following conditions are met: (i) dynamically internationally stable price system, (ii) no large exchange rate changes, (iii) risk can be covered by forward markets, (iv) no monopolistic speculation by the central bank, (v) reasonable protection of debtors and creditors by maintaining an increasing flow of long-term capital movements and (vi) wages and profits are not tied to a price index in which import goods are heavily weighted (Mundell, 1961).

Following Mundell (1961), McKinnon (1963) extends this theory by studying the importance of the openness of an economy. He states that the impact of a devaluation is unlikely to provoke a significant response in large economies. Moreover, McKinnon (1963) argues that the weight of traded goods does not have a significant impact on wages and price stability. For smaller economies, he finds the opposite result. This is against the Balassa-Samuelson effect, which states that consumer prices and wages in fast growing countries are systematically higher in slow growing countries (Balassa,1964; Samuelson,1964). Therefore, he claims there should be large currency areas. This finding is opposite to Mundell's (1961), who claims OCAs should be as small as possible. Hence, there was not yet an unambiguous conclusion about the size of an OCA.

Kenen (1969) further develops these theories, by arguing that the exports of a member country should be largely diversified and somewhat equal to that of other member countries. Furthermore, Kenen (1969) states that random asymmetric shocks are related to the expenditure pattern of a country. Therefore, he claims that if total output and export are enough diversified, a country only partially experiences the consequences of these shocks (Kenen, 1969).

These three economists (i.e., Mundell, McKinnon and Kenen) lay the foundation for OCA theory which lasts around three decades before it was adjusted again. Frankel and Rose (1998) study the endogeneity of OCA criteria. This endogeneity implies that countries, who fail the OCA criteria before joining the Union, turn the economic conditions in such a way that joining the OCA becomes the right decision. Frankel and Rose (1998) refer to this as a self-fulfilling property. They sketch a graph which represents the decision whether a country should float independently or insert a common currency (Figure 1). This graph implies that countries with a high correlation of business cycles across countries and a high extent of international trade are good candidates for a common currency and should join an OCA, and vice versa (Frankel and Rose, 1998).

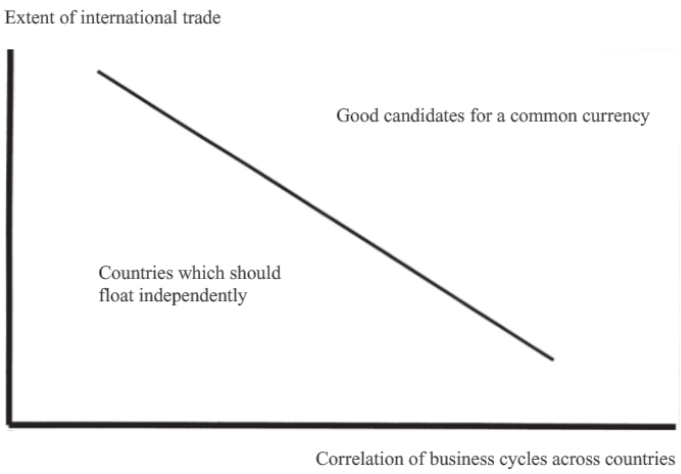

Figure 1: Business cycle correlation in relationship to international trade
Source: Frankel & Rose (1998)

In the Delors report (1989), a committee studies the feasibility of an economically integrated European Union. They look at all different kinds of aspects, ranging from one European central bank (nowadays the ECB) to freedom of capital movements. Looking back on this report 30 years later, one can conclude that only some of the goals are achieved (e.g., adopting a single currency, internationally orientated monetary policy but meanwhile maintaining some degree of freedom on national level, etc.), but that the current OCA is not completely like it was designed by the Delors committee. Moreover, the committee argues the following: "*a Union in Europe implies that there is complete freedom of goods, services, persons and capital, as well as irrevocably fixed exchange rates between national currencies and, finally, a single currency"* (Delors, 1989, p. 13).

A more recent study by Aizenman (2016) outlines a negative consequence of an OCA, namely the sensitivity for a financial crisis. According to Aizenman (2016), asymmetric financial shocks pose a threat to the stability of currency unions. This is because the sudden stop of financial flows of a small number of countries in the OCA can cause the entire chain of financial flows to come to a halt (Aizenman, 2016). Furthermore, Aizenman (2016, p. 3) reaches the following conclusion: '*the odds of a successful currency area depend on the viability of effective institutions and policies dealing with adjustment to asymmetric financial and real shocks that impact its members'*. Moreover, he argues that the absence of such arrangements may magnify real distortions in the financial system and destabilize currency unions (Aizenman, 2016). This was demonstrated after the recent worldwide financial crisis when the stability of the EU was jeopardized.

2.2 Wage rigidity

2.2.1 Nominal wage rigidity

Wage rigidity can be defined as the phenomenon when wages are unable to change, even though that particular sector is hit by a shock (e.g., an expansionary monetary or a fiscal expansion) (Babecký et al., 2009). According to Babecký et al. (2009), wage rigidity can be defined as an obstacle to wage adjustments rather than infrequent adjustments or stickiness of wages. Two types of wage rigidity exist: nominal and real wage rigidity. The former means that wages are unable to change, because of for example strong negotiations with unions (Smith, 2000), whereas the latter means that wages rise in proportion to inflation, which is defined by the consumer price index (CPI) (see Section 2.2.2). Smith (2000) argues that wage rigidity occurs because a proportion of workers' pay is observed at a frequency lower than their contract duration. The idea that nominal wages could be rigid goes all the way back to Keynes (1936). Fehr and Goette (2005) study the correlation between nominal wage rigidity and inflation and find that nominal wage rigidity occurs in low inflation environments. Furthermore, O'Brien (1989) finds that nominal wage rigidity occurs in times of a recession. This finding is supported by Schmitt-Grohé and Uribe (2016), who argue that nominal wage rigidity can be a negative externality, as it causes overborrowing in times of booms and excessive rates of unemployment during recessions.

Kaur (2014) studies the relationship between nominal wages and business cycles and find an asymmetric adjustment mechanism: nominal wages rise in response to positive shocks, but they do not fall as a consequence of negative shocks. According to Fallick, Lettau and Wascher (2016), there was nominal wage rigidity present in the U.S. during and after the Great Recession, but they did not find significant differences between these periods. Although Smith (2000) finds that there was significant evidence of rigid wages in the UK's labour market, she is unable to conclude with certainty that these rigid wages have a macroeconomic impact. This argument is supported by Haefke, Sonntag and Van Rens (2013), who state that in their data set, wages of new hires are volatile as opposed to the aggregate wage. They are unable to conclude anything about the latter.

According to Holden (2004), one of the advantages of nominal wage rigidity is that it gives the workers an advantage in future negotiations, since in most European countries the wages can only change with mutual consent. Macleod and Malcomson (1993) have shown that this kind of contract is efficient under a large variety of circumstances in unionized economies. Several studies show that when policy makers aim for a too low inflation target, it might lead to a higher rate of

unemployment, due to this nominal wage rigidity (see e.g., Holden,1994; Tobin 1995). However, there are also studies that argue the opposite and state that the unemployment is due to the inflationary environment, and that the market recovers by itself (Ball and Mankiw, 1994).

2.2.2 Real wage rigidity

Real wage rigidity occurs when, for example due to a monetary expansion, the price level rises. As a consequence of the risen price level, the nominal wage rises as well. Both will rise in proportion to the monetary expansion, leaving the real wage unchanged (Obstfeld, 2002). Furthermore, Obstfeld (2002) argues that in theory the models of rigid real wages only work in practice through large-country effects when looking at the ECB's monetary policy effectiveness.

However, Christoffel and Linzert (2005) study whether there is wage rigidity in Europe and conclude that wages in Europe are rigid in many respects: high firing costs, unemployment benefits and strong unions. Especially high firing costs are important, as they prevent wages from adjusting instantaneously (Christoffel & Linzert, 2005) Moreover, the existence of both nominal and real wage rigidity in micro wage data is confirmed by many other studies (see e.g., Smitch, 2000; Sunde, Bauer & Bonin, 2003; Knoppik & Beissinger, 2003).

In addition, Krause and Lubik (2007) study the effect of search and matching frictions in the labour market in a 'new' Keynesian model. They find, after introducing real wage rigidity to the model, that a negative correlation exists. The real wage rigidity increases the magnitude of the labour market flows to more realistic values (Krause & Lubik, 2007). Furthermore, Holden and Wulfsberg (2009) state that the existence of downward real wage rigidity decreases the overall spread of the wage distribution. They also find that this downward real wage rigidity eventually leads to higher real wages. Babecký et al. (2009) conduct a survey in Europe to check whether real wage rigidity occurs in firms. They conclude, with the help of bivariate probit regressions, that real wage rigidity occurs quite a lot in Europe.

3. Data and Methodology

In this section, the data collection process and the adjustments made to this data are described. Consequently, the methodology is explained briefly. This consists of the empirical methods applied on the data to reach the results.

3.1 Data

This bachelor thesis investigates wage rigidity and labour flexibility in Europe and that is why the wage rate and employment are the most important variables. The data has been retrieved from Eurostat, which is the statistical office of the EU with the mission to provide high quality statistics for Europe (Eurostat, 2017). The time frame for this research has been set from the 1st of January 1996 until the 31st of December 2011. This way it is possible to see how the wages adjusted in response to macroeconomic shocks like the introduction of the euro and the worldwide financial crisis of 2008.

The wages, displayed in this section, are real wages per quarter (in €). The average quarterly wages for the Netherlands, Greece and the UK are investigated and there will be a check for significant differences between these countries. Only wages of full-time workers are considered in this survey. Moreover, it is assumed that the wages are equally distributed throughout the year, as annual nominal wage values were collected and these were then deflated and divided by four. No other sources were consulted, as these could give different numbers than those from Eurostat because of for example different measures. The wage patterns are displayed in Figure 2. One derives from Figure 2 that the average annual income in the period 1996-2011 has been growing on quite a constant scale. Only for the UK there has been a decline in income around the time of the financial crisis.

As mentioned, these are the real wage values and the Guardian (2016) conducted a survey in which they found that the real wages in the UK have declined over 10 per cent in the period 2007-2015. Only Greece did worse regarding the real wage. Furthermore, Greece, Portugal and the UK were the only three OECD countries to have a decline in real wages (Guardian, 2016). In addition, Greece has a couple of missing values in the data set. Therefore, Spain is also added to represent the GIIPS countries.

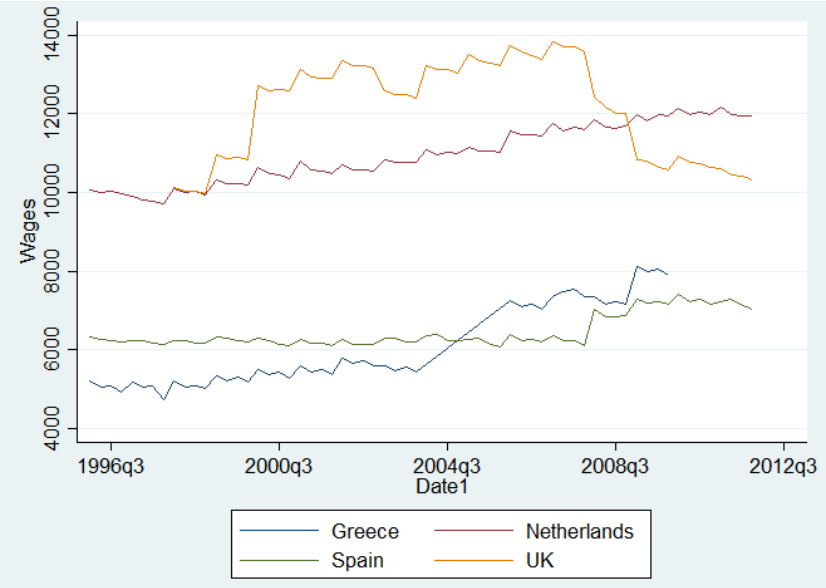

Figure 2: Average quarterly gross income in the period 1995-2011 (€).

Furthermore, some adjustments are made regarding the wages. Firstly, the natural logarithm has been taken, then the first difference method[2] is applied and finally these values are squared (see Table 1). This has been done to create a variable which will help to show the wage flexibility. By minimizing the differences for the values of the squared natural logarithm, it is easier to compare the countries and one is able to see whether wages have significantly changed.

Next, quarterly employment numbers are collected for the period 1996-2011. This is an important variable for this research, as it is interesting to see how the labour market is adjusting to shocks when this no longer can be done by the exchange rate. People are considered among employment if they are aged between 20 and 64. Also for employment the natural logarithm has been taken and the first difference method is applied.

Moreover, country-specific shocks are used as control variables in order to prevent omitted variable bias (OVB). Firstly, the gross domestic product (GDP) is added to the data set. This way it is possible to check how the wealth of a country contributes to the flexibility of the labour market. For the variable GDP, there is quarterly data available for the period 1995-2012. The data had to be corrected for inflation, the natural logarithm has been taken and the first difference method is applied. GDP is measured in billions (€) and gives a clue of how the economy grew over the selected period.

[2] The first difference method uses the difference between the current value of the variable and its previous value. Formally this is expressed as: $W_t - W_{t-1} = \Delta W^2$. *(Note: W = Wages).*

Furthermore, the total real public expenditure on the labour market in the countries has been added. This variable consists of expenditures on (i) training, (ii) employment incentives, (iii) supported employment and rehabilitation, (iv) direct job creation and (v) start-up incentives. Since these amounts differ significantly for the countries in the data set, we decided to consider them in this research as well. The amounts were originally given as annual numbers (€), but it is assumed they are equally distributed throughout the year. So, to make them quarterly, they were divided by four. Also for this variable the natural logarithm has been taken and the first difference method is applied.

Table 1: Important (pooled) figures from the data set.

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Employment	272	13,658.09	8,778.473	3,539	27,815
Wages	232	8,985.599	2,808.41	4,753.373	13,824.95
FirstDiff	272	-37,018	1,523.212	-11,949.87	10,130.57
LN(Wages)	232	9.052	0.325	8.467	9.534
FirstDiff-LN(Wages)	227	0.002	0.029	-0.103	0.159
GDP	272	254,442	190,181.5	43,972.15	685,121.8
PublicExp	128	913,502.3	694,281.4	33,691.11	2,090,925
Square	90	0.131	0.087	0.000	0.399

Note: Employment = number of full-time workers aged 20-64 (1,000), Wages = quarterly wage values, FirstDiff = the first difference of the absolute wage values, LN(Wages) = the natural logarithm of the wages, GDP = in billion (€), PublicExp = total quarterly public expenditure on the labour market Squared = the squared value of the first differences after taking the natural logarithm.*

Table 1 reveals some notable information about the pooled data. A country split is to be found in Appendices 2-5. First, it is worth mentioning that the spread of the wages across the countries is large, with a minimum value of 4,753 euro in the fourth quarter of 1997 in Greece to a maximum value of 13,824 euro in the first quarter of 2007 in the UK. This means that the UK reached its highest value just before the crisis struck. Moreover, the difference in public expenditure on the labour market between for example the Netherlands and the UK is significantly large, even though the UK's employment is almost four times as sizeable as the Dutch's. Furthermore, the inflation across the four countries follows a similar pattern over time, implying that the prices across countries did not differ that much. Lastly, one derives that the differences in GDP are quite sizeable, however this is due to the size of the country.

3.2 Methodology

The data is tested as panel data with dummy variables for the countries. It is panel data, as we are dealing with the behaviour of several entities (countries) over time. In this way, it is possible to account for the different effects for each country separately. All the tests for this bachelor thesis are done with help of the statistical programme Stata. The model is first checked on stationarity and autocorrelation. Next, different forms of regressions are run. This includes adding lags to the model. The number of lags are determined according to the Bayasian Information Criterion (BIC). Finally, throughout this entire research a significance level[3] of five per cent is being used. This significance level, however, could cause errors in whether the hypotheses should be rejected or not. If the null-hypothesis is rejected and this should not have been the case, one speaks of a type I error (Belknap, Mitchell, O'Toole, Helms &Crabbe, 1996). Moreover, if the null-hypothesis is not rejected and this should have been done, one speaks of a type II error (Belknap et al., 1996).

3.2.1 Ordinary least squares (OLS)

To create a linear regression model, this study uses the OLS technique, which provides a helpful estimate of future behaviour based on historical values. OLS minimizes the sum of squares between the actual values and the predicted values based on some explanatory variables. The dependent variable in this research is employment, whereas the independent variables consist of the wage, GDP, public expenditure on the labour market and the squared value of the first difference of the natural logarithm of the wages. The general OLS formula looks like the following:

$$Y_i = \beta_0 + \beta_j \cdot X_j + \delta_i + \varepsilon_i$$

Y_i = employment
β_0 = constant
X_j = average quarterly income, GDP, public expenditure on the labour market and squared value of the first difference of the natural logarithm of the wages
δ_i = dummy variable indicating the country
ε_i = error term

The outcome provides the relationship between these variables. For example, how a change in the wages affects the employment, *ceteris paribus*. Everything else which cannot be explained by the model has been put in the error term ε.

[3] The significance level indicates the maximum P-value at which the null-hypothesis can be rejected.

4. Results

This part of the thesis provides the results when testing if the EU can be called an OCA. First, the model is checked for stationarity and autocorrelation. Next, several regressions are run and finally the variance in the wages is measured.

4.1 Stationarity and autocorrelation

Before running any form of regressions, one has to check if the model is not subject to stationarity and autocorrelation. The former is checked with the 'Levin-Lin-Chu unit-root test' (LLC unit-root test). This test allows to check for stationarity in panel data. The result of the test is depicted in Table 2. The LLC unit-root test has been conducted on the dependent variable: employment.

Table 2: Test for stationarity on the variable employment.

Levin-Lin-Chu unit-root test for Employment		
H0: Panels contain unit roots		Number of panels = 4
Ha: Panels are stationary		Number of periods = 68
	Statistic	P-value
Unadjusted t	0.4265	
Adjusted t*	4.447	1,0000

Table 2 shows that, since the null-hypothesis is 'panels contain unit roots', with a P-value of 1.0000, one can reject the null-hypothesis. This means that the model is stationary and no problems are to be found at this stage.

Following, the autocorrelation in the model is checked. This is done by performing the 'Wooldridge test for autocorrelation in panel data'. The test has the null-hypothesis of no first-order autocorrelation. When looking at Table 3, one can derive that no autocorrelation is to be found in the model (P-value = 0.0803). This implies, that the regressions can be run.

Table 3: Wooldridge rest for autocorrelation in panel data.

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
F (1, 3) = 6.764
Prob > F = 0.0803

4.2 Regressions

4.2.1 OLS-regression without lags

Throughout this entire section, regressions with fixed effects are used. This is done, because we are only interested in analysing the impact of variables that change over time. Firstly, an OLS-regression is run without adding any lags. In a later stage, these results will be compared to the results of the OLS-regression with lags. One derives from Table 4 that the variables square, FirstDiff-LN(Wages) and FirstDiff-LN(PublicExp) do not have a significant effect on employment (P-value < 0.05), whereas the other variables do have a significant effect. For example, if LN-(Wages) go up by 1%, then employment declines with 0.401, *ceteris paribus*. This results is consistent with the theory (Boeri & Van Ours, 2013) that when wages are more expensive, labour supply will decline. The difference between the pooled OLS-estimator and the OLS-estimator subdivided by country is displayed in Appendix 6.

Furthermore, Table 4 shows that the effect of LN(GDP) is significant with a coefficient of 0.534. This implies that if the elasticity of GDP rises with 1%, then the elasticity of employment rises with 53.4%. This is a strong relationship, which can be explained by the fact that the wealth of country contributes heavily to the employment rate.

Moreover, the overall R-squared of the model is 0.9994, which normally means that 99.94% of the change in employment is explained by the explanatory independent variables. However, this R-squared is highly inflated, because every country got a 'customized coefficient'. That is why the R-squared in this model cannot be used to explain the change in employment.

Table 4 shows the different fixed effects for the countries in the data set. For example, the coefficient for the Netherlands is -0.058, whereas the coefficients for the UK and Spain are non-negative. This implies that the countries have a different 'starting position' and this could explain why some countries react differently to shocks than other countries.

Table 4: OLS regression with fixed effects without lags.

Regression with fixed effects					
		Number of obs = 44			
R-squared = 0.9994		F (10, 33) = 5,812.13			
Adj R-squared = 0.9993		Prob > F = 0.000			
LN(Employment)		*Coef*	*Std Error*	*t*	*P > |t|*
	LN(Wages)	-0.401	0.068	-5.87	0.000
	Diff-LN(Wages)	0.520	0.299	1.74	0.091
	Square	-0.117	0.104	-1.13	0.268
	LN(GDP)	0.534	0.066	8.05	0.000
	Diff-LN(GDP)	-.0310	0.064	-4.83	0.000
	LN(PublicExp)	-0.122	0.035	3.50	0.001
	Diff-LN(PublicExp)	-0.002	0.036	-0.07	0.947
Country					
	Netherlands	-0.058	0.106	-0.54	0.590
	Spain	0.269	0.170	1.58	0.123
	UK	0.722	0.143	5.04	0.000
	Constant	4.643	0.721	6.44	0.000

4.2.2 OLS-regression with lags

Next, another OLS-regression is run. The difference is that this time lags have been added to the previous model. The number of lags are determined according to the BIC-criterion. At a first glance, one already derives that the R-squared of the model has stayed the same, as this one is highly inflated as well. In addition, it is visible in Table 5 that all natural logarithms of wages, GDP and public expenditure on the labour market are significant up to the first lag. When one compares the effect of wages on employment with the previous regression, one concludes that the effect has become stronger. Now, if wages rise by 1%, then employment declines with 0.547, *ceteris paribus*.

The elasticity of GDP, compared to the regression without any lags, has increased to 0.564. This means that if the elasticity of GDP rises with 1%, then the elasticity in employment rises with 0.564, *ceteris paribus.* Thus, the predictive power of GDP with a lag has become even better and stronger than before without any lags.

The fixed effects of the countries have become stronger compared to the model without lags. However, the signs, both positive and negative, have stayed the same for the countries in the data set. For example, the fixed effect of the Netherlands declined to -0.073, whereas for Spain and

the UK the coefficients are 0.306 and 0.855 respectively. Meaning that the endowment differences even have grown, which later can help answering the research question.

Another result, which come forward as a bit surprising is that all the first differences of the natural logarithms and the squared term have no significant effect on employment. On the other side, these variables have been added to explain the variability in wages, which is discussed in Section 4.3.

Table 5: OLS regression with fixed effects with lags.

Regression with fixed effects					
		Number of obs = 44			
R-squared = 0.9997		F (7, 30) = 5,315.04			
Adj R-squared = 0.9994		Prob > F = 0.000			
LN(Employment)		*Coef*	*Std Error*	*t*	*P > |t|*
	LN(Wages)				
	L1	-0.547	0.137	-5.92	0.000
	Diff-LN(Wages)	0.389	0.288	1.71	0.094
	Square	-0.103	0.098	-1.15	0.264
	LN(GDP)				
	L1	0.564	0.071	8.13	0.000
	Diff-LN(GDP)	-0.029	0.067	-5.01	0.000
	LN(PublicExp)				
	L1	-0.147	0.048	3.69	0.000
	Diff-LN(PublicExp)	-0.001	0.038	-0.06	0.935
Country					
	Netherlands	-0.073	0.114	-0.68	0.574
	Spain	0.306	0.182	1.87	0.104
	UK	0.855	0.162	5.25	0.000
	Constant	3.894	0.738	6.51	0.000

4.3 Variance in the wages

Finally, after establishing different kind of effects of the variables on employment, the last thing to do is to check to which extent the variance in the wages moves along after macroeconomic shocks. This is done by checking the variable 'square', which represents the squared value of the first difference of the natural logarithm of the wages. So, for all countries in the data set this variable has been plotted and the result is depicted in Figure 3.

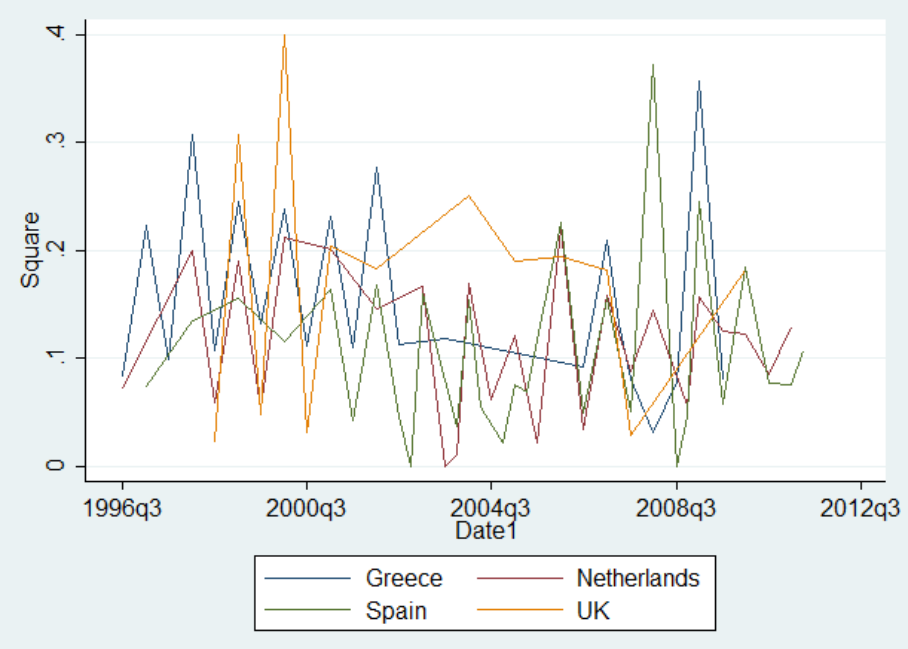

Figure 3: Variance of the wages for the countries in the data set (1996-2011).

A notable result from Figure 3 is the peak for the UK around 1999. This is in the year of the introduction of the euro and this probably explains why the difference is this large. Another result that comes forward in Figure 3 are the two peaks around 2008. Greece and Spain causes these peaks, which show up around the time of the worldwide financial crisis. As discussed in the introduction, the GIIPS countries were struck heavily by the crisis and this could explain the variance in the wages at that time. However, for the Netherlands no notable or striking results can be deduced from Figure 3. This could be correlated to the fact that the Netherlands has a negative fixed effect (see Sections 4.2.1 & 4.2.2). Moreover, there are no responses to be found that are the same for all the member countries, which is to be expected in an OCA.

5. Concluding Remarks

In this section, the findings of this research are summed up. Consequently, the research question is answered and the economic implications are mentioned. Finally, the caveats of this research and recommendations for economic policy are given.

5.1 Conclusion

At the beginning of this bachelor thesis, the following research question has been formulated: *''To which extent is Europe an optimum currency area regarding labour flexibility?''*. It has been interesting to see if the labour market reacts to shocks, which were normally processed by the exchange rates.

First, in Section 4.1 non-stationarity or autocorrelation was found. That is why the OLS-regressions are run without any adjustments. In the OLS-regression without any lags, we find significant effects of wages, GDP and public expenditure on the labour market on employment. Furthermore, for the Netherlands we find a negative fixed effect, whereas for Spain and the UK we find a positive fixed effect. However, this model is still subject to OVB. For this reason, one has to be careful with extrapolating the results. Adding lags to the model has resulted that the significant effects did not change, however, just as the fixed effects, they became stronger. In both models, the R-squared is highly inflated and that makes it impossible to interpret. Finally, when checking the variance of the wages over time, one deduces that some single member states have reacted to certain macroeconomic shocks. On the other side, there no jointly effects are found in the results.

Concluding, one can say that the EU is on its way in becoming an OCA, but it still has too many flaws in its system regarding labour flexibility to be called an OCA. This is because the EU failed to find a system in which the initial fixed effects can be covered or used to help member countries. Right now, only sole reactions from countries were to be found and no jointly ones.

5.2 Caveats

This research has been executed under a couple assumptions and therefore it cannot be fully extrapolated. For example, an OCA is not only defined by the labour flexibility in that area. Policies conducted by the governments and the central bank also have an effect on how well the Union is performing. Moreover, this research did not use many observations and it only used four countries to represent the entire Union. That is why some of the results could be biased and one has to be

very careful with extrapolating these results. Therefore, further research should use more data to make a more accurate estimate.

Furthermore, one of the caveats is that not many country-specific variables have been added to the data (only GDP and public expenditure on the labour market). Future research should use more of these variables to make a more precise conclusion, whether Europe is an OCA or not. If for example the variable gender pay gap would have been added to the model, one can make a distinction in wages for men and women and check if there are significant differences and if they change over time. Another variable which could be added in future research is a binary variable for the fiscal policy in a country. This policy, conducted by the government, can heavily influence the labour market and could therefore also be the reason of the bias. Moreover, future research can account for the fact that workers take into consideration how rigid wages are before accepting lower wages as part of a training program (i.e., general training or firm-specific training).

Finally, using panel data could also bring some flaws with itself, like cross-country dependency (i.e., correlation between countries) or data collection issues (i.e., the sampling design). The former is difficult to test, but it is necessary to include this in future research to make the conclusion more accurate.

5.3 Policy recommendations

Since it turned out to be that Europe cannot be defined as an OCA, the EU has to increase their involvement on the labour market to make sure it becomes one in the future. This can, for example, be done by increasing the public expenditure on the labour market. Currently, only a select number of countries spend enough on their labour market, whereas others rely on the market to take care of itself. However, it has turned out that the market is unable to react and recover by itself.

Another policy recommendation, which is consistent with the former, is to ensure the labour migration happens more smoothly. Right now, the language barrier forms one of the main issues of why labour migration fails to work. That is why this barrier needs to be removed in order to improve the labour migration.

Finally, a recommendation would be to conduct an expansionary fiscal policy. As mentioned in the introduction, this is also one of the ways to react to certain macroeconomic shocks. An advantage, compared to the increase in public expenditure on the labour market, is that this policy would only have to be conducted on international scale, thus by the ECB, whereas the increase in expenditure requires active involvement of all the member states.

References

Aizenman, J. (2016). *Optimal Currency Area: A 20th Century Idea For the 21st Century?* (No. w22097). National Bureau of Economic Research.

Babecký, J., Du Caju, P., Kosma, T., Lawless, M., Messina, J., & Rõõm, T. (2009). Downward nominal and real wage rigidity. *Wage Dynamics Network*. Retrieved May 4, 2017.

Balassa B., (1964), "The purchasing-power parity doctrine: A reappraisal" *The Journal of Political Economy*, Vol.72, pp. 584-596.

Ball, L. and Mankiw, N. G. (1994). Asymmetric price adjustment and economic fluctuations. Economic Journal, 247–61.

Belknap, J. K., Mitchell, S. R., O'Toole, L. A., Helms, M. L., & Crabbe, J. C. (1996). Type I and type II error rates for quantitative trait loci (QTL) mapping studies using recombinant inbred mouse strains. *Behavior genetics*, *26*(2), 149-160.

Boeri, T., & Van Ours, J. (2013). *The economics of imperfect labor markets*. Princeton University Press.

Brouwer, J., Paap, R., & Viaene, J. M. (2008). The trade and FDI effects of EMU enlargement. *Journal of International Money and Finance*, *27*(2), 188-208.

Christoffel, K. P., & Linzert, T. (2005). The role of real wage rigidity and labor market frictions for unemployment and inflation dynamics.

Copeland, L. S. (2014). *Exchange rates and international finance*. Pearson Education.

Cuestas, J. C., & Staehr, K. (2015). The Great Leveraging in the GIIPS Countries: Domestic Credit and Net Foreign Liabilities. *Sheffield Economic Research Paper Series*, *201501*.

Dellas, H., & Tavlas, G. (2005). Wage rigidity and monetary union. *The Economic Journal*, *115*(506), 907-927.

Delors, J. (1989). *Report on economic and monetary union in the European community (Rep.)*

European Central Bank (n.d.). Convergentiecriteria. Retrieved April 30, 2017, from https://www.ecb.europa.eu/ecb/orga/escb/html/convergence-criteria.nl.html

Eurostat. (2017). Your key to European statistics. Retrieved June 06, 2017, from http://ec.europa.eu/eurostat/about/overview

Fallick, B., Lettau, M., & Wascher, W. (2016). Downward Nominal Wage Rigidity in the United States During and After the Great Recession.

Fehr, E., & Goette, L. (2005). Robustness and real consequences of nominal wage rigidity. *Journal of Monetary Economics*, *52*(4), 779-804.

Frankel, J. A., & Rose, A. K. (1998). The endogenity of the optimum currency area criteria. *The Economic Journal*, *108*(449), 1009-1025.

Goldberg, L. (1999). Is optimum currency area theory irrelevant for economies in transition? *Sweeney, RJ, Wihlborg, C. and Willett, TD (eds.): Exchange Rate Policies for Emerging Market Economies*, 45-60.

Haefke, C., Sonntag, M., & Van Rens, T. (2013). Wage rigidity and job creation. *Journal of monetary economics*, *60*(8), 887-899.

Holden, S. (1994). Wage bargaining and nominal rigidities. *European economic review*, *38*(5), 1021-1039.

Holden, S. (2004). The costs of price stability: Downward nominal wage rigidity in Europe. *Economica*, *71*(282), 183-208.

Holden, S., & Wulfsberg, F. (2009). How strong is the macroeconomic case for downward real wage rigidity?. *Journal of monetary Economics*, *56*(4), 605-615.

Kaur, S. (2014). *Nominal wage rigidity in village labor markets* (No. w20770). National Bureau of Economic Research.

Kenen, P. (1969). 'The theory of optimum currency areas: an eclectic view', Monetary Problems of the International Economy, edited by R.A. Mundell and A.K. Swoboda, Chicago: Chicago University Press 1969.

Keynes, J. M. (1936). The General Theory of Employment, Interest and Money. London: MacMillan.

Knoppik, C., & Beissinger, T. (2003). How rigid are nominal wages? Evidence and implications for Germany. *The Scandinavian Journal of Economics*, *105*(4), 619-641.

Krause, M. U., & Lubik, T. A. (2007). The (ir) relevance of real wage rigidity in the New Keynesian model with search frictions. *Journal of Monetary Economics*, *54*(3), 706-727.

Krugman, P. (2013). Revenge of the optimum currency area. *NBER Macroeconomics Annual*, *27*(1), 439-448.

MacLeod, W. B. and Malcomson, J. M. (1993). Investment, holdup, and the form of market contracts. American Economic Review, 37, 343–54.

McKinnon, R. I. (1963). Optimum currency areas. *The American Economic Review*, *53*(4), 717-725.

Mundell, R. A. (1961). A theory of optimum currency areas. *The American economic review*, *51*(4), 657-665.

'Nexit' & 'Frexit' – Geert Wilders call for Dutch referendum. (n.d.). Retrieved April 20, 2017, from https://www.ft.com/content/12aeb6df-cc96-3c8f-95fd-dcded701a197

O'Brien, A. P. (1989). A behavioral explanation for nominal wage rigidity during the Great Depression. *The Quarterly Journal of Economics*, *104*(4), 719-735.

Obstfeld, M. (2002). *Exchange rates and adjustment: perspectives from the new open economy macroeconomics* (No. w9118). National Bureau of Economic Research.

Samuelson P.A. (1964), "Theoretical notes on trade problems", *The Review of Economics and Statistics*, Vol 46, pp.145-154.

Schmitt-Grohé, S., & Uribe, M. (2016). Downward nominal wage rigidity, currency pegs, and involuntary unemployment. *Journal of Political Economy*, *124*(5), 1466-1514.

Smith, J. C. (2000). Nominal wage rigidity in the United Kingdom. *The Economic Journal*, *110*(462), 176-195.

Sunde, U., Bauer, T., & Bonin, H. (2003). Real and Nominal Wage Rigidities and the Rate of Inflation: Evidence from West German Micro Data.

The Economist. (2012, March 31). Still sickly. Retrieved May 02, 2017, from http://www.economist.com/node/21551495

The Guardian. (2016, July 26). UK joins Greece at bottom of wage growth league. Retrieved May 12, 2017, from https://www.theguardian.com/money/2016/jul/27/uk-joins-greece-at-bottom-of-wage-growth-leaugue-tuc-oecd

Tobin, J. (1995). Inflation and unemployment. In *Essential Readings in Economics* (pp. 232-254). Macmillan Education UK.

Appendix

Maastricht Convergence Criteria

- National currency in ERM for 2 years.
- Budget deficit smaller than 3% of GDP.
- Government debt smaller than 60% of GDP.
- Inflation smaller than 1.5% above average of the lowest three.
- Long-term interest rates smaller than 2% above average of the lowest three.

Appendix 1: The Maastricht Convergence Criteria established in 1992.
Note: ERM = European Exchange Rate Mechanism, GDP = Gross Domestic Product.
Source: ECB (2017)

Greece					
	Obs.	*Mean*	*Std. Dev.*	*Min.*	*Max*
Employment	68	4,089.50	288.385	3,539	4,492
LNEmployment	68	8.314	0.071	8.172	8.41
Diff-LNEmployment	68	-0.030	0.247	-2.032	0.029
Wages	48	6,033.96	1,057.40	4,753.37	8,131.51
LNWages	48	8.691	0.167	8.467	9.004
Diff-LNWages	46	0.003	0.038	-0.072	0.127
GDP	68	57,176.76	7,115.23	43,972.15	70,299.23
LNGDP	68	10.946	0.125	10.691	11.161
Diff-LNGDP	68	-0.035	0.311	-2.492	0.129
PublicExp	28	95,667.50	32,062.25	33,691.11	138,953.50
LNPublicExp	28	11.394	0.434	10.425	11.842
Diff-PublicExp	27	0.015	0.273	-0.856	1.012

Appendix 2: The Greek data.

Netherlands					
	Obs.	*Mean*	*Std. Dev.*	*Min.*	*Max*
Employment	68	7,424.06	370.536	6,484	7,932
LNEmployment	68	8.911	0.051	8.777	8.979
Diff-LNEmployment	67	0.002	0.005	-0.0168	0.009
Wages	64	10,964.64	745.47	9,705.69	12,183.60
LNWages	64	9.3	0.068	9.18	9.408
Diff-LNWages	63	0.003	0.163	-0.019	0.048
GDP	68	152,769.20	15,133.59	122,377.30	177,204.50
LNGDP	68	11.932	0.102	11.715	12.085
Diff-LNGDP	67	0.005	0.036	-0.058	0.067
PublicExp	36	1,186,133.00	92,206.27	974,265.50	1,315,734.00
LNPublicExp	36	13.983	0.081	13.789	14.089
Diff-PublicExp	35	-0.009	0.297	-0.118	0.073

Appendix 3: The Dutch data.

Spain					
	Obs.	*Mean*	*Std. Dev.*	*Min.*	*Max*
Employment	68	16,822.19	2,414.05	12,260	20,241
LNEmployment	68	9.719	0.15	9.414	9.915
Diff-LNEmployment	68	0.023	0.151	-0.380	1.242
Wages	64	6,457.88	410.88	6,064.90	7,404.93
LNWages	64	8.771	0.061	8.71	8.909
Diff-LNWages	63	0.002	0.025	-0.025	0.138
GDP	68	259,042.30	37,743.80	189,729.60	320,987.60
LNGDP	68	12.454	0.152	12.153	12.678
Diff-LNGDP	68	0.025	0.176	-0.082	1.382
PublicExp	36	1,773,664.00	196,894.50	1,446,007.00	2,090,925.00
LNPublicExp	36	14.382	0.114	14.184	15
Diff-PublicExp	35	-0.000	0.058	-0.221	0.154

Appendix 4: The Spanish data.

UK					
	Obs.	*Mean*	*Std. Dev.*	*Min.*	*Max*
Employment	68	26,296.62	1,001.86	24,449	27,815
LNEmployment	68	10.176	0.038	10.104	10.233
Diff-LNEmployment	68	0.019	0.141	-0.007	1.161
Wages	56	12,142.63	1,263.68	9,970.75	13,824.95
LNWages	56	9.399	0.107	9.207	9.534
Diff-LNWages	55	0	0.036	-0.103	0.159
GDP	68	548,779.70	81,584.64	225,903.50	685,121.80
LNGDP	68	13.203	0.171	12.327	13.437
Diff-LNGDP	68	0.017	0.079	-0.096	0.509
PublicExp	28	274,916.40	54,086.03	200,939.80	374,276.70
LNPublicExp	28	12.506	0.195	12.211	12.833
Diff-PublicExp	27	0.004	0.127	-0.268	0.411

Appendix 5: The British data.

Variable	*OLS*	*OLS_dum*
LN(Wages)	-0.621***	-0.401***
Diff-LN(Wages)	0.371	0.520
Square	-0.061	-0.117
LN(GDP)	0.975***	0.534***
Diff-LN(GDP)	-0.565***	-0.310***
LN(PublicExp)	-0.020**	0.121**
Diff-LN(PublicExp)	0.155**	-0.002
Country		
Netherlands		-0.058
Spain		0.269
UK		0.722***
Constant	3.347***	4.643***
N	44	44
R-squared	0.998	0.999
R-squared adj	0.997	0.999

*Legend: * P < 0.05, ** P < 0.01, *** P < 0.001*

Appendix 6: Difference OLS-regression with fixed effects between pooled and dummy.