Country Size and Labor Market Flexibility in the European Monetary Union: Why Small Countries Have more Flexible Labor Markets

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Abstract

This paper explores the impact of country size on labor market flexibility in a monetary union with a common monetary policy as conducted in EMU. I apply a Barro-Gordon framework and test its result empirically for EMU. Results confirm that small countries demand higher labor market flexibility than large countries. Small countries use labor market flexibility to be protected against monetary policy in favor of large countries and use flexibility as a substitute for monetary policy. Thereby, national inflation volatilities and unemployment volatility are important determinants. Business cycle synchronization reduces the need of small countries for additional labor market flexibility.

Keywords: Structural reforms, labor market flexibility, European Monetary Union, country size, Barro-Gordon model, business cycle synchronization.

JEL-Codes: D78, E42, E52, E61, F15

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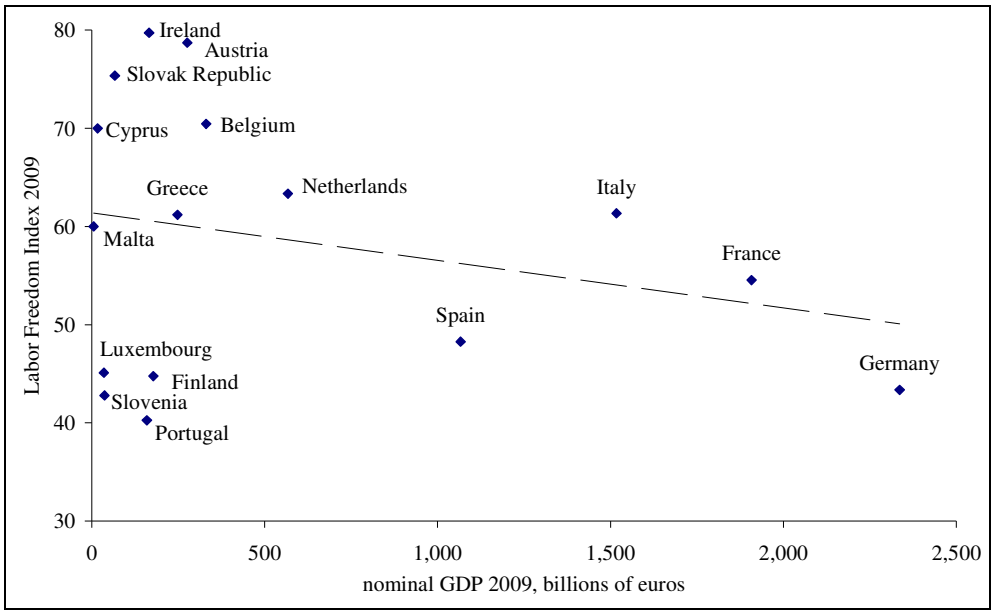
I. Introduction

Globalization and the European integration and most recently the need to adjust to large intra-euro area current account imbalances have built up pressure on European countries to adopt more flexible institutions, especially on labor markets (IMF 2007, European Commission 2008, Zemanek et al 2009). However, small open countries of the European Monetary Union have on average more flexible labor markets if measured by the Heritage Labor Freedom index (Figure 1). This observation goes in line with empirical results of Duval and Elmeskov (2006) who find that small countries implement more structural reforms than large countries. One reason for higher labor market flexibility in small countries might be the common monetary policy framework in EMU as small countries have a smaller weight in monetary policy decisions than large countries. In this paper, I analyze whether such a "one-size" monetary policy results in the observed country size-specific labor market flexibility. As theoretical framework I use a Barro-Gordon model. I then test my theoretical results in an empirical analysis for the EMU.

Figure 1: *GDP and Labor Freedom in EMU*[1].



Source: Eurostat and the Heritage Foundation.

[1] High values of the Labor Freedom Index indicate higher labor market freedom. Nominal GDP figures of 2009 are taken from the IMF World Economic Outlook forecast.

Up to now, research on this issue remains relatively scarce. The seminal paper by Mundell (1961) on optimum currency areas has implicitly addressed the role of monetary policy for labor market flexibility. Mundell argued that in a monetary union (with symmetric country size), a country needs flexible labor markets to adjust to asymmetric shocks as exchange rates and monetary policy cannot work as automatic stabilizers. Bean (1998) confirms this hypothesis by arguing that in a monetary union, national governments lose control over monetary policy and therefore need to implement labor market flexibility to restore macroeconomic flexibility. The role of asymmetric country size in a monetary union can be explained by Kenen (1969) who argues that small countries with low industrial diversification are more vulnerable to asymmetric shocks. This implies that they are forced to be more flexible than large countries. This is even more the case if the central bank reacts only marginally to asymmetric real shocks in small countries due to the small weight in the monetary policy reaction function (Hefeker 2006).

The theoretical analysis of labor market flexibility using a Barro-Gordon framework (Kydland/Prescott 1977, Barro/Gordon 1983a, 1983b) goes back to influential papers by Calmfors (2001), Berthold and Fehn (1998) and Sibert and Sutherland (2000). They all discuss labor market flexibility between autonomous and common monetary policy in the run up to EMU. Up to the present, little research has been done on the determinants of labor market flexibility within a monetary union. In this paper I want to close that gap by investigating the impact of country size on labor market flexibility in a monetary union, in particular in the EMU.

The paper is organized as follows: In section 2, I scrutinize the role of country size for labor market flexibility in a monetary union. In section 3, I introduce the baseline Barro-Gordon framework and develop a monetary union model. At this point, country size is introduced as well as a monetary policy characteristic quite similar to the European Monetary Union. Section 4 analyzes the impact of country size in a monetary union on labor market flexibility and in section 5 I empirically test the theoretical results for the EMU. I summarize my results and give policy implications in section 6.

II. Country size and labor market flexibility in a monetary union

The general need for macroeconomic flexibility in a monetary union arises from irreversible fixed nominal exchange rates and a common monetary policy. National economic policy cannot use monetary policy and exchange rates anymore to adjust to asymmetric macroeconomic shocks. The adjustment process depends on real price and wage changes between countries. This implies that prices and wages, and therefore also the labor markets need to be flexible (Mundell 1961).

The necessary level of macroeconomic flexibility depends on factors as discussed by Bean (1998). First, Bean argues that more flexibility will be required if business cycles within the monetary union are less synchronized. Then the common monetary policy cannot work as a union-wide stabilizer for all countries and may be insufficient from a single country's perspective. And second, if countries of a monetary union have different production structures, then the probability of asymmetric economic shocks increases. This argument is in line with Krugman (1993) who argues that in a monetary union regional specialization increases. As the probability of asymmetric shocks rises, member countries of a monetary union need more flexibility than countries outside.

Anecdotic evidence (Figure 1) and empirical results of Duval and Elmeskov (2006) raise the question of the impact of country size on labor market flexibility within a monetary union. Kenen (1969) provides a first theory to this. He argues in his theory on optimum currency areas that small countries with a low-level of industrial diversification are more vulnerable to asymmetric shocks. To some extent, other industrial sectors can not compensate for sector specific asymmetric shocks. Therefore, the need for labor market flexibility in less diversified small countries within a currency union needs to be greater than in large countries.

A further reason for higher labor market flexibility in small countries might be the one-size monetary policy as conducted in the EMU. This common monetary policy does not stabilize equally all EMU member countries against asymmetric shocks. The reason is the construction of the one-size monetary policy. The aim of the European Central Bank (ECB) is to provide price stability based on the Harmonized Index of Consumer Prices (HICP). This EMU-wide index itself is calculated from weighted national price indices of all member countries. Country weights depend on the member countries' economic size in terms of private consumption (ECB 2004, Eurostat 2001) (see Table 1).

Table 1: *Country Weights of EMU Member Countries in the HICP in 2009 (in per mill).*

Country	Weight
Austria	30.2
Belgium	33.9
Cyprus	2.5
Finland	16.8
France	206.0
Germany	260.7
Greece	34.6
Ireland	15.6
Italy	185.0
Luxembourg	2.6
Malta	0.8
Netherlands	50.9
Portugal	22.0
Slovak Republic	6.8
Slovenia	3.7
Spain	127.9

Source: Eurostat 2009.

The computation of the HICP allows a single country's national inflation to differ from the central bank's target as a result of national wage and fiscal policies or country specific shocks. Crucially, however, it depends on the size of the country how the ECB will react to this development. For instance, the ECB's monetary policy will only marginally reflect low inflation due to a recession in a small country, as weighted EMU-wide inflation will just marginally change. In contrast, a similar economic development in a large country will be echoed in the ECB's monetary policy. Therefore, small countries of the EMU are forced to regain competitiveness and economic progress via high flexibility and structural reforms. In the case of large countries, the ECB will (partially) address a recession by interest rate cuts. Hence, small countries have ex-ante a larger incentive for high labor market flexibility.

Contrary, Berger and Hefeker (2004) argue that country size does not necessarily affect labor market flexibility. They refer to the decision mechanism of the ECB. Directors and representatives of national central banks decide on monetary policy with equal voting power (one-country-one-vote). If national representatives act on behalf of their home countries then monetary policy decision might be biased. In an extreme case, small countries might form a coalition to overrule large countries. Nevertheless, this argumentation is less realistic and questions the credibility of ECB's monetary policy.

III. The baseline two-country model

To analyze the impact of country size on labor market flexibility, I use a model of time inconsistency in monetary policy based on Kydland and Prescott (1977) and Barro and Gordon (1983a, 1983b), which is in line with previous literature (Berthold/Fehn 1998, Sibert/Sutherland 2000, Calmfors 2001, Belke/Herz/Vogel 2005).

The original framework by Barro and Gordon refers to the monetary policy decision of the central bank by assuming a short-term Phillips-curve relationship between inflation and unemployment. If the inflation rate rises above expected inflation, then cost of labor will fall in real terms, this in turn reduces unemployment, as economic agents are not able to differentiate between nominal and real price increases. Therefore, the central bank can exploit the Philips-curve relationship to reduce unemployment at the cost of higher inflation.

In addition to the original Barro-Gordon model, in the extended model (e.g. Calmfors 2001) the national government decides on the optimum degree of labor market flexibility for the economy. The government might increase labor market flexibility because they reduce unemployment as labor market distortions are reduced. Further the country is more protected against unemployment volatility in the case of asymmetric shocks. Nevertheless, higher labor market flexibility is not free of costs. The government will face in particular political costs such as opposition from voters and insiders who stand to lose their benefits and rents from low labor market flexibility. General strikes, as have occurred in France on several occasions, or a change in government, as in Germany in 2005 are examples of such political costs. Hence, the government will balance costs of higher labor market flexibility against utility of lower unemployment.

Within this extended framework, unemployment could therefore be reduced by surprise inflation of the central bank and/or by structural reforms of the government. The central bank decides on its optimum inflation and the government decides on the optimum labor market flexibility. As I model a one-size monetary policy as conducted in EMU, I assume a conservative central bank, which only aims for low and stable inflation. This central bank does not use surprise inflation to reduce unemployment. Only national governments adjust labor market flexibility to curb unemployment.

The monetary union in my model consists of two countries $(i = 1,2)$. A supranational central bank is responsible for a common monetary policy, which aims to provide a stable low inflation based on a weighted union-wide inflation rate. In analytic terms, the central bank

minimizes its loss function where losses occur from a deviation of the weighted union-wide inflation rate from the objective inflation rate. The central bank's loss function consists of two separate national loss functions of both member countries weighted by relative country size similar to EMU monetary policy. Relative country size is expressed by the factor a for country 1 and $(1-a)$ for country 2. The country specific loss functions of the central bank (denoted by subscript CB) are defined as standard quadratic loss-functions:

(1) $L_{CB} = a(L_{CB,1}) + (1-a)(L_{CB,2}) \quad a \in (0,1)$ with

(2) $L_{CB,1} = \frac{1}{2}(\pi - k + \varepsilon_1)^2$ and $L_{CB,2} = \frac{1}{2}(\pi - k + \varepsilon_2)^2$

Union wide inflation rate is expressed by π. k ($k \geq 0$) indicates an objective inflation above zero like the ECB target of "…*below but close to 2 %*…" (ECB 2004: 51). Positive and negative deviations of inflation from the target increase the loss of the central bank. In addition, national inflation rates π_i are allowed to deviate from union-wide inflation as possible in the euro area. For instance, different national economic developments, national asset market developments, or national wage and fiscal policies might result in asymmetric national inflation behavior. I model national inflation developments by national inflation shocks: ε_i with $E[\varepsilon_i] = 0; \text{var}(\varepsilon_i) > 0$. These shocks are assumed to be exogenous and independent of unemployment.[2] The national inflation rate becomes $\pi_i = \pi + \varepsilon_i$. The loss function of the central bank therefore is:

(3) $L_{CB} = a\frac{1}{2}(\pi - k + \varepsilon_1)_1^2 + (1-a)\frac{1}{2}(\pi - k + \varepsilon_2)_2^2$

Depending on country size, the central bank will react to asymmetric national inflation developments. Each country's government independently decides on its optimum labor market flexibility. Their loss functions (denoted by subscript Gov) include inflation and unemployment *u* as equally weighted but also a proxy for labor market flexibility *s*. Factor γ weighs labor market flexibility in the loss function and indicates also the importance of political costs of labor market flexibility.

(4) $L_{Gov_i} = \frac{1}{2}(\pi - k + \varepsilon_i)^2 + \frac{1}{2}u_i^2 + \gamma s_i \quad (i = 1,2);\ s \in (0,1);\ \gamma > 0$

[2] I will later abolish this latter assumption.

The interrelationship between unemployment, inflation and labor market flexibility is defined in a Phillips-curve following Calmfors (2001). Additionally, I add inflation shocks to the inflation term. By doing so, I apply national Phillips-curves which include the respective national inflation rate $\pi_i = \pi + \varepsilon_i$:

(5) $u_i = (\tilde{u} - \theta s_i) - (1 - s_i)(\pi + \varepsilon_i - \pi^e) + (1 - s_i)\mu_i \quad s \in (0,1),\ \hat{u} \in (0,1)$ and $\theta \in (0, \tilde{u})$.

Calmfors (2001) assumes an economy with a fraction s of unregulated sectors and a fraction $(1-s)$ of regulated sectors. In unregulated sectors of the economy, wages are almost fully flexible. Real wages are renegotiated continuously based on inflation and exogenous shocks. In contrast, in regulated sectors wages are set by long-term agreements based on the expected inflation and expected value of exogenous shocks. Therefore, s represents a measure of overall labor market flexibility of the economy. Calmfors assumes that the choice of labor market flexibility is linked to political costs. For high labor market flexibility, more or broader structural reforms are necessary but at higher political costs. Therefore, s in equation 4 and 5 are equally used.

The unemployment rate u_i depends first on equilibrium unemployment $\tilde{u}$. Higher labor market flexibility reduces equilibrium unemployment weighted by factor θ (first term). θ can only reach the value of $\tilde{u}$, which secures a non-negative unemployment rate, in the case of $s = 1$. Second, unemployment is affected by unexpected national inflation as result of an inflation shock $(\pi + \varepsilon_i - \pi^e) \neq 0$. If national inflation π_i exceeds (is lower than) expected inflation π^e then unemployment will decline (increase). However, a highly flexible labor market lowers the sensitivity of unemployment on unexpected inflation (second term) as a larger part of the economy will renegotiate wage contracts. Third, unemployment might be changed by a country-specific asymmetric unemployment shock μ_i, which is assumed to be an independent and identically distributed (i.i.d.) white noise shock, with: $E[\mu] = 0; \text{var}(\mu) > 0$. Again, labor market flexibility lowers the impact of asymmetric unemployment shocks on unemployment (third term) because wages can easily be adjusted to a shock. Summarizing, labor market flexibility increases the ability of an economy to absorb surprise inflation and asymmetric shocks via wage variation instead of employment variation.

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IV. Structural reforms and country size

In this section, I solve the model to obtain the optimum labor market flexibility with respect to country size. First, I assume, that inflation shocks are uncorrelated between countries $\text{cov}(\varepsilon_1, \varepsilon_2) = 0$. In so doing, I can more precisely analyze determinants that affect optimum labor market flexibility. The model is solved by minimizing function (3) with respect to π. This yields via the optimum monetary policy[3] the expected inflation rate π^e and the optimum union wide inflation rate π^*.

(6) $\pi^e = k$

(7) $\pi^* = k - a\varepsilon_1 - (1-a)\varepsilon_2$

The private sector in the monetary union expects a union-wide inflation rate equal to the central bank's target because the central bank only controls inflation and inflation shocks are ex-ante expected to be zero. The central bank will choose an optimum inflation rate and monetary policy in response to national inflation developments. A positive national inflation shock (higher inflation) imposes an additional loss in the central bank's loss function. Hence, optimum inflation will be lower to minimize the loss. That indicates a restrictive monetary policy. However, the impact of national inflation shocks on union wide equilibrium inflation depends on country size. A shock in a large country affects optimum union wide inflation relatively more.

Governments will anticipate the central bank's monetary policy reaction and will select their optimum degree of labor market flexibility. For instance for country 1, the government's loss function (4) is minimized with respect to s_1 subject to (5), (6), and (7). After calculating the expected value, it yields the expected marginal costs of labor market flexibility. I set the latter equal to zero (First Order Condition) and solve for s_1, which is the optimum labor market flexibility s_1^* for country 1:

(8) $$s_1^* = 1 - \frac{\gamma + \theta(\theta - \tilde{u})}{(a-1)^2(\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2) + \theta^2 + \sigma_{\mu_1}^2} \qquad \text{for } s_1^* \in (0,1)$$

Optimum labor market flexibility depends only on exogenous variables and is symmetric for country 2:

[3] See Annex for all equations.

$$(9) \qquad s_2^* = 1 - \frac{\gamma + \theta(\theta - \tilde{u})}{((1-a)-1)^2\left(\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2\right) + \theta^2 + \sigma_{\mu_2}^2} \quad \text{for } s_2^* \in (0,1)$$

Equation (8) and (9) reveal that optimum labor market flexibility depends positively on unemployment variance $\sigma_{\mu_i}^2$. The higher unemployment variation, the more flexibility will both countries need to cushion the shocks, as monetary policy does not react to unemployment shocks. Further, higher equilibrium unemployment $\hat{u}$ and a larger effectiveness of labor market flexibility to reduce equilibrium unemployment θ will be answered by higher labor market flexibility. High costs of structural reforms γ reduce optimum labor market flexibility as the utility of higher labor market flexibility is more likely offset by political costs of flexibility. Most important, country size a is negatively related to labor market flexibility. Additionally, inflation variances of both countries will force governments to choose higher labor market flexibility.

The impact of labor market flexibility is the result of two effects. First, if inflation variance of country 2 is higher than country 1, it will not be directly affected by a rising inflation in country 2. However, such an inflation shock influences the union-wide inflation rate and thereby the central bank's loss-function. To maintain the objective inflation rate, the central bank will react with restrictive or expansive monetary policy. Then monetary policy will spill over to country 1. First, monetary policy acts like surprise inflation or deflation, which affects the unemployment of country 1 via the Phillips-curve relationship. Second, higher or lower inflation rather than objective inflation, constitutes a loss for the government of country 1. In fact, a negative inflation shock (lower inflation) in country 2 would lower unemployment in country 1 via expansive monetary policy. Conversely, a positive shock (higher inflation in country 2) would increase unemployment via restrictive monetary policy.

Such spill-over effects can be reduced or eliminated if country 1 has highly flexible labor markets. Then, monetary policy in favor of country 2 will not affect unemployment as wages are continuously adjusted. Whether country 1 will choose high labor market flexibility (as it is not free of cost) however, depends on its size. If country 1 is small then negative monetary spill-over will be large as higher inflation in country 2 increases the union wide inflation rate relatively more strongly. Country 1 might then face high unemployment. Utility of high labor market flexibility will exceed costs of higher labor market flexibility. Therefore, a small country will desire a high degree of flexibility. In contrast, if country 1 is large then negative unemployment effects are less intense or only marginal. In the presence of reform costs, a

large country 1 will prefer lower flexibility to "save" political costs of high labor market flexibility.

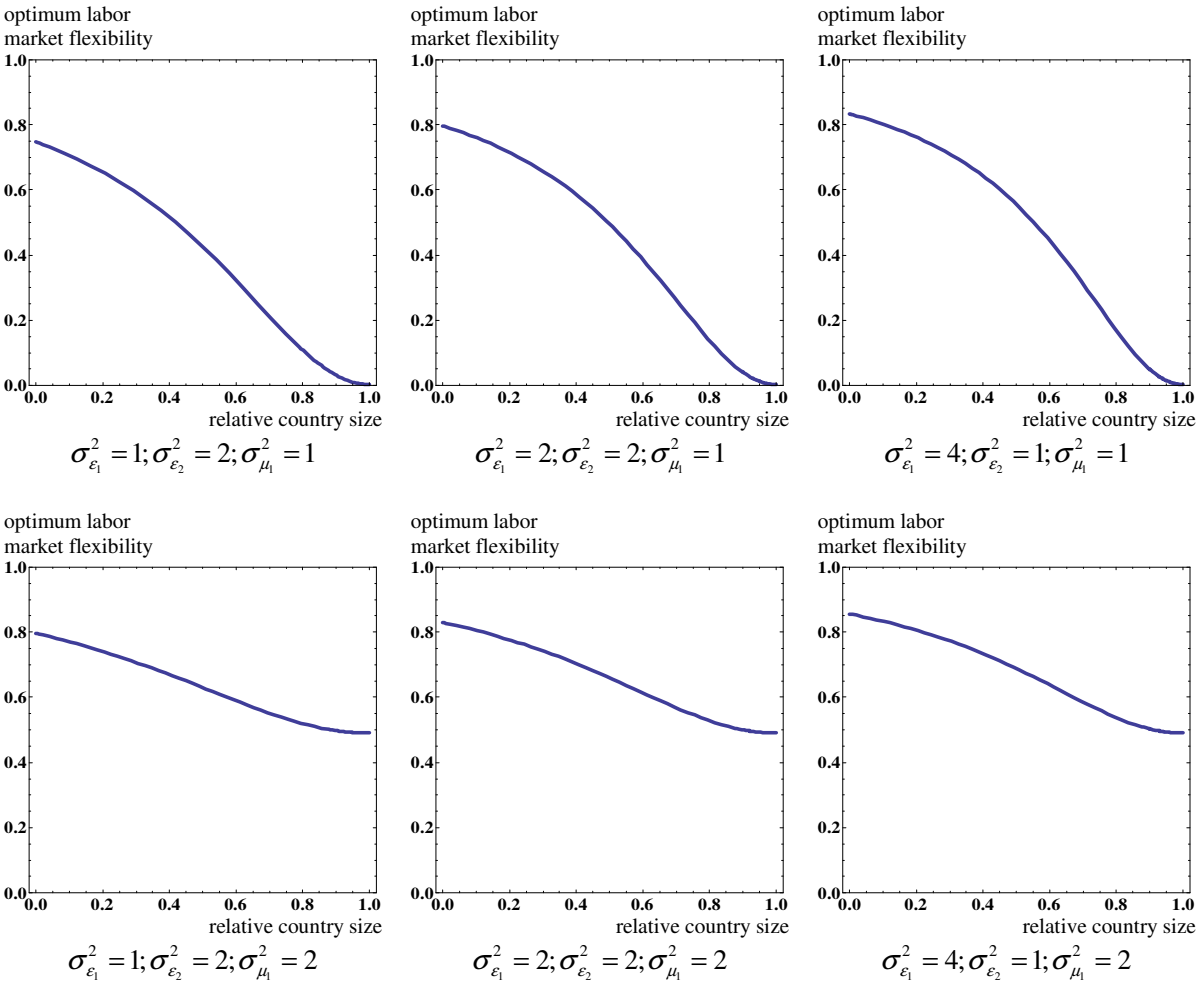
Second, if country 1 has higher inflation variance and inflation rises than country 1, it will be directly affected in two ways. First, national inflation is unequal to expected inflation ($\pi_i \neq \pi^e$) and states therefore a loss for the government. Second, changed inflation will impact on unemployment via the Philips-curve if the labor market is inflexible. Surprise inflation will lower unemployment; unexpected low inflation will increase unemployment. However, the central bank will react on the inflation shock as union wide inflation rate is unequal to the objective rate. Monetary policy will compensate for national effects (inflation and unemployment). National and expected inflation rates converge again and unemployment is finally less changed.

Nevertheless, the degree of monetary policy reaction and hence shock compensation depends on country size. A shock in a small country 1 will affect union wide inflation only marginally. Therefore, monetary reaction will also be small. Inflation difference and unemployment change as result of the shock will be almost uncompensated in a small country 1. In contrast, effects of an inflation shock in a large country 1 will be almost completely compensated. Assuming inflexible labor markets, a small country 1 will end up with a relatively high loss of changed inflation. Changed unemployment can be a gain (in the case of surprise inflation) or a loss (in the case of lower inflation). A large country 1 has a relatively small loss from changed inflation and gains or loses marginally from changed unemployment. Therefore, a small country will choose high labor market flexibility as the central bank does not react to changed inflation which will always state a certain loss for the government 1.

The small country will prefer higher labor market flexibility than the large country to avoiding monetary policy spill-over. It makes itself independent from spill-over of monetary policy in favor of country 2. Further, it substitutes lost flexibility of an autonomous monetary policy by labor market flexibility. Figure 2 illustrates the relationship for numerical examples. [4] While the x-axis shows the relative country size, the y-axis is optimum labor market flexibility.

[4] I set equilibrium unemployment at 5 percent, gamma is set simply at one and theta at 0.05 to avoid non-negative figures of equilibrium unemployment in the case of perfect labour market flexibility. A variation of values does not change the general relationship.

Figure 2: *Country size and optimum labor market flexibility, uncorrelated inflation shocks.*



Correlation between inflation and unemployment

As extension, I allow different shocks to correlate. First, I assume that inflation and unemployment shocks are correlated $E[\varepsilon_i]=0;\text{var}(\varepsilon_i)>0;E[\mu_i]=0;\text{var}(\mu_i)>0$; $\text{cov}(\varepsilon_i,\mu_i)\neq 0$. In particular, I assume a negative correlation which is plausible in economic terms. In a recession higher unemployment and low inflation might occur, as additional unemployment might reduce consumption, wage growth and therefore price inflation. In contrast, low unemployment, rising wages and consumption are responsible for higher inflation during a boom. Therefore, I capture with this specification national business cycles. Again, I solve the model and obtain the optimum labor market flexibility that includes the covariances between inflation shocks and unemployment shocks $\sigma_{\varepsilon_1,\mu_1}$ and $\sigma_{\varepsilon_2,\mu_2}$:

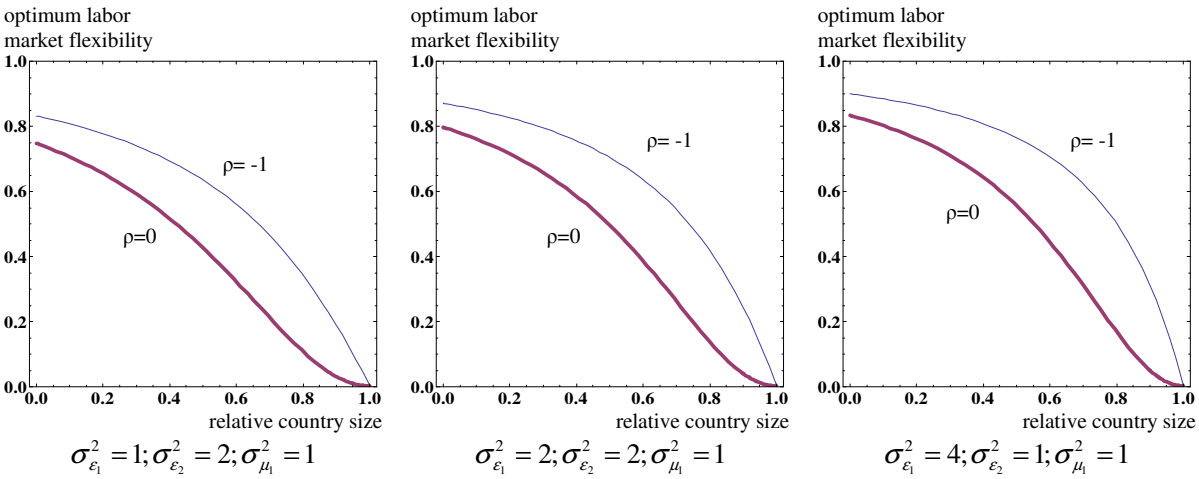
$$(10) \qquad s_1^* = 1-\frac{\gamma+\theta(\theta-\tilde{u})}{(a-1)^2\left(\sigma^2_{\varepsilon_1}+\sigma^2_{\varepsilon_2}\right)+2(a-1)\sigma_{\varepsilon_1,\mu_1}+\theta^2+\sigma^2_{\mu_1}} \qquad \text{and}$$

$$(11) \qquad s_2^* = 1 - \frac{\gamma + \theta(\theta - \tilde{u})}{((1-a)-1)^2\left(\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2\right) + 2((1-a)-1)\sigma_{\varepsilon_2,\mu_2} + \theta^2 + \sigma_{\mu_2}^2}$$

The assumed negative correlation between inflation and unemployment shocks increases labor market flexibility irrespective of country size. In case of a recession, lower than expected inflation, first, states a loss for the government. Second, inflation increases unemployment via the Phillips-curve relationship. Additionally, unemployment rises as a result of the unemployment shock. Although the central bank will partly compensate with expansive monetary policy, a country will end-up with higher unemployment – partly from lower inflation and directly from the unemployment shock.

Especially, the large country will now prefer relative higher labor market flexibility, as the small country has already a high level flexibility. Figure 3 shows the relationship between relative country size and optimum labor market flexibility dependent on the correlation between unemployment and inflation shocks. $\rho_{\varepsilon_i,\mu_i} \in (-1,1)$ is the correlation coefficient. Bold lines indicate $\rho_{\varepsilon_i,\mu_i} = 0$ and thin lines $\rho_{\varepsilon_i,\mu_i} = -1$.

Figure 3: *Country size and optimum labor market flexibility, correlated inflation and unemployment shocks.*



Correlation between national inflation rates

In the last step, I remove the assumption of uncorrelated national inflation shocks $E[\varepsilon_i]=0;\text{var}(\varepsilon_i)>0;\text{cov}(\varepsilon_1,\varepsilon_2)\neq 0$. By doing so, I account for asymmetric and symmetric inflation shocks which are related to business cycle synchronization within a monetary union. Inflation rates in both countries are probably higher in a boom than in a recession. Positive correlation of national inflation shocks therefore accounts for business cycle synchronization. If I solve the model again, I get the optimum labor market flexibility for country 1 and 2:

$$(12) \qquad s_1^* = 1 - \frac{\gamma + \theta(\theta - \tilde{u})}{(a-1)^2\left(\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2\right) + 2(a-1)\sigma_{\varepsilon_1,\mu_1} - 2(a-1)^2\sigma_{\varepsilon_1,\varepsilon_2} + \theta^2 + \sigma_{\mu_1}^2}$$

$$(13) \qquad s_2^* = 1 - \frac{\gamma + \theta(\theta - \tilde{u})}{((1-a)-1)^2\left(\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2\right) + 2((1-a)-1)\sigma_{\varepsilon_2,\mu_2} - 2(a-1)^2\sigma_{\varepsilon_1,\varepsilon_2} + \theta^2 + \sigma_{\mu_2}^2}$$

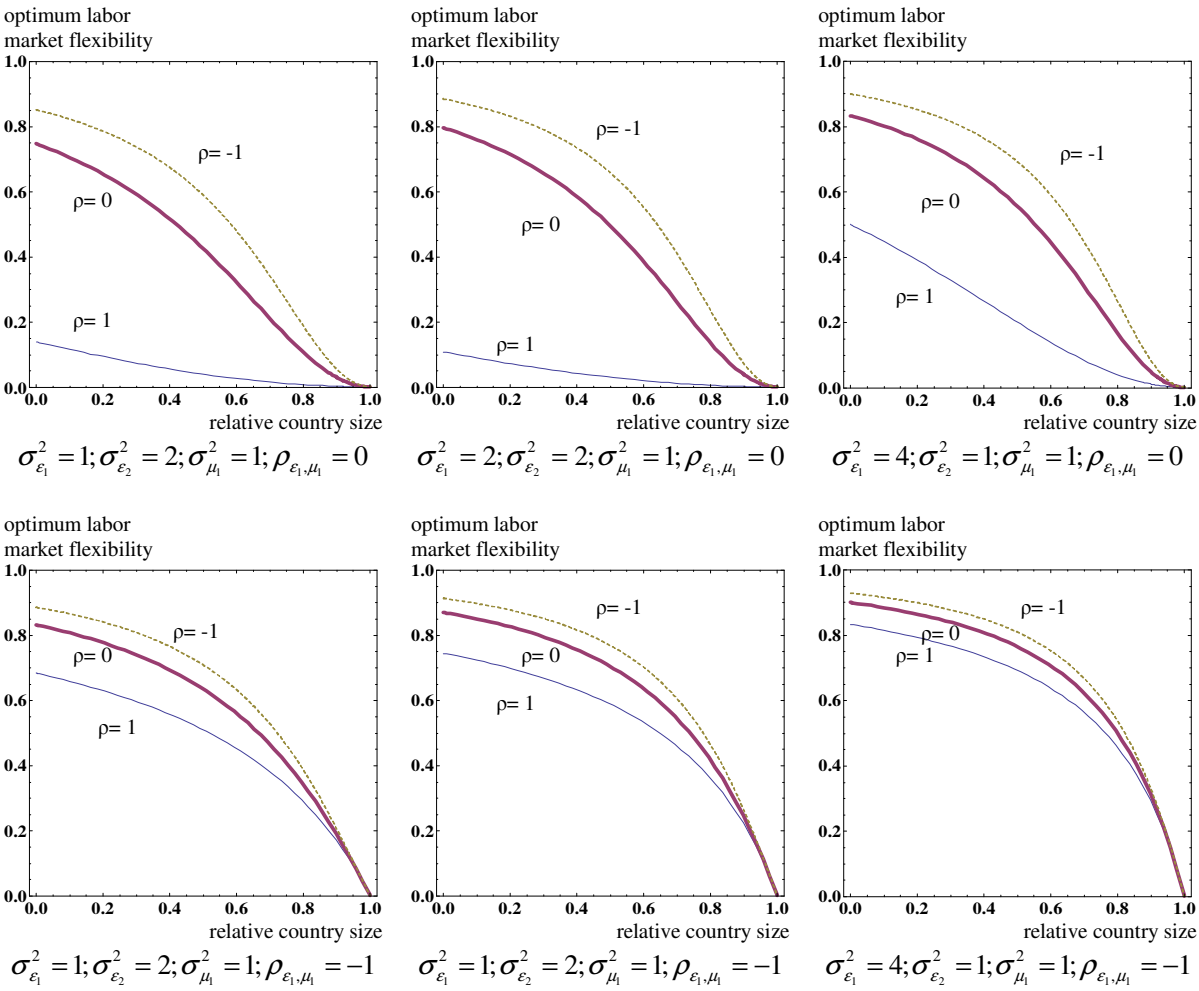
In addition to equation (10) and (11), the covariance between two inflation shocks $\sigma_{\varepsilon_1,\varepsilon_2}$ is a determinant for optimum labor market flexibility. A negative covariance reduces the second term of equation (12) and (13) which reduces optimum labor market flexibility. In contrast, positive values for the covariance increase optimum labor market flexibility. This result confirms Bean (1998).

If inflation shocks are negatively correlated, inflation shocks in the small country will be accelerated by the monetary policy reaction in favor of the large country. For example, the small country has low inflation as a result of a recession. The optimal monetary policy reaction would be expansive monetary policy. However, as the large country has high inflation, the central bank will pursue a restrictive monetary policy. Inflation in the small country falls even more and unemployment rises. Hence, the small country needs additional labor market flexibility.

In the case of positive correlated inflation shocks, which assume business cycle synchronization, monetary policy will always meet the need of the small country. Too low inflation will always be compensated by expansive monetary policy and vice versa. Therefore, business cycle synchronization lowers the need for additional labor market flexibility in the small country. The gap in labor market flexibility between the small and the large country is reduced.

Figure 4 shows the relationship between country size and optimum labor market flexibility for different correlation coefficients of national inflation shocks $\rho_{\varepsilon_1,\varepsilon_2} \in (-1,1)$. Bold lines indicate $\rho_{\varepsilon_1,\varepsilon_2} = 0$, thin lines $\rho_{\varepsilon_1,\varepsilon_2} = 1$, and dashed lines $\rho_{\varepsilon_1,\varepsilon_2} = -1$.

Figure 4: *Country size and optimum flexibility, correlated inflation shocks.*



V. Empirical analysis

In this section I test my theoretical results in an empirical analysis for the EMU. In particular, I test the impact of country size, national inflation volatility, unemployment volatility, inflation correlation, and correlation between national inflation and unemployment on labor market flexibility.

Data and model specification

I base my estimates on a bilateral data set for eleven EMU core countries[5] over the period 2004-2008. The bilateral data set reflects the two-country setting of my theoretical model and increases the number of observations to 550.

I measure *labor market flexibility* (lmf) by the Labor Freedom index published by the Heritage Foundation (Heritage 2009). The index ranges from 0 to 100 with higher values indicating higher labor freedom. It includes legal and regulatory aspects of a country's labor market framework, such as minimum wages, employment protection, and measurable regulatory burdens on hiring and working hours. Unfortunately, data on labor market flexibility are only available from 2005 to 2009. As the index is published at the beginning of a year, I link index values to macroeconomic values of the respective past year.

Country size (size) is first measured by nominal GDP, taken from the IMF World Economic Outlook Database. To account for my bilateral model setting, I calculate the relative country size of a country relative to another $\left(\frac{size_i}{size_j}\right)$ with i and j identifying countries. Second, I use population figures from the IMF World Economic Outlook Database as proxy for country size, again measured in relative values, to check for robustness of my results. The *inflation variance* ($\sigma^2_{\varepsilon_i}$) and *inflation correlation* ($\sigma_{\varepsilon_i,\varepsilon_j}$) are calculated from monthly national HICP inflation figures, provided by Eurostat. Similarly, *unemployment variances* are based on monthly seasonal adjusted unemployment figures by Eurostat.

I use the following linear regression equation:

$$(13) \qquad lmf_i = \beta_0 + \beta_1\left(\frac{size_i}{size_j}\right) + \beta_2\sigma^2_{\varepsilon_i} + \beta_3\sigma^2_{\varepsilon_j} + \beta_4\sigma_{\varepsilon_i,\mu_i} + \beta_5\sigma_{\varepsilon_i,\varepsilon_j} + \beta_6\sigma^2_{\mu_i} + \beta_7 I + \varepsilon\,.$$

[5] Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain. I use these early entry countries only, as these countries have had several years to adjust their labor market flexibility to EMU conditions as assumed in my model.

I estimate relative country size, national inflation variances, correlation between inflation and unemployment, inflation correlation, and unemployment variance on labor market flexibility in a pooled OLS regression. Subscripts i and j indicate countries. ε is the white noise error term.

Additionally, by introducing an interaction term *I*, I test, whether the relationship between relative country size and labor market flexibility is influenced by national inflation rate volatilities (Jaccard/Turrisi 2003). Such interaction effects can be isolated by product terms of relative country size (focal variable) and the variance variable (moderator variable): $(size_i / size_j)(\sigma^2_{\varepsilon_i})$ or $(size_i / size_j)(\sigma^2_{\varepsilon_j})$. Note, that the interpretation of regression coefficients changes. With an eye on my own estimations, the interpretation of regression coefficients can be summarized as follows (Jaccard/Turrisi 2003): β_1 captures the effect of relative country size on labor market flexibility if the inflation variance in country i (j) is zero, β_2 (β_3)estimates the effect of inflation variance in country i (j) on labor market flexibility if country size is zero[6], and β_7 indicates the number of units that β_1 increases/decreases if inflation variance in country i (j) grows by one unit.

Taking my theoretical results, I would expect the following results. First, the coefficient of relative country size should be negative to confirm that country size is negatively related with labor market flexibility. Second, I expect both coefficients of national inflation variances to be positive. Third, correlation between unemployment and inflation should result in a negative coefficient as well as the coefficient for inflation correlation, as a high inflation correlation is associated with lower labor market flexibility. And fifth, the empirical results for unemployment variance would match theoretical one, if its coefficient becomes positive. The interaction term is expected to become negative. That would indicate, that a rising inflation variance in country i (j) increases the need for labor market flexibility in small countries – the negative effect of country size would be accelerated.

I use a robust OLS estimator. As correlation between my independent variables is low, biasing effects of multicoliniarity are not expected.

[6] This latter interpretation is not realistic and will therefore not used.

Estimation results

Table 2 and 3 show regression results for estimation using GDP and population as proxy for country size. Notably, country size matters for labor market flexibility in the EMU. The coefficient for relative country size is negative and statistically significant in all specifications. Large countries of the EMU have on average lower labor market flexibility than small countries. This relationship is robust over all estimation specifications.

In contrast to my theoretical results, the coefficient for inflation variance in country i is negative. However, the inflation variance of country j appears to be positive, but at low significance. Therefore, the need to be protected against spill-over against monetary policy in favor of the other country can be partly confirmed. The coefficient for correlation between unemployment and inflation is significant, but positive. The role of business cycle synchronization can not be confirmed as the coefficient for inflation correlation is insignificant. Nevertheless, unemployment variance shows the expected sign. Hence, higher unemployment volatility raises the demand for labor market flexibility.

Results for interaction effects are displayed in table 4. Both interaction terms are positive. This confirms that rising inflation variance, irrespective of country, increases the need for labor market flexibility in small countries. However, the effect is especially evident for inflation variance in country i, as the interaction term for inflation variance in country j fails the common level of statistic significance.

Table 2: *Regression results of pooled OLS estimations using GDP as proxy for relative country size.*

dependent variable: labor market flexibility of country i (lmf_i)	#1	#2	#3	#4	#5	#6
relative country size (GDP)	-0.649***	-0.659***	-0.638***	-0.682***	-0.680***	-0.682***
($size_i/size_j$)	(0.123)	(0.125)	(0.123)	(0.125)	(0.125)	(0.124)
inflation variance i	-6.262***		-7.934***	-7.297***	-6.995***	-9.679***
$var(\varepsilon_i)$	(1.896)		(2.218)	(2.131)	(2.220)	(3.218)
inflation variance j		-0.805	3.264	4.538*	4.850*	5.244**
$var(\varepsilon_j)$		(2.097)	(2.465)	(2.585)	(2.696)	(2.703)
correlation between unemployment and inflation $corr(\varepsilon_i, \mu_i)$				2.973***	3.004***	3.258***
				(0.990)	(0.992)	(0.994)
correlation of inflation rates					-0.752	-0.540
$corr(\varepsilon_i, \varepsilon_j)$					(1.670)	(1.681)
unemployment variance i						2.231*
$var(\mu_i)$						(1.260)
constant	62.8***	61.4***	62.4***	62.2***	62.5***	62.6***
	(0.800)	(0.856)	(0.867)	(0.845)	(0.975)	(0.976)
obersvations	550	550	550	550	550	550
R-square	0.05	0.03	0.05	0.07	0.07	0.07

Robust standard errors are reported in parentheses. *, ** and *** indicate significance of 10%, 5% and 1%.

Table 3: *Regression results of pooled OLS estimations using population as proxy for relative country size.*

dependent variable: labor market flexibility of country i (lmf_i)	#7	#8	#9	#10	#11	#12
relative country size (population)	-0.645***	-0.666***	-0.628***	-0.662***	-0.660***	-0.664***
($size_i/size_j$)	(0.120)	(0.122)	(0.120)	(0.121)	(0.122)	(0.122)
inflation variance i	-6.062***		-7.466***	-6.820***	-6.574***	-9.309***
$var(\varepsilon_i)$	(1.889)		(2.215)	(2.129)	(2.220)	(3.194)
inflation variance j		-1.129	2.727	3.956	4.216	4.612*
$var(\varepsilon_j)$		(0.209)	(2.461)	(2.577)	(2.689)	(2.695)
correlation between unemployment and inflation $corr(\varepsilon_i, \mu_i)$				2.918***	2.943***	3.203***
				(0.987)	(0.989)	(0.992)
correlation of inflation rates					-0.620	-0.401
$corr(\varepsilon_i, \varepsilon_j)$					(1.671)	(1.681)
unemployment variance i						2.276*
$var(\mu_i)$						(1.252)
constant	62.8***	61.6***	62.4***	62.3***	62.5***	62.6***
	(0.776)	(0.847)	(0.853)	(0.832)	(0.959)	(0.960)
obersvations	550	550	550	550	550	550
R-square	0.05	0.04	0.06	0.07	0.07	0.08

Robust standard errors are reported in parentheses. *, ** and *** indicate significance of 10%, 5% and 1%.

Table 4: *Regression results of pooled OLS estimations with interaction terms..*

dependent variable: labor market flexibility of country i (lmf_i)	#13	#14	#15	#16
relative country size (GDP)	-0.114	-0.448**	-0.133	-0.506***
$(size_i/size_j)$	(0.199)	(0.184)	(0.201)	(0.185)
inflation variance i	-2.598	-7.692***	-4.671	-9.432***
$var(\varepsilon_i)$	(2.818)	(2.211)	(3.412)	(3.186)
inflation variance j	3.113	4.802	5.033*	6.647**
$var(\varepsilon_j)$	(2.425)	(3.039)	(2.635)	(3.210)
correlation between unemployment and			3.237***	3.241***
inflation $corr(\varepsilon_i, \mu_i)$			(1.000)	(0.996)
correlation of inflation rates			-0.261	-0.511
$corr(\varepsilon_i, \varepsilon_j)$			(1.641)	(1.676)
unemployment variance i			2.634**	2.200*
$var(\mu_i)$			(1.264)	(1.239)
interaction term 1	-2.104***		-2.209***	
$(size_i/size_j)*var(\varepsilon i)$	(0.537)		(0.590)	
interaction term 2		-0.835		-0.775
$(size_i/size_j)*var(\varepsilon j)$		(0.546)		(0.577)
constant	61.1***	61.9***	61.3***	62.2***
	(0.982)	(0.971)	(0.590)	(1.060)
obersvations	550	550	550	550
R-square	0.07	0.05	0.09	0.08

Robust standard errors are reported in parentheses. *, ** and *** indicate significance of 10%, 5% and 1%.

VI. Conclusion and economic policy implications

The aim of this paper was to analyze why small countries in the EMU have on average higher labor market flexibility than large countries. The common monetary policy as conducted by the ECB provides an explanation for different levels of labor market flexibility in EMU member countries as small countries are less considered in such a particular monetary policy.

I show within my extended Barro-Gordon framework for a two-country monetary union and in an empirical analysis for the EMU that labor market flexibility depends negatively on country size. The main reason for this is volatile national inflation rates in the monetary union which are differently considered in the monetary policy. Therefore, small countries need more flexible labor markets to be protected against monetary policy in favor of large countries and to substitute lost autonomous monetary policy by labor market flexibility. My theoretical results further suggest that business cycle synchronization within a monetary union reduces the gap in labor market flexibility between small and large countries, as monetary policy fits, at least partly, for small and large countries. However, I cannot confirm this result empirically.

My results therefore call for that national economic policy should avoid strong national inflation movements within the EMU. This incorporates especially national fiscal policy, for instance taxation, fiscal stimulus as in the current crisis, and public sector wages. For large countries it would be useful to lower reform costs to increase the overall level of labor market flexibility in the euro area. This could be achieved for instance with a better communication of the need and benefits of labor market reforms for economic growth, employment, and income. Especially in the light of the intra-euro area current account imbalances and the current financial and economic crisis (Zemanek et al 2009), higher flexibility in all euro area countries would help to readjust imbalances and to cure the aftermath of the crisis. Persistent differences in labor market flexibility might additionally destabilize the EMU as economic shocks will hit countries differently and monetary policy could not provide proper adjustment for all countries.

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Annex: Deriving of Equations

Loss function of the central bank:

(A1) $L_{CB} = a\frac{1}{2}(\pi - k + \varepsilon_1)^2 + (1-a)\frac{1}{2}(\pi - k + \varepsilon_2)^2$

Deriving of optimum monetary policy by minimizing (A1):

(A2) $\frac{\delta L_{CB}}{\delta \pi} = -k + \pi + a\varepsilon_1 + \varepsilon_2 - a\varepsilon_2 = 0$

Union wide inflation rate, depended on optimum monetary policy:

(A3) $\pi = k - a\varepsilon_1 - \varepsilon_2 + a\varepsilon_2$

Expected inflation rate:

(A4) $E[\pi] = k$ because of: $E[\varepsilon_i] = 0$

Loss function of the government 1:

(A5) $L_{Gov_1} = \frac{1}{2}(\pi + \varepsilon_1 - k)^2 + \frac{1}{2}u_1^2 + \gamma s_1$

Phillips curve of country 1:

(A6) $u_1 = \tilde{u} - \theta s_1 - (1-s_2)(\pi + \varepsilon_1 - \pi^e) + (1-s_1)\mu_1$

Loss function of government 1 taking in account A3, A4 and A6:

(A7) $L_{Gov_1} = \frac{1}{2}(-a\varepsilon_1 - \varepsilon_2 + a\varepsilon_2)^2 + \frac{1}{2}(\tilde{u} - \theta s_1 - (1-s_1)(\varepsilon_1 - a\varepsilon_1 - \varepsilon_2 + a\varepsilon_2) + (1-s_1)\mu_1)^2 + \gamma s_1$

Ex-ante minimization of the government 1's loss function:

(A8) $$\frac{\delta E\left[L_{Gov_1}\right]}{\delta s_1} = \gamma + \frac{1}{2}\left(-4(a-1)^2\sigma_{\varepsilon_1,\varepsilon_2}(s_1-1) + 4(a-1)\sigma_{\varepsilon_1,\mu_1}(s_1-1) + 2(a-1)^2(s_1-1)\left(\sigma_{\varepsilon_1}^2+\sigma_{\varepsilon_2}^2\right) + 2\theta(s\theta-\tilde{u}) + (s_1-2)\sigma_{\mu_1}^2 + s_1\sigma_{\mu_1}^2\right) = 0$$

Ex-ante optimum labour market flexibility for country 1:

(A9) $$s_1^* = 1 - \frac{\gamma + \theta(\theta-\tilde{u})}{(a-1)^2\left(\sigma_{\varepsilon_2}^2+\sigma_{\varepsilon_1}^2\right) + 2(a-1)\sigma_{\varepsilon_1,\mu_1} - 2(a-1)^2\sigma_{\varepsilon_1,\varepsilon_2} + \theta^2 + \sigma_{\mu_1}^2}$$

First derivation of s_1^* with respect to *a*:

(A10) $$\frac{\delta s_1^*}{\delta a} = \frac{2\left((a-1)\left(\sigma_{\varepsilon_2}^2+\sigma_{\varepsilon_1}^2\right) + \sigma_{\varepsilon_1,\mu_1} - 2(a-1)\sigma_{\varepsilon_1,\varepsilon_2}\right)(\gamma+\theta(\theta-\tilde{u}))}{\left((a-1)^2\left(\sigma_{\varepsilon_2}^2+\sigma_{\varepsilon_1}^2\right) + 2(a-1)\sigma_{\varepsilon_1,\mu_1} - 2(a-1)^2\sigma_{\varepsilon_1,\varepsilon_2} + \theta^2 + \sigma_{\mu_1}^2\right)^2} =$$

$$\frac{2\left((a-1)\left(\sigma_{\varepsilon_2}^2+\sigma_{\varepsilon_1}^2\right) + \left(\rho_{\varepsilon_1,\mu_1}\sqrt{\sigma_{\varepsilon_1}^2\sigma_{\mu_1}^2}\right) - 2(a-1)\left(\rho_{\varepsilon_1,\varepsilon_2}\sqrt{\sigma_{\varepsilon_1}^2\sigma_{\varepsilon_2}^2}\right)\right)(\gamma+\theta(\theta-\tilde{u}))}{\left((a-1)^2\left(\sigma_{\varepsilon_2}^2+\sigma_{\varepsilon_1}^2\right) + 2(a-1)\sigma_{\varepsilon_1,\mu_1} - 2(a-1)^2\sigma_{\varepsilon_1,\varepsilon_2} + \theta^2 + \sigma_{\mu_1}^2\right)^2} \le 0 \text{ if } \sigma_{\varepsilon_1,\varepsilon_2} = \left(\rho_{\varepsilon_1,\varepsilon_2}\sqrt{\sigma_{\varepsilon_1}^2\sigma_{\varepsilon_2}^2}\right) \le 0$$