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I. INTRODUCTION

The Maastricht Treaty went into effect in November 1993 with eleven European Countries joining forces to form the European Monetary Union (EMU). The EMU was a drastic new initiative to bring economic integration one step further by creating a common currency for Europe – a monetary union that would abolish the transaction costs of converting one EC currency to another, as well as eliminating exchange rate variability and uncertainty among traders and investors.

The eleven member states were required to meet several convergence criteria prescribed in the Maastricht Treaty relating to inflation, interest rates, government debt, and exchange rate volatility. High inflation countries such as Italy and Ireland are working hard to force down their inflation close to that of the three best performing member states, such as Germany.

This paper examines how disinflation in high inflation economies affects unemployment levels. According to Keynesian macroeconomic theories, a decrease in inflation will cause an increase in unemployment in the short run. Due to high inflation over the years among countries like Italy and Ireland, their expected inflation rate is significantly high. As a result, when the government starts a process of disinflation though restrictive fiscal and monetary policies, economic activity declines, and significant short run increase in unemployment follows.

In opposition to the Keynesian theories, contemporary rationale expectations theory states that a country's commitment and its announcement to

join the Monetary Union could create an effect that will lower the citizens' expectations of inflation levels. If the monetary authority is known for its reputation and credibility of policy commitment, then inflation levels could be reduced without the cost of significant unemployment.

The implication of possible short-term unemployment is crucial. High inflation countries may have to bear the heavy cost of unemployment in order to meet the convergence criteria. The decision to join the EMU might change if there exist a significant increase in unemployment, resulting in a severe impact on the economy. High unemployment leading to recession could subsequently cause failure of the European Monetary Union.

Section II offers a historical background of the EMU, Section III examines the Theory of Optimum Currency Areas and the Philips Curve that relates inflation to unemployment. Section IV provides an empirical model that looks at unemployment in the economy of the EMU states. Section V presents and interprets the regression results. Section VI gives the implications of the results on European Economies and offers policy implications and Section VII concludes this paper.

II. HISTORICAL BACKGROUND

In line with the European Union's objective to create an economically integrated region that will have common trade regulations, the European Monetary System was established in 1979. A subset of countries established an adjustable pegged exchange rate system through the Exchange Rate

Mechanism (ERM) where countries were required to maintain their actual exchange rate within an allowed fluctuation band of plus minus 2.25 percent. When some countries were unable to keep their exchange rates within the stated ERM band, it was revised and realigned to a larger range that will be easier for some member states to maintain. By the 1990s, several countries such as Italy, Spain, Britain, and Portugal joined the ERM with bands of 6 percent.

This fixed exchange rate system created a discipline effect. This discipline effect is an evidence of the Law of One Price. This theory states that in markets free of transportation costs and official trade barriers, identical goods from two countries should be sold at identical prices after accounting for the exchange rates (Krugman, Obtsfeld, 1997).

This brings us to the theory of Purchasing Power Parity that states that the exchange rate between two countries is equal to the ratio of the countries' price levels. In floating exchange rate systems, the exchange rate would naturally move to the purchasing power parity (Krugman, Obtsfeld, 1997). But since the EMU has fixed exchange rates, it is changes in the price levels that will have to adjust for the disparities. Germany was considered as the lead in the system due to its size and the reputation of its central bank. Because of this, countries became disciplined by the fixed exchange rates to lower their inflation similar to that of Germany. (Pugel, Lindert, 2000)

Europe continued to strive for a more integrated economy by dismantling barriers to trade and removing capital controls by 1990. These increased movements of trade and capital flows called for even more integration in terms of

inflation rates and interest rates in order to avoid speculative capital flight (Hughes, 1999). Speculative capital flight occurs because of differences in interest rates between two countries where the country with a higher interest rate will attract capital from the country with a lower interest rate. Because of the high degree of capital mobility between the EMU states, capital moves across borders very quickly once interest rate disparities are present.

The Maastricht Treaty was drafted in 1991 and became effective in November 1993, which called for the establishment of the European Monetary Union where countries will use a single union-wide currency. Countries intending to join the Union must meet five criteria, called the convergence criteria. They were (Pugel, Lindert, 2000)

a. Inflation rate must be no higher than 1.5 percentage points above the average of the 3 lowest inflation countries,
b. Exchange rate must be within the ERM bands without realignment for 2 preceding years of joining,
c. Interest rates on government bonds must be no higher than 2 percentage points above the average of the 3 lowest inflation countries,
d. Budget deficit must be no larger than 3 percent than its GDP, and
e. Gross government debt must be no larger than 60 percent of its GDP.

As mentioned earlier, this paper will focus on the first criterion – restriction of inflation rates. The following section will detail why the contractionary policies to decrease inflation may create a problem for the economy.

III. THEORETICAL FRAMEWORK

The Theory of Optimum Currency Areas helps in explaining the rationale behind economic integration. But before getting into that, we need to understand why disinflation causes unemployment. The Philips Curve is a theory that best illustrates that phenomenon.

Philips Curve

The Philips curve posits that the inflation rate is dependent on expected inflation (π^e), cyclical unemployment ($u - u^n$) and supply shocks (ε). The equation takes the following form:

$$\pi = \pi^e - \beta(u - u^n) + \varepsilon$$

Based on the assumption of adaptive expectations, people form their expectations of inflation from past or recently observed inflation. Therefore π^e can be written as the previous year's inflation level, π_{-1}. This means that if a country is at the level of natural unemployment and price levels have been rising quickly, then it will be expected to continue rising because past inflation have influenced people's expectations on future inflation. This implies that inflation is inertial and

price levels will continue to rise at the prevailing inflation rate until some event such as a recession (which increases unemployment above natural unemployment) or a supply shock (Mankiw, 1997).

Cyclical unemployment means the deviation of unemployment from the natural rate. An increase in unemployment other than the natural rate causes cyclical unemployment to increase and as a result, the inflation rate is pulled downwards. The term β determines the responsiveness of inflation level to the change in cyclical unemployment. Figure 1 shows the relationship between inflation and unemployment in terms of the Philips curve (Mankiw, 1997).

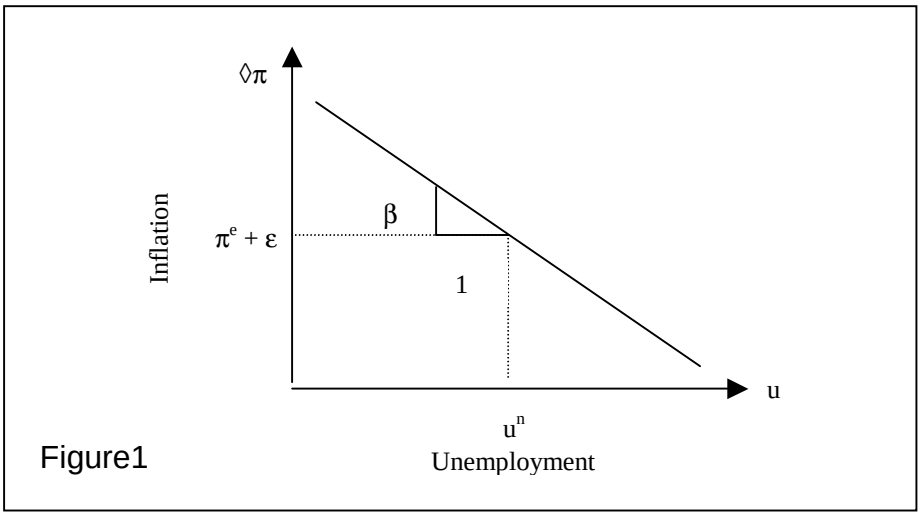

Figure1

Therefore, in order to influence inflation levels, the government can increase or decrease aggregate demand (which will in turn result in changes in the level of unemployment) through fiscal and monetary policies. In the Maastricht treaty, high inflation EU states were required to bring their inflation levels down to that of the three best performing EU states. This means that the

government will have to impose some kind of restrictive fiscal policy to fight the inertial inflation. When that happens, aggregate demand falls and as a result, the economy is faced with a recession in the short run.

Theory of Optimum Currency Areas

The Philips Curve tells us why inflation and unemployment are inversely related, implying that the convergence criteria could be very costly in the short run for some EU countries. Now we need to reevaluate whether the European Union is suitable as a common currency area where exchange rates are fixed to the area's currency. In deciding the costs and benefits of joining a fixed exchange rate system, The Theory of Optimum Currency Areas predicts that fixed exchange rates are most appropriate for areas that are closely integrated in terms of international trade and factor movements (Krugman, Obtsfeld, 1997).

Developed by Robert Mundell in the 1960s, this theory suggests that a high degree of economic integration among countries will lead to higher monetary efficiency gains when these countries fix their exchange rates against the area's currency (Krugman, Obtsfeld, 1997). The key impediment to a successful common currency area is the large differences between countries in terms of its economy, its citizens' expectations on inflation and interests of the individual states. To illustrate, Mundell uses a simple model of two economically opposite entities that are initially at full employment and balance of payments equilibrium. Mundell's argument lies on two assumptions: 1) money wages and prices cannot be reduced in the short run without causing unemployment (as

predicted by the Philips Curve), and 2) monetary authorities act to prevent inflation. In the original document written by Mundell in the American Economic Review, he names the two entities A and B and illustrates the effect of a shift in demand from the goods of entity B to entity A:

> *Suppose first that the entities are countries with national currencies. The shift of demand from B to A causes unemployment in B and inflationary pressure in A. To the extent that prices are allowed to rise in A the change in terms of trade will relieve B of some of the burden of adjustment. But if A tightens credit restrictions to prevent prices from rising all the burden of adjustment is thrust onto country B; what is needed is a reduction in B's real income and if this cannot be effected by a change in the terms of trade—because B cannot lower, and A will not raise, prices—it must be accomplished by a decline in B's output and employment. The policy of surplus countries in restraining prices therefore imparts a recessive tendency to the world economy on fixed exchange rates or (more generally) to a currency area with many separate currencies.* (Mundell, 1961)

Mundell then adds more assumptions into this model by saying that the entities are now within a region of closed economy with a common currency and the national government of both countries now pursues a full employment policy. He shows that the same shift in demand from B to A causes not only unemployment in country B and inflation in country A, but also a surplus in A's balance of payments. Since the priority now is to maintain full employment, the central bank might increase money supply to correct the unemployment in B, but that will only aggravate A's inflationary pressure. Therefore Mundell concludes that forming a common currency area cannot prevent both unemployment and

inflation at the same time among its members if they are not highly economically integrated (Mundell, 1961).

A different representation of Mundell's model by Grauwe takes on the same assumptions but this time, he uses Germany and France as examples. Like Mundell, Grauwe demonstrates that the shift in demand causes unemployment in France and inflationary pressure in Germany. But Grauwe argues that there are two mechanisms that will bring back equilibrium in the two countries. The two mechanisms are wage flexibility and mobility of labor. If there is sufficient free movement of labor between European countries, then an increase in unemployment in France will cause the unemployed workers to look for jobs in Germany, thus balancing out the disequilibrium, as long as wages are flexible (Grauwe, 1994).

Unfortunately, labor does not move as freely as we would like it to be among the EU regions. Perhaps the most apparent barrier to mobility of labor among EU countries is the barrier of language and culture. An econometric study by Barry Eichengreen of the University of California at Berkeley found that regional unemployment rates are much similar in the United States than the national unemployment rates among EU members. This implies that there is some magnitude of differences in the demand for labor and wages among these EU states. (Krugman, Obtsfeld, 1997).

Another barrier to mobility of labor is caused by government regulation. As in many countries, the government typically requires potential employees to obtain residency status before he or she is allowed to work in the country.

Therefore it becomes harder for unemployed workers in say, France, to look for employment in Germany (Krugman, Obtsfeld, 1997).

While the Philips Curve suggests that low inflation will lead to high unemployment, the unemployed population can actually obtain jobs from other member states if labor is mobile across borders with little restrictions. If this is true, then the unemployment gap is likely to close up and this means that while inflation decreases, unemployment is not affected. In a way, this would invalidate the assumptions of the Philips Curve.

IV. EMPIRICAL MODEL

The empirical model utilizes the Philips curve to construct a regression model to test its validity in four high inflation countries in the EMU. Data was obtained from the International Financial Statistics Database published by the International Monetary Fund. Based on the Philips Curve, it can be hypothesized that inflation and unemployment is inversely related. Note that the Philips Curve takes the following form:

$$\pi = \pi^{e} - \beta(u - u^{n}) + \varepsilon \qquad \text{Equation 1}$$

This equation implies that actual inflation will equal expected inflation if unemployment equals natural unemployment. This means that inflation is 100% inertial and if all else equal, people's expectations on inflation, which will be based on last year's inflation, will be a perfect predictor of actual inflation. This is obviously not completely accurate. Expectations are merely assumptions based on things such as past experiences that should not be a perfect indicator of actual inflation levels.

Before moving on to formulate the empirical model, two assumptions need to be applied: 1) past inflation is used as a proxy for expected inflation, implying an adaptive expectations model (therefore $\pi^e = \pi_{-1}$), and, 2) natural unemployment is fixed. Next, to illustrate that inflation is inertial but not 100% inertial, the coefficient θ is assigned to π_{-1} as follows:

$$\pi = \theta\pi_{-1} - \beta(u - u^n) + \varepsilon \qquad \text{Equation 2}$$

In his explanation of the Philips Curve, Mankiw posits that $\theta = 1$, implying that actual inflation is 100% inertial. This means that prices are sticky and people's expectation on this year's inflation is heavily dependent on the level of previous year's inflation. Therefore if θ is equal to or close to one, there is little flexibility in prices and consequently wages. On the other hand, this modified Philips curve model allows for θ to be some value so as to not restrain it to the value of one.

By manipulating the terms in equation 2, the following equation was obtained: (The details of this transformation can be found in Appendix 1)

$$u = u^n + 1/\beta(\theta\pi_{-1} - \pi) + \varepsilon/\beta \qquad \text{Equation 3}$$

where u = unemployment

u^n = natural unemployment

π_{-1} = inflation lagged by one year

π = inflation

ε = error term

Based on the relationship between unemployment and inflation observed in equation 3, a partially complete regression model was formulated with unemployment as the dependent variable. What is done here is merely changing the terms in equation 3 into a form that can be easily recognized as a regression model:

$$UNEMP = \alpha + \alpha_1 INFLAT\_1 + \alpha_2 INFLAT + e \qquad \text{Equation 4}$$

Where UNEMP = u

INFLAT_1 = π_{-1}

INFLAT = π

α = u^n

α_1 = θ/β

α_2 = $1/\beta$

e = ε/β

The following hypotheses were derived from this:

1. Expected inflation (INFLAT_1) is positively related to this year's unemployment, that is, α_1 is expected to carry a positive sign. The rationale behind this idea is that when business people expect high inflation, they are likely to lower costs. One way to achieve lower cost is by hiring fewer workers and this directly causes higher unemployment.

2. Inflation (INFLAT) is negatively related to unemployment, that is, α_2 is expected to carry a negative sign. When the government tries to lower inflation through contractionary fiscal policies, aggregate demand decreases. The resulting decreased income level makes businesses poorer and they end up hiring fewer workers.

This regression was run for data from four high inflation countries, Finland, Italy, Portugal, and Spain. Annual data were used and they spanned across 12 years: beginning from the year 1985 to 1997.

Since this regression required the usage of cross sectional and time series data, three dummy variables representing Finland, Italy and Portugal were added into the regression. Spain was the omitted variable.

$$UNEMP = \alpha + \alpha_1 INFLAT\_1 + \alpha_2\ INFLAT + \propto_3 FINLAND + \propto_4 ITALY + \propto_5 PORTUGAL + e \qquad \textbf{MODEL 1}$$

These dummy country variables are shift parameters that are meant to pick up the effect of country specific characteristics on unemployment. Since Spain is the omitted variable, the constant represents the predicted level of natural unemployment for Spain. The coefficients attached to the individual dummy variables represent that particular country's natural rate of unemployment with respect to Spain's level of natural unemployment. For example if the coefficient for FINLAND (α_3) is equal to –11.063, this means that Finland's level of natural unemployment is 11.063 percent less than Spain's. To illustrate,

assume that after the regression was run, α=16.569 and α_3=-11.063. Therefore Finland's u^n is equal to:

16.593 + (-11.063) = 5.53

Therefore Finland's predicted level of natural unemployment is 5.53 percent.

It is also interesting to note that if this and the previous year's inflation equal zero, Model 1 predicts that unemployment will equal natural unemployment for the individual countries.

As we know, the Maastricht treaty was enacted in 1992. At that time, countries intending to join the union began decreasing inflation levels. The government's announcement to join the union may have resulted in a change in the population's expectations on inflation. This suggests the hypothesis that there may be a structural change within the economy that might cause inflation levels to have a different effect on unemployment from the year 1992 onwards. MODEL 2 attempts to look at this factor. For this regression, two new variables were created and added into MODEL 1. The first variable, D92, is a dummy variable that equals 1 for data from the years 1992 to 1997, and 0 for data from the years before 1992. The second variable, called INFL_D92 is an interaction variable between D92 and INFLAT. The addition of these two variables into the model allowed a kink to take shape. These two variables and variables from MODEL 1 make up the second regression model:

$$UNEMP = \alpha + \alpha_1 INFLAT\_1 + \alpha_2 INFLAT + \propto_3 FINLAND + \propto_4 ITALY + \propto_5 PORTUGAL + \alpha_6 D92 + \alpha_7 INFL\_D92 + e \quad \textbf{MODEL 2}$$

By doing this, the model is controlling for a change in the effect of inflation on unemployment for the years after 1991.

V. REGRESSION RESULTS

MODEL1

Results of regression from Model 1 are presented in Table 1. The coefficient INFLAT_1 was significant to the 0.1 level. INFLAT was significant to the 0.005 level. Both these coefficients have the expected sign. With this, we can infer that inflation and unemployment is indeed inversely related. Inserting the coefficients into the regression model, the following equation was obtained:

$$UNEMP = 22.565 + 0.45INFLAT\_1 - 0.94INFLAT - 11.161FINLAND - 8.863ITALY - 12.823PORTUGAL + e \quad \text{Equation 5}$$

Comparing this to equation 3 (keep in mind that INFLAT_1 = π_{-1} and INFLAT = π), the values for θ/β and $1/\beta$ were determined to be 0.45 and 0.94. Subsequently, θ can be calculated by dividing θ/β by $1/\beta$ (0.45/0.94), giving a value of 0.478. A summary of the values obtained for $1/\beta$, θ/β, θ and β is presented in Table 3.

The values obtained for $1/\beta$ and θ were then replaced into equation 3:

$$u = u^n + 0.94(0.478\pi_{-1} - \pi) + \varepsilon/\beta$$

Bringing natural unemployment, u^n, over to the left hand side, the following equation was obtained:

$$u - u^n = 0.94(0.478\pi_{-1} - \pi) + \varepsilon/\beta \qquad \text{Equation 6}$$

This simple equation reveals a lot about the effect of a fall in inflation on unemployment. Contrary to the generalized Philips Curve that Mankiw had presented, this equation says that $\theta \neq 1$. Assuming no supply shocks (therefore $\varepsilon = 0$), equation 6 calculates the deviation of unemployment from its natural level (cyclical unemployment) based on the change in inflation rate from the previous year.

From the equation above, the results from MODEL 1 were used to calculate the predicted level of unemployment for individual countries. Table 4 lists the predicted unemployment levels for Spain based on different decreases in inflation levels. The previous year's inflation is assigned a hypothetical value of 20%, and it is assumed that there are no supply shocks.

Notice that the larger the fall in inflation, the larger the predicted level of unemployment. A small decrease in inflation, say from 20% to19%, causes 13.36% unemployment. On the other hand, a large decrease in inflation causes a high level of unemployment. For example, when inflation falls from 20% to 11%, unemployment is predicted to be much higher: 20.88%. This is consistent with the hypothesis that inflation is negatively related to unemployment.

MODEL 2

The coefficients and significance of each variable are presented in Table 2. All variables were significant to the 0.001 level except INFLAT_1 and INFLAT.

Both these variables lost their significance in this model. The coefficient of INFLAT is extremely low (but still negative) and insignificant. The reason for the loss in significance could be that unemployment levels were fairly steady and might be unresponsive to changes in inflation in the years before 1992.

What may be happening is that before the Maastricht Treaty, countries were experiencing a steady level of unemployment year after year. Changes in inflation may not cause large shifts in unemployment due to the fact that the population has been expecting the high inflation levels and steady increase in inflation year after year. But after the Maastricht treaty in 1992, the governments of high inflation countries intending to join the EMU began forcing down inflation levels and this might tighten the economy and put businesses in a position of lower wealth. This, according to the Philips Curve, would result in an increase in unemployment.

Because INFLAT was insignificant in MODEL 2, one might think that MODEL 2 invalidates the Philips Curve assumption that inflation is related to unemployment. But, a logical explanation behind the low coefficient and insignificance of INFLAT before 1992 is that the economy may be experiencing steadily high levels of inflation that are of expected levels. This can be explained by referring back to the Philips Curve:

$$\pi = \pi^{e} - \beta(u - u^{n}) + \varepsilon$$

When expected inflation is equal to actual inflation and assuming no supply shocks, unemployment would equal its natural level. Therefore theoretically, no matter what level of inflation the economy is experiencing, as long as it is of an

expected level, then unemployment will probably not be affected by inflation levels. Of course, this is a very shaky conclusion to make because expected inflation levels are difficult to measure. Expectations also vary from one individual to another. There is a need to assume that the population is rationale and educated in its expectations of inflation.

Nonetheless, we can conclude that unemployment was unresponsive to the changes in prices. But on and after the year 1992, the economy went through a process of disinflation due to the contractionary fiscal policies applied by the government. This squeezed aggregate demand and income levels, which consequently lead to a lower inflation levels.

The coefficient of INFL_D92 represents the effect of inflation on unemployment from 1992 onwards. This variable has a negative coefficient of –1.404 and is very significant. This means that after the introduction of the Maastricht treaty in 1992, the model predicts that unemployment levels became very responsive to changes in inflation. Again, this may be because of the squeeze on aggregate demand. From this, it is predicted that a kink occurred in 1992 where unemployment became more responsive to changes in inflation compared to the years before 1992.

VI. POLICY IMPLICATIONS / CONLUDING REMARKS

This study found some evidence of negative effects created by the Maastricht Treaty's first convergence criterion. One of the major conclusions of this paper is that disinflation will inevitably create higher unemployment levels. As

seen in the results of MODEL 1, the larger the decrease in inflation level within a single year, the larger the predicted unemployment would be. Therefore in order to avoid the high unemployment levels, the government can plan on a gradual decrease in inflation, instead of a rapid decrease. If steps were taken to create a gradual disinflation process, people's expectations on inflation would also decrease over time. Higher unemployment levels are certainly inevitable, but it will be relatively lower than if the government tries to force down inflation drastically in a very short time.

An interesting future research would be to look at what will happen to predicted unemployment when inflation levels decrease at a steady rate over a period of several years instead of a drastic decrease. Is it costlier (in terms of unemployment) to allow drastic disinflation now and at the same time lowering people's expectations on inflation, (thereby creating lower unemployment levels in future)? Or will it be better to allow gradual disinflation and experience relatively lower unemployment over a period of several years?

It may be difficult to present any form of sound and reliable suggestions on policymaking decisions at this stage of the study. Remember that the convergence criteria also consist of four other factors relating to exchange rates, interest rates, budget deficit, and government debt. The first criterion that this study looked at may mean that the process of gaining eligibility into the union comes with a cost in the form of unemployment, but the other criteria in the Maastricht Treaty might offset the negative effects of disinflation.

Further research can include controls for labor mobility and wage flexibility as mentioned in the theory section. Another possible future research would be to include the effects of other convergence criteria such as the restriction on the level of budget deficit and interest rates.

The problem of autocorrelation was apparent in both the regressions as shown by low Durbin Watson test statistics. Nonetheless, this study made certain implications that are crucial in the government's decision to join the EMU. The tradeoff between inflation and unemployment might be too costly for these high inflation European countries.

APPENDIX 1

From the Philips Curve equation,

$\pi = \theta\pi_{-1} - \beta(u - u^n) + \varepsilon$

the terms can be moved around as illustrated:

$\beta(u - u^n) = \theta\pi_{-1} - \pi + \varepsilon$

$u - u^n = 1/\beta\ (\theta\pi_{-1} - \pi + \varepsilon)$

$u = u^n + 1/\beta(\theta\pi_{-1} - \pi) + \varepsilon/\beta$

1. Natural unemployment, u^n, will be assumed as fixed and will therefore be the constant in the regression.
2. θ/β will the coefficient for π_{-1}
3. $1/\beta$ will be the coefficient for π
4. ε/β will be the error term in the regression

TABLE1: REGRESSION RESULTS FOR MODEL 1
Adjusted R^2 = 0.745

Variable	Expected Sign	Coefficient (t-statistics)	Significance
CONSTANT		22.565 (18.739)	.000
INFLAT_1	+	0.450 (2.002)	.051
INFLAT	-	-0.940 (-3.092)	.003
FINLAND	?	-11.161 (-8.896)	.000
ITALY	?	-8.863 (-7.337)	.000
PORTUGAL	?	-12.823 (-9.660)	.000

TABLE 2: REGRESSION RESULTS FOR MODEL 2
Adjusted R^2 = 0.865

Variable	Expected Sign	Coefficient (t-statistics)	Significance
CONSTANT		16.852 (12.269)	.000
INFLAT_1	+	0.240 (1.439)	.157
INFLAT	-	-6.937E-04 (-0.003)	.998
FINLAND	?	-11.396 (-11.664)	.000
ITALY	?	-8.717 (-9.898)	.000
PORTUGAL	?	-14.550 (-14.119)	.000
D92	+	9.821 (6.521)	.000
INFL_D92	–	-1.404 (-5.085)	.000

TABLE 3: SUMMARY OF VALUES FOR 1/β, θ/β, θ AND β

	VALUE	
θ/β	0.450	$\propto_1$
1/β	0.940	$\propto_2$
θ	0.478	0.450 / 0.940
β	1.064	1 / 0.940

TABLE 4: PREDICTED UNEMPLOYMENT FOR SPAIN BASED ON ONE-TIME ARBITARY CHANGES IN INFLATION LEVELS

inflat_1 (π_{-1})	INFLAT (π)	%change $((\pi_{-1}-\pi)/\pi_{-1})*100$	natural unemployment (u^n)	cyclical unemployment ($u-u^n$)	predicted unemployment* (u)
20	20	0	22.23	-9.8136	12.4164
20	19	-5	22.23	-8.8736	13.3564
20	18	-10	22.23	-7.9336	14.2964
20	17	-15	22.23	-6.9936	15.2364
20	16	-20	22.23	-6.0536	16.1764
20	15	-25	22.23	-5.1136	17.1164
20	14	-30	22.23	-4.1736	18.0564
20	13	-35	22.23	-3.2336	18.9964
20	12	-40	22.23	-2.2936	19.9364
20	11	-45	22.23	-1.3536	20.8764
20	10	-50	22.23	-0.4136	21.8164
20	9	-55	22.23	0.5264	22.7564
20	8	-60	22.23	1.4664	23.6964
20	7	-65	22.23	2.4064	24.6364
20	6	-70	22.23	3.3464	25.5764
20	5	-75	22.23	4.2864	26.5164
20	4	-80	22.23	5.2264	27.4564
20	3	-85	22.23	6.1664	28.3964
20	2	-90	22.23	7.1064	29.3364
20	1	-95	22.23	8.0464	30.2764
20	0	-100	22.23	9.8136	32.0436

* for Spain, the predicted level of natural unemployment is 22.23, based on the results of MODEL1. Therefore, in order to calculate unemployment for Spain, we add cyclical unemployment ($u-u^n$) values to the level of natural unemployment.

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