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Abstract

A new initiative to further integrate the European Union went into effect in Novem ber 1993 with the Maastricht Treaty. With this treaty eleven European Countries joined forces to form the European Monetary Union (EMU). The EMU brings 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.

A Case of the Philips Curve in the Formation of a Monetary Union

A Glimpse at High Inflation Countries of the European Monetary Union

By Yuet Wen Wan

I. INTRODUCTION

A new initiative to further integrate the European Union went into effect in November 1993 with the Maastricht Treaty. With this treaty eleven European Countries joined forces to form the European Monetary Union (EMU). The EMU brings 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 are 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 closer to the levels of the better performing members, such as Germany.

"The decision to join the EMU might change if the risk of significant increases in unemployment exists, which would have a severe impact on the economy."

This paper examines how disinflation in high inflation economies affects unemployment levels. According to classical macroeconomic theories, a downward force on inflation will cause unemployment. 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 fiscal and monetary policies, economic activity declines, and there is a significant short run increase in unemployment.

In opposition to the classical theories, contemporary views state 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 the risk of significant increases in unemployment exists, which would have a severe impact on the economy. High unemployment would lead to recession, which 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 to maintain their actual exchange rate within a band of plus or minus 2.25 percent. 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. Germany was considered as the lead in the system due 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 flows called for even more integration in terms of inflation rates and interest rates in order to avoid speculative capital flight, creating what political scientists call a 'spillover effect' (Hughes, 1999).

This high degree of capital mobility created the need for a single currency. Thus, the Maastricht Treaty was drafted in 1991 and became effective in November 1993. This treaty 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 are:

a. Inflation rate must be no higher than 1.5 percentage points above that 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 that of the 3 lowest inflation countries,
d. Budget deficit must be no larger than 3 percent of its GDP, and
e. Gross government debt must be no larger than 60 percent of its GDP.

(Pugel, Lindert, 2000)

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

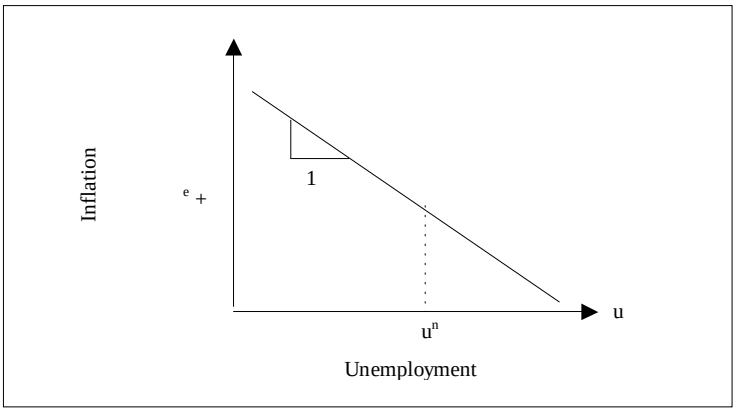
III. THEORETICAL FRAMEWORK

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

Philips Curve

The Philips curve posits that the inflation rate is dependent on expected inflation (π_e), cyclical un-

Figure 1 : Relationship Between Inflation and Unemployment



employment (u - u^n) and supply shocks (ε). The equation takes the following form:

$$\pi = \pi_\varepsilon - \beta(u - u_n) + \varepsilon$$

Based on the assumption of adaptive expectations, people form their expectations of inflation from past or recently observed inflation. Therefore π_ε 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 has influenced people's expectations on future inflation. This implies that inflation is inertial and inflation levels will remain high until some event increases unemployment above natural unemployment such as a recession or a supply shock (Mankiw, 1997).

Cyclical unemployment is 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).

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 policies. In the Maastricht treaty, EU states with high inflation were required to bring their inflation levels down to the level 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 may not be appropriate for some EU countries. Now we need to evaluate 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 impediments to a successful common currency area are the large differences between countries, citizens' expectations on inflation, and general interests. 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 now pursues a full employment policy. He shows that the same shift in demand from B to A causes not only unemployment and inflation in the respective countries, but also a surplus in A's balance of payments. Since the priority now is to maintain full employment, the central bank might increase the 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 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 a potential employee to obtain residency status before he or she is allowed to work in the country. Therefore it becomes harder for unemployed workers in one country, to look for employment in another (Krugman, Obtsfeld, 1997).

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 are 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 is equal, people's expectations on inflation, which will be based on last year's inflation, will be a perfect predictor of actual inflation. This may or may not be the case.

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_e 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 of 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 one.

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

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

OR

$$u = u_n + \theta/\beta\pi_{-1} - 1/\beta\pi + \varepsilon/\beta \qquad \text{Equation 3}$$

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. This is merely changing the terms in equation 3 into a form that can be easily recognized as a regression model:

$$UNEMP = \alpha + \alpha_1 INFLAT\_1 + \alpha_2 INFLAT + \varepsilon$$

Equation 4

Where UNEMP = u
INFLAT_1 = π_{-1}
INFLAT = π
α = u_n
α_1 = θ/β
α_2 = $1/\beta$
ε = ε/β

The following hypotheses were derived from this:

1. Expected inflation (in this case, last year's inflation is used as a proxy for expected inflation) 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 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 from the year 1985 spanned across at least 13 years and up to 15 years for each country, depending on availability of data. Availability of data based on years is summarized as follows:

Finland: 1985 -1999
Italy: 1985-1997
Portugal: 1985-1997
Spain 1985-1998

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.

$$UNEMP = \alpha + \alpha_1 INFLAT\_1 + \alpha_2 INFLAT + \alpha_3 FINLAND + \alpha_4 ITALY + \alpha_5 PORTUGAL + e$$

MODEL 1

These dummy country variables were meant to pick up the effect of individual countries. The coefficients attached to these dummy variables represent that country's level of natural rate of unemployment with respect to Spain's level of natural unemployment. Since Spain is the omitted variable, the constant represents the predicted level of natural unemployment for Spain. To calculate u_n for Finland for example, the coefficient for FINLAND (α_3) will be added to the constant (α). Assuming that after the regression was run, α=16.569 and α_3=-11.063, then Finland's u_n is equal to:

16.593 + (-11.063) = 5.53.

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

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

As we know, the Maastricht treaty was enacted in 1993. 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. From that, two new variables are created and added into MODEL 1. The first variable, D92, is a dummy variable that equals 1 for data from the years 1992 to

Table 1: Regression Results for Model 1

Variable	Expected Sign	Coefficient (t-statistics)	Significance
CONSTANT		22.230(19.927)	.000
INFLAT_1	+	0.447(2.033)	.047
INFLAT	-	-0.913(-3.088)	.003
FINLAND	?	-10.900(-9.349)	.000
ITALY	?	-8.655(-7.461)	.000
PORTUGAL	?	-12.702(-9.845)	.000

1997, and 0 for data from the years before 1992. The second variable, called INFL_D92 is an interaction between D92 and INFLAT. These two variables produced the following equation for the second regression model:

$$UNEMP = \alpha + \alpha_1 INFLAT\_1 + \alpha_2 INFLAT + \alpha_3 FINLAND + \alpha_4 ITALY + \alpha_5 PORTUGAL + \alpha_6 D92 + \alpha_6 INFL\_D92 + e$$

MODEL 2

By doing this, the model is controlling for a change in the effect of inflation on unemployment for the years after 1991. 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 1993, the governments of high inflation countries intending to join the EMU began forcing down inflation levels and this might tighten the economy. This, according to the Philips Curve, would result in an increase in unemployment. By including INFL_D92, the model is allowing a kink to take shape. This will be much clearer when the results are presented.

V. REGRESSION RESULTS

MODEL 1

Results of regression from Model 1 are presented in Table1. The coefficient INFLAT_1 was only significant to the 0.05 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:

$$UNEMP = 22.230 + 0.447INFLAT\_1 - 0.913INFLAT - 10.9FINLAND - 8.655ITALY - 12.702PORTUGAL + e$$

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 0.447 and 0.913. Subsequently, q can be calculated by dividing θ/β by $1/\beta$ (0.447/0.913), giving a value of 0.49. The term b can also be calculated as the inverse of $1/\beta$ (1/0.913) giving the value 1.0952. A summary of the values obtained for $1/\beta$, θ/β, θ and β is presented in Table 2.

The values obtained for β and θ were then replaced into equation 3. Bringing natural unemployment, u_n, over to the left hand side, the following equation is obtained:

$$u - u_n = 0.913(0.49\pi_{-1} - \pi) + \varepsilon/\beta$$

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.

Based on the equation above, Table 3, a table that calculates the predicted cyclical unemployment for Spain as the level of inflation falls, is created. The

Table 2: Summary Of Values For 1/β, θ/β, θ And β

	VALUE	
θ/β	0.447	∝1
1/β	0.913	∝2
θ	0.49	0.447 / 0.913
β	1.095	1 / 0.913

Table 3: Simulation Of Predicted Unemployment Based On Arbitrary Changes In Inflation Levels

Inflat_1 (π-1)	Inflat (π)	% Change in inflation ((π-1-π)/π-1)*100	Natural Unemployment (u_n)	Cyclical Unemployment ($u-u_n$)	Predicted Unemployment* (u)
20	20	0	22.23	-9.3126	12.9174
20	19	-5	22.23	-8.3996	13.8304
20	18	-10	22.23	-7.4866	14.7434
20	17	-15	22.23	-6.5736	15.6564
20	16	-20	22.23	-5.6606	16.5694
20	15	-25	22.23	-4.7476	17.4824
20	14	-30	22.23	-3.8346	18.3954
20	13	-35	22.23	-2.9216	19.3084
20	12	-40	22.23	-2.0086	20.2214
20	11	-45	22.23	-1.0956	21.1344
20	10	-50	22.23	-0.1826	22.0474
20	9	-55	22.23	0.7304	22.9604
20	8	-60	22.23	1.6434	23.8734
20	7	-65	22.23	2.5564	24.7864
20	6	-70	22.23	3.4694	25.6994
20	5	-75	22.23	4.3824	26.6124
20	4	-80	22.23	5.2954	27.5254
20	3	-85	22.23	6.2084	28.4384
20	2	-90	22.23	7.1214	29.3514
20	1	-95	22.23	8.0344	30.2644
20	0	-100	22.23	8.9474	31.1774

* 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-un) values to the level of natural unemployment.

Table 4: Regression Results For Model 2

Adjusted R^2 = 0.845

Variable	Expected Sign	Coefficient (t-statistics)	Significance
CONSTANT		16.654 (11.664)	.000
INFLAT_1	+	0.262 (1.494)	.142
INFLAT	-	-3.144E-02 (-0.111)	.912
FINLAND	?	-11.089 (-11.350)	.000
ITALY	?	-8.346 (-9.153)	.000
PORTUGAL	?	-14.268 (-13.223)	.000
D92	+	8.584 (5.687)	.000
INFL_D92	-	-1.179 (-4.238)	.000

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 13.83% 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: 21.13%. 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 4. All variables were significant to the 0.001 level except INFLAT_1 and INFLAT. Both these variables lost its significance in this model. The coefficient of INFLAT is extremely low (but still negative) and insignificant. The loss in significance may not be a bad thing because as mentioned earlier, unemployment levels were fairly steady and might be unresponsive to changes in inflation in the years before 1992. Hence INFLAT_1 is also insignificant.

The coefficient of INFL_D92 represents the effect of inflation on unemployment from 1992 onwards. This variable has a negative coefficient 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. This may be because the population is not accustomed to the fall in inflation levels. From this, the model predicts that a kink occurred in 1992 where unemployment became more responsive to changes in inflation compared to the years before 1992. The individual country variables represent the predicted level of natural unemployment in these countries.

VI. POLICY IMPLICATIONS

The findings in the regression results will aide in formulating policy implications for the member states of the European Monetary Union and other European countries that are intending join the Union. Does the cost of joining exceed the benefits? Is it rational for high inflation countries to join the Union?

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 governments can plan on a gradual decrease in inflation, instead of a rapid decrease. If steps are 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 topic for 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 lower people's expectations on inflation, (thereby creating lower unemployment levels in the future)? Or will it be better to allow gradual disinflation and experience relatively lower unemployment over a period of several years?

Further research can include controls for labor mobility and wage flexibility as mentioned in the theory section. Other 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.

APPENDIX 1

From the Philips Curve equation,
$\pi = \pi_e - \beta(u - u_n) + \varepsilon$
the terms can be moved around as illustrated:
$\beta(u - un) = \pi_e - \pi + \varepsilon$
$u - u_n = 1/\beta\ (\pi_e - \pi + \varepsilon)$
$u = u_n + 1/\beta(\pi_e - \pi) + \varepsilon/\beta$
Natural unemployment, u_n, will assumed as fixed and will therefore be the constant in the regression. ε/β will be the error term in the regression.

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