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CONFERENZA

DEFICIT SPENDING AND UNEMPLOYMENT GROWTH:
EVIDENCE FROM OECD COUNTRIES (1970-2009)

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Deficit spending and unemployment growth: evidence from OECD countries (1970-2009)

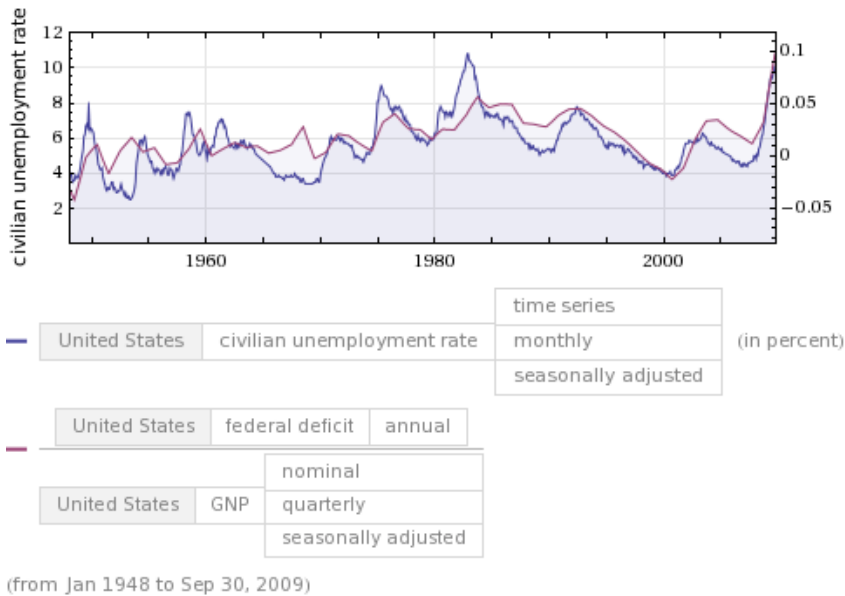*- Preliminary and incomplete version -*

Abstract

We analyse the long run relationship between unemployment, UR, and the ratio of deficit to GDP, NLG/GDP, for 28 OECD countries from 1970 to 2009.

Based on the panel unit root test by Im et al. (2003), we found evidence supporting the unit root hypothesis for UR and NLG/GDP, e.g., the variables appear non stationary. On the basis of Westerlund (2007) tests to data on UR and NLG/GDP, we also found cointegration between the two variables. The tests have been repeated for a reduced sample of the 19 OEDC countries belonging to the European Union. Even in this case, the evidence supports the unit root hypothesis for both UR and NLG/GDP and cointegration between the two variables. The long run relations obtained for the 28 OECD countries and the 19 OEDC countries belonging to the European Union show that increasing public deficits increases the unemployment rate. Moreover, the reduction of the sample to the 19 countries of the EU, shows a worsening of the effect of the public deficits on UR, with the estimated coefficient increasing from about 0.37 to about 0.43.

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1. Introduction

The Physics Forums website reports the following figure for the United States, and poses the subsequent question.

United States | civilian unemployment rate | time series / monthly / seasonally adjusted | (in percent)

United States | federal deficit | annual

United States | GNP | nominal / quarterly / seasonally adjusted

(from Jan 1948 to Sep 30, 2009)

"According to my understanding of this graph, the derivative of the United States unemployment rate is a direct result of deficit spending by the United States Federal Government.
The greater the amount of deficit spending the exponentially higher the unemployment rate.
*Are there any economists here that can improve upon my calculation?"*

In order to answer the question, a preliminary reflection might be done by considering the misery index of Moody, the well known international rating agency, obtained by simply adding a country's fiscal deficit to its unemployment rate. The implications of high values of the misery index in a given country when high unemployment is associated to high deficits are that, while a high percentage people in search of a job in these countries have a hard life, the merit of credit of the government is precarious too and the public finances may need sooner or later a hard adjustment processes. Therefore, the perspectives of these countries are both socially and economically bleak. If, on the other hand, the unemployment is low, but the deficit reaches enormous levels, the employment becomes precarious because this situation cannot be prolonged. And if the unemployment rate is extremely high, but the deficit is low, the social situation is unsound and, in democracy, likely to become very unstable. Thus the misery index, even if appears a simplistic indicator, is not meaningless and its composition adds significance to it. The following figures 1 to 4 show for the 28 OECD countries considered in this paper the behaviour of misery index over time, together with the unemployment rate, UR, and the Net Lending Government ratio to GDP, NLG/GDP,

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which takes negative sign in case of deficits and positive in case of surplus. The countries' grouping is chosen only for presentation reasons.
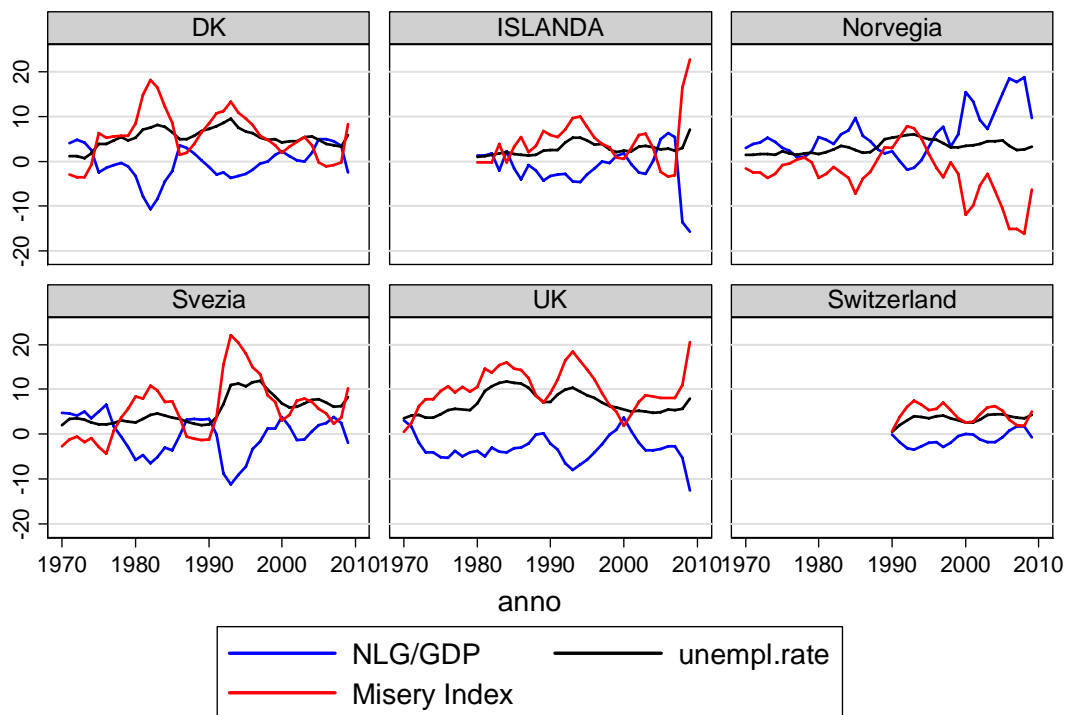
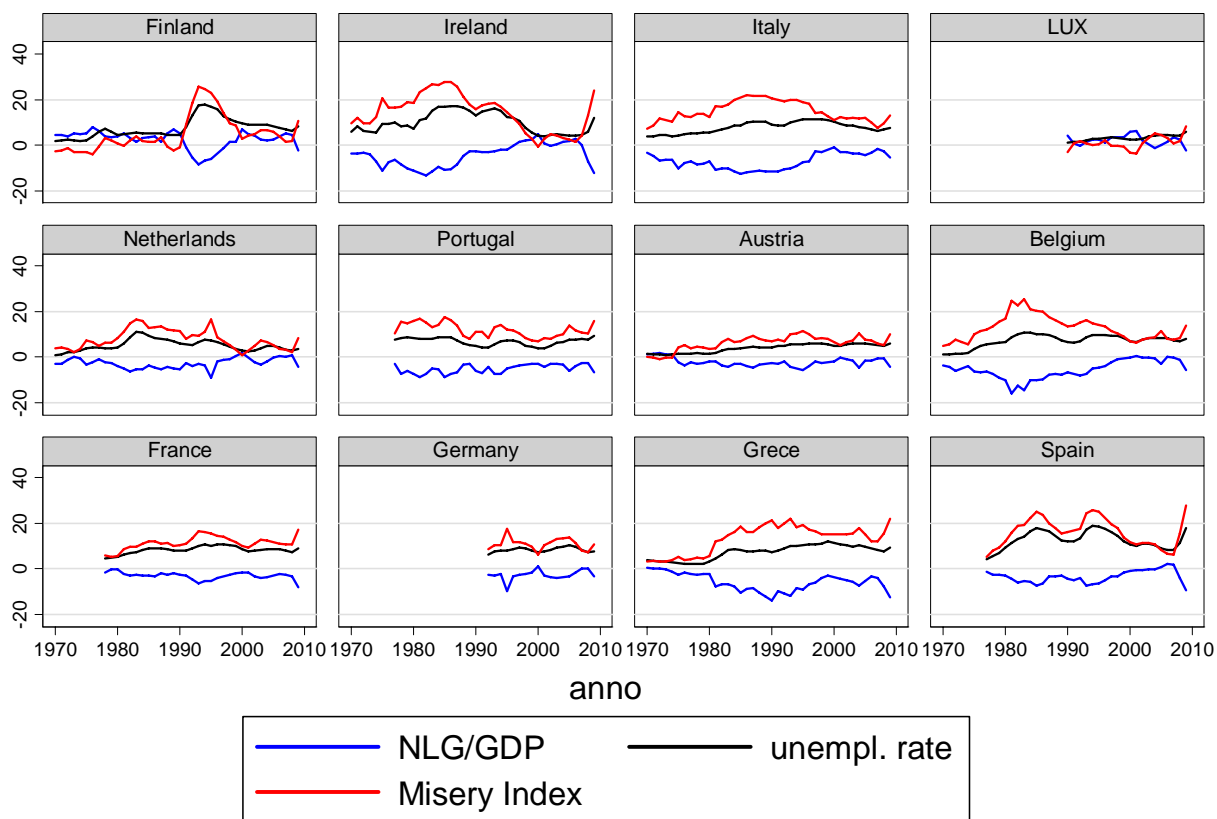**Figure 1. OECD countries of the zone Asia-Pacific**
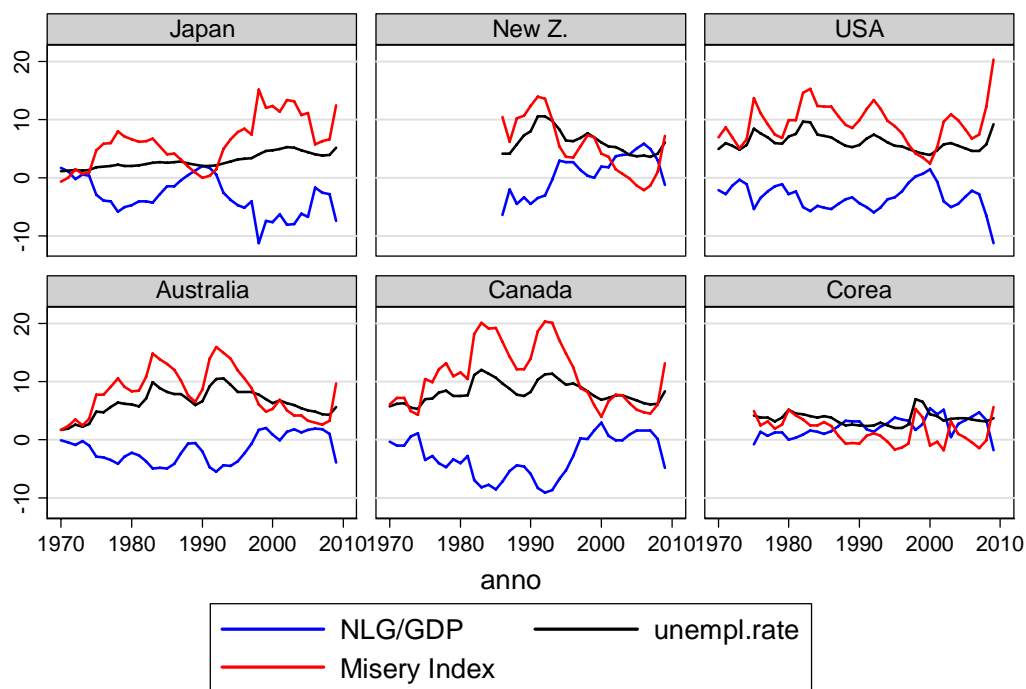
Figure 2. Former communists, OECD countries
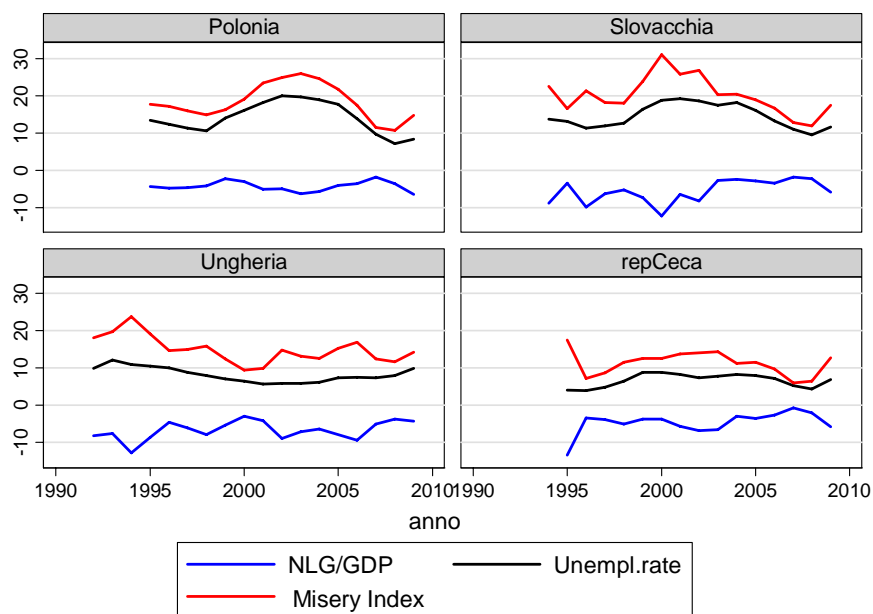
Figure 3. OECD/European countries of the NON-EURO zone

Figure 4. OECD countries in the EUROZONE (excluding Slovakia in fig. 2)

The Moody's simple sum of the two indicators as an index of misery of a country, while meaningful, as for both its level and its composition, entices us to further enquire about the inner relation between UR and NLG/GDP. Therefore, going beyond the above pictures, the case of a nexus of the two phenomena would be either that budgetary deficits do not create employment, but the opposite, or that unemployment (due to a mix of factors) causes large fiscal deficit, or both, or/and that there are other factors to be considered - such as underdevelopment, wrong politic/economic institutions, hobbesian disorder - that cause the bad combination of unemployment and high deficits.

In this respect, however, after the great crisis of 2008, the debate has been reopened on the appropriateness of deficit spending fiscal policies to contain the rising unemployment. Recently, Jeffrey Sachs has argued that the US fiscal stimulus policies have failed their objectives (mainly, GDP growth and employment). Indeed, he argues that fiscal policies of Keynesian type assumed necessary to prevent the great depression and, in the same line, the deficit spending policy, used to relaunch the US economy, both in the short and in the long run, have always found the public consensus, even in the presence of increasing debts, because of the political appeal of tax cuts in front of rising public expenditures.

Indeed, even if the stimulus of these fiscal policies was effective in the short run, as for GDP growth and unemployment, their magnitude and their durance would cause compounded effects, relevant in the long run. It is true that, in principle, corrective fiscal measures reducing drastically the deficits and even providing surpluses are generally recommended in periods of economic booms. But, in practice, it is difficult to ascertain whether and when a boom is really such because the level of full employment has been reached. There may be still a substantial unemployment, while bottlenecks are appearing in several sectors of the economy, with sector wages and prices' increases. Politicians do not like to be blamed for restrictive fiscal policies that reduce the growth rate, particularly in presence of an important level of unemployment. It is unlikely that the corrective measures are enough to counteract the compounded effects of huge deficits in the periods of depression and high unemployment. Even if, in principle, they seem to accept the idea of high budgetary deficits in periods of depression, contrasted by opposite policies in periods of over expansion, they seem to believe that economic growth is mostly driven by high domestic demand for consumption and that this GDP growth reduces the ratio of previous debts to GDP, so that in the long run deficits may be self sustainable. Fiscal policies through the cycle are likely to be not compensatory because expansionary policies due to the neo Keynesian bias in their favour and to other reasons, well known in the public choice literature, are more popular than restrictive policies. Also for these reasons, it is important to know whether in the long run public deficits are favourable or not to the reduction of unemployment and to the GDP growth. Yet, it is not only interesting to disclose the long run effects of deficits on the unemployment level. It is also interesting to observe whether high

unemployment rates are a cause of lung run fiscal deficits, perhaps because politicians in presence of high unemployment rates are generally prone to fiscal deficits and cautious in adopting restrictive fiscal policies, even when corrective measures might seem appropriate.

Due to the multiple facets of the issue, in section 2 we concentrate on the unemployment and deficits analysis in the long run. This issue has received scant econometric attention and the relationship between UR and NLG/GDP has not been the subject of a large portion of recent literature. We concentrate both on the 28 OECD countries and on the 19 OECD countries belonging to the European Union, from year 1970 to year 2009. Preliminary conclusions follows in section 3.

2. The model

As a preliminary approach, by employing cross sectional analysis to obtain estimates of this relationship between the unemployment rate and NLG/GDP with OECD data, we found that most of the observed variation in UR can be explained by variation in NLG/GDP. The results, not reported, showed that the unemployment rate is positively related to NLG/GDP. Therefore it seems that the Keynes' sentence that in the long run we are all dead is applicable to the policies of deficit spending in that a high unemployment rate leads to the disappearance of the fair chances of pursuing welfare. Likely Keynes was meaning that the issues of shorter run were necessary, in the periods of the great depression, as those in which he wrote the General Theory, while the long run effects of the short run expansionary policies were extremely uncertain. Nevertheless, the Keynesians have had more ambitious tasks. With their emphasis on the demand-driven growth, they have apparently suggested permissive fiscal policies also as for the log run. Another objection to the mentioned results may be that UR causes fiscal deficit that, in turn, increases the ratio of public debt to GDP, because, as seen, by creating distributional inequalities stimulates politicians to permissive fiscal policies. Notice, however, that politicians do not need to be naïve neo keynesian to behave in this way. High unemployment may politically require higher welfare expenditures, lower taxes on basic consumption, lower taxation of labour, higher expenditures for public works and for depressed areas, subsidies to the sectors and enterprises which otherwise might fail. And even if deficits increase the future debt burdens politicians, who want to keep the power, may rationally have a short sighted views. Finally, the above mentioned results can be criticized for the assumption that UR is homogenously distributed across countries. In this respect, however, by resorting to panel data offers a number of advantages over pure cross-sectional data. For instance, using multiple years of data increases the sample size while simultaneously allowing to control for a wide range of time invariant country characteristics through the inclusion of country specific constants and trends. In addition, with

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multiple time series observations for each country, it is possible to exploit the presence of unit roots and cointegration, if any, in UR and NLG/GDP.

Here we verify cointegration by using a panel consisting of 28 OECD countries spanning the years 1970 to 2009, the data have annual frequency and the variables are taken in levels. We model UR and NLG/GDP with a linear time trend in their levels to capture the cyclical trends to which the different economies are subject to in the shorter runs .

The basic model we postulate between NLG/GDP and UR might be

either
$$NLG/GDP_{it} = \mu_i + \tau_i t + \beta_i UR + e_{it}$$

or
$$UR_{it} = \mu_i + \tau_i t + \beta_i (NLG/GDP) + e_{it}$$

The first step in our analysis of this relationship is to test whether the variables are nonstationary or not. To this effect, we employ the test of Im et $al.$ (2003) based on the assumption of no cross-sectional dependence. The tests are normally distributed under the null hypothesis of nonstationarity and permit the individual autoregressive roots to differ across the cross-sectional units. For the implementation of the test, all bandwidths and lag lengths are chosen according to $4(T/100)^{2/9}$. The number of lags and leads are chosen by the Akaike criterion. The test results reported in Table 1 indicate a rejection of the null at the 5% level of significance.

Table 1. Im-Pesaran-Shin (2003) test on 28 OECD countries. Deterministics chosen: constant and trend; augmented by 2 lags (average)

```
NLG/GDP
t-bar test, N,T = (15,40)          Obs = 555
    t-bar     cv10      cv5        cv1    W[t-bar]    P-value
  -2.194    -2.440    -2.520    -2.670    -0.343      0.366

UR
t-bar test, N,T = (23,40)          Obs = 851
    t-bar     cv10      cv5        cv1    W[t-bar]    P-value
  -2.095    -2.380    -2.440    -2.550     0.142      0.557
```

The tests are implemented with a constant and trend in the test regression. The lags and leads in the error correction test are chosen according to the Akaike criterion. All other bandwidth and lag orders are set according to the rule 4(T/100)2/9. The unit root tests take a unit root as the null hypothesis while the cointegration tests take no cointegration as the null. The p-values are for a one-sided test based on the normal distribution.

Thus, based on the panel unit root test proposed by Im et al. (2003), we are able to reject the presence of a unit root in either variable, moreover, once a linear time trend has been accommodated, the null hypothesis is also rejected. Apparently, the evidence seems to support the unit root hypothesis for UR and NLG/GDP, we therefore conclude that the variables appear to be nonstationary.

The second step in our empirical analysis is to test whether UR and NLG/GDP are cointegrated. We apply the Westerlund (2007) (see also Persyn and Westerlund, 2009) tests on cointegration to data on UR and NLG/GDP. The results presented in Table 2 suggest that we cannot reject the null hypothesis of no cointegration at the 1% level for UR and NLG/GDP. The calculated values of the error correction statistics are presented along with bootstrapped p-values in Table 2. When using the bootstrapped p-values, we see a clear rejection of the null, at the 1% level, which we take as evidence in favour of cointegration.

Table 2. Westerlund ECM panel cointegration tests

UR on NLG/GDP
Results for H0: no cointegration
With 28 series and 1 covariate
Average AIC selected lag length: 1.71
Average AIC selected lead length: 0

Statistic	Value	Z-value	P-value
Gt	-3.562	-7.944	0.000
Ga	-15.444	-2.821	0.002
Pt	-15.669	-5.229	0.000
Pa	-14.693	-5.085	0.000

NLG/GDP on UR
Results for H0: no cointegration
With 28 series and 1 covariate
Average AIC selected lag length: 1.64
Average AIC selected lead length: 0

Statistic	Value	Z-value	P-value
Gt	-3.289	-6.146	0.000
Ga	-15.865	-3.156	0.001
Pt	-13.983	-3.265	0.001
Pa	-13.858	-4.345	0.000

Finally we report the long run relations (in either direction) obtained for the 28 OECD countries. Table 3 shows that the increasing public deficits increase the unemployment rate, with the estimated coefficient being about 0.37. Table 4 reports the reverse estimated equation showing that the long run NLG/GDP increases are explained by the increase of UR with an estimated coefficient of about 0.7.

Table 3. Long run equation(28 OECD countries).. Dependent variable UR

```
Fixed-effects (within) regression          Number of obs      =       908
Group variable: country                    Number of groups   =        28
R-sq:  within  = 0.3205                     Obs per group: min =        15
       between = 0.3387                                   avg =      32.4
       overall = 0.3026                                   max =        40
                                           F(2,27)            =     32.85
corr(u_i, Xb)  = 0.0740                     Prob > F           =    0.0000
```

	Coef.	Robust Std.Err.	t	P>|t|	[95%	Conf.Interval]
NLG/GDP	-0.37204	0.054616	-6.81	0	-0.4841	-0.25997
trend	0.083923	0.017442	4.81	0	0.048136	0.11971
constant	-161.424	34.74982	-4.65	0	-232.724	-90.1228
sigma_u	2.601196					
sigma_e	2.072667					
rho	0.611654	(fraction of variance due to u_i)				

.

Table 4. Long run equation (28 OECD countries). Dependent variable NLG/GDP

```
Fixed-effects (within) regression          Number of obs      =       908
Group variable: country_nu~o               Number of groups   =        28
R-sq:  within  = 0.2772                     Obs per group: min =        15
       between = 0.2763                                   avg =      32.4
       overall = 0.2645                                   max =        40
                                           F(2,27)            =     43.16
corr(u_i, Xb)  = -0.0844                    Prob > F           =    0.0000
|
```

	Coef.	Robust Std.Err.	T	P>|t|	[95%	Conf.Interval]
UR	-0.70383	0.076954	-9.15	0	-0.86173	-0.54593
trend	0.092805	0.026051	3.56	0.001	0.039352	0.146258
constant	-182.509	51.78437	-3.52	0.002	-288.762	-76.2564
sigma_u	2.657176					
sigma_e	2.850827					
rho	0.464885	(fraction of variance due to u_i)				

In order to avoid the likely comment that the countries considered are too different as for their individual economic policies and institutions, we further test the above relation for the 19 OEDC countries belonging to the European Union. They are: Austria, Belgium, Czech Republic, Danmark Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg; Netherlands, Poland, Portugal, Slovakia, Spain, Sweden, UK. We test again for the reduced sample whether the variables are nonstationary or not, by employing the test of Im *et al.* (2003).

Table 5. Im-Pesaran-Shin (2003) test on 19 OECD countries into the EU. Deterministics chosen: constant and trend; augmented by 2 lags (average)

```
NLG/GDP
t-bar test, N,T = (10,40)        Obs = 370
   t-bar    cv10     cv5       cv1   W[t-bar]   P-value
  -2.214   -2.500   -2.600    -2.780   -0.356    0.361

UR
t-bar test, N,T = (13,40)        Obs = 481
   t-bar    cv10     cv5       cv1   W[t-bar]   P-value
  -2.023   -2.440   -2.520    -2.670    0.415    0.661
```

The tests are implemented with a constant and trend in the test regression. The lags and leads in the error correction test are chosen according to the Akaike criterion. All other bandwidth and lag orders are set according to the rule 4(T/100)2/9. The unit root tests take a unit root as the null hypothesis while the cointegration tests take no cointegration as the null. The p-values are for a one-sided test based on the normal distribution.

As expected, we are able to reject the presence of a unit root in either variable, moreover, once a linear time trend has been accommodated, the null hypothesis is also rejected. Thus, there is evidence to support the unit root hypothesis for UR and NLG/GDP and we therefore conclude that the variables appear to be nonstationary. We further test whether UR and NLG/GDP are cointegrated. The results presented in Table 6 again based on Westerlund procedure suggest that we cannot reject the null hypothesis of no cointegration at the 5% level for UR and NLG/GDP

Table 6. Westerlund ECM panel cointegration tests (19 OECD into the EU)

```
UR on NLG/GDP
Results for H0: no cointegration
With 19 series and 1 covariate
Average AIC selected lag length: 1.84
Average AIC selected lead length: 0
-------------------------------------------+
 Statistic |   Value  |  Z-value  | P-value |
-----------+----------+-----------+---------|
     Gt    |  -3.847  |  -8.093   |  0.000  |
     Ga    | -15.516  |  -2.371   |  0.009  |
     Pt    | -12.779  |  -4.158   |  0.000  |
     Pa    | -14.480  |  -4.033   |  0.000  |
-------------------------------------------+

NLG/GDP on UR
Results for H0: no cointegration
With 19 series and 1 covariate
Average AIC selected lag length: 1.63
Average AIC selected lead length: 0
-------------------------------------------+
 Statistic |   Value  |  Z-value  | P-value |
-----------+----------+-----------+---------|
     Gt    |  -3.554  |  -6.501   |  0.000  |
     Ga    | -15.108  |  -2.104   |  0.018  |
     Pt    | -10.788  |  -1.838   |  0.033  |
     Pa    | -11.684  |  -1.992   |  0.023  |
-------------------------------------------+
```

Even in this case the calculated values of the error correction statistics are presented along with bootstrapped p-values, on which basis we see a clear rejection of the null that we take as evidence in favour of cointegration.

Finally, in tables 7 and 8, we report the long run relation in both the direction. It is interesting to notice that with respect to the long run relations obtained for the 28 OECD countries, the reduction of the sample to the 19 countries of the EU, determines a worsening of the effect of the public deficits on UR. The estimated coefficient in this relation passes from about 0.37 to about 0.43.

Table 7. Long run equation(19 OECD/EU countries). Dependent variable UR

```
Fixed-effects (within) regression          Number of obs    =       599
Group variable: country_nu~o               Number of groups =        19
R-sq:  within  = 0.3461                     Obs per group: min =       15
       between = 0.2927                                      avg =      31.5
       overall = 0.2946                                      max =        40
                                            F(2,18)          =     37.40
corr(u_i, Xb)  = 0.0036                     Prob > F         =    0.0000
```

	Coef.	Robust Std.Err.	T	P>|t|	[95%	Conf.Interval]
NLG/GDP	-0.43436	0.063461	-6.84	0	-0.56769	-0.30104
trend	0.101368	0.020808	4.87	0	0.057652	0.145084
constant	-195.826	41.43959	-4.73	0	-282.888	-108.765
sigma_u	2.63364					
sigma_e	2.327642					
rho	0.561443	(fraction	Of	variance	due	to u_i)

Table 8. Long run equation(19 OECD/EU countries).. Dependent variable NLG/GDP

```
Fixed-effects (within) regression          Number of obs    =       599
Group variable: country_nu~o               Number of groups =        19
R-sq:  within  = 0.2852                     Obs per group: min =       15
       between = 0.1920                                      avg =      31.5
       overall = 0.2257                                      max =        40
                                            F(2,18)          =     35.29
corr(u_i, Xb)  = -0.1407                    Prob > F         =    0.0000
```

|	Coef.	Robust Std.Err.	T	P>|t|	[95%	Conf.Interval]
UR	-0.63392	0.077228	-8.21	0	-0.79617	-0.47167
trend	0.090985	0.02725	3.34	0.004	0.033735	0.148236
constant	-179.678	54.17599	-3.32	0.004	-293.497	-65.8582
sigma_u	2.517703					
sigma_e	2.811948					
rho	0.444959	(fraction	Of	variance	due	to u_i)

The explanation of the stronger negative effect of the deficit on employment as compared to the OECD countries as a whole may be found in the characters of the EU countries both in the public sector size and in the market economy. As for the public economy it is worth noting that the EU countries have generally and bigger public sector both in terms of public spending as percentage of GDP and in terms of tax burden. Actually, as shown in Figure 5 the difference between the two groups of countries, on the disbursement side, reaches even 14% in certain years.

Figure 5. Total disbursements (general government) as a percentage of GDP (average of groups of EU and NON EU countries)
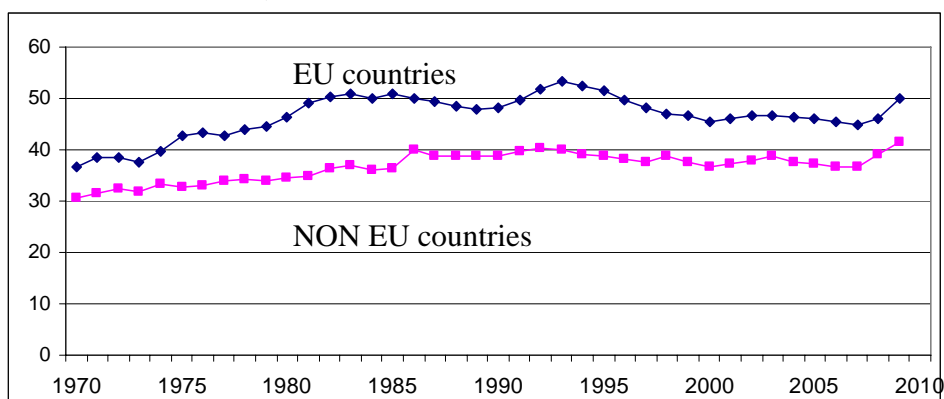

It follows that for any level of deficit, the product of the private sector is smaller and more taxed. As for the market economy, the EU countries internal market is less homogeneous as that of the US and more distant from the Asia Pacific area. This may reduce the effectiveness of fiscal stimulus to the demand *via* budgetary deficits. Moreover the NAIRUs of the EU economies, even if fluctuating, are, with few exceptions, higher than those of the non EU area, likely because of the greater rigidities in the labour market.

Figure 6. NAIRU for the groups of EU countries

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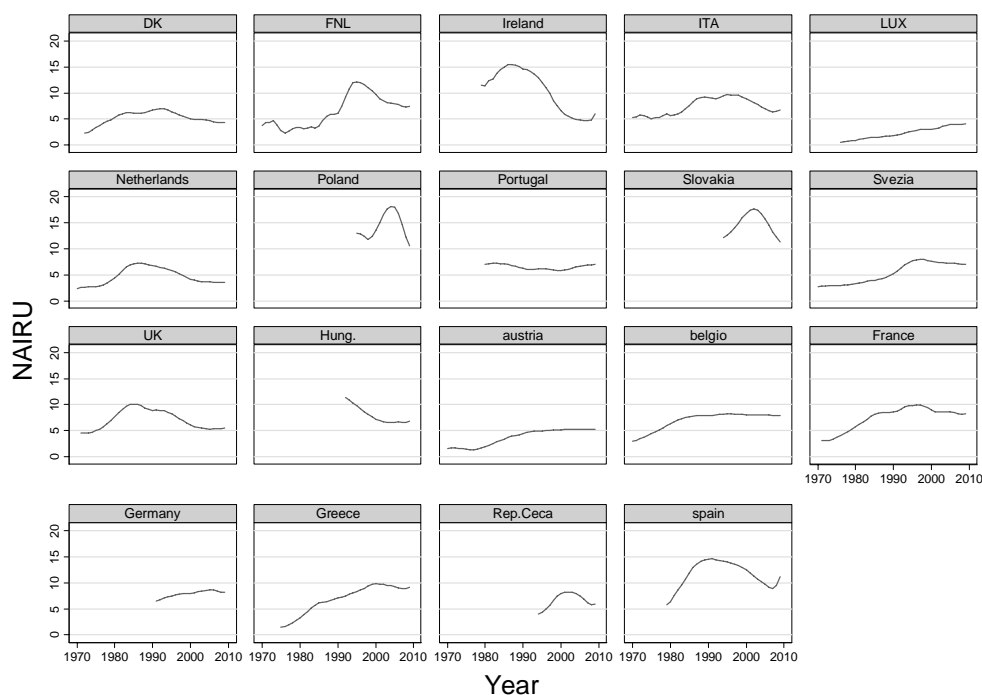
Figure 6. NAIRU for the groups of NON EU countries
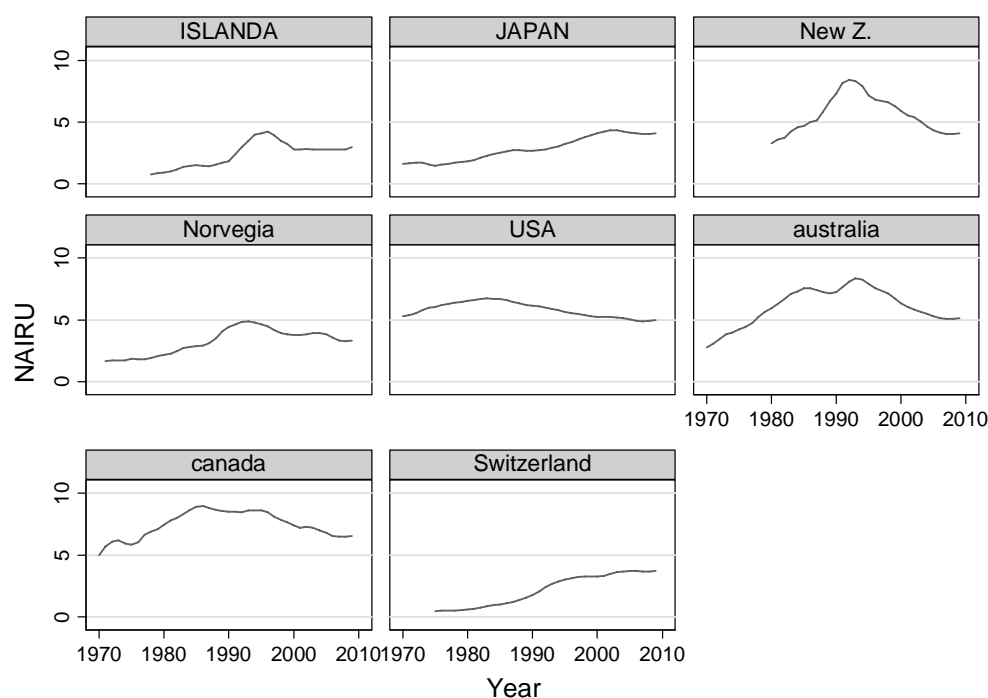
However, an additional factor that might explain the difference between the negative effects of deficits on employment might be the demographic factor. Europe is an ageing continent, while non European OECD countries (with the exception of Japan) are growing in population and younger. Some authors, considering some or all of these factors, argue that there is an Euro sclerosis. On the reason why in Europe high deficits have stronger negative effects on employment, additional research is certainly needed. Beside providing a stimulus in that direction, may also explain why European governments show less faith in the neo keynesian recipes of stimulus via fiscal deficit and more propensity to adopt reductions of them.

3. Preliminary conclusions.

We noticed that, a part from the Moody's Misery index, the relation between unemployment and deficits has received scant econometric attention. Therefore, we concentrated the analysis on their long run relationship, for 28 OECD countries from year 1970 to year 2009.

Based on the panel unit root test proposed by Im et al. (2003), first, we have been able to reject the presence of a unit root in either variable. Apparently, the evidence seems to support the unit root hypothesis for UR and NLG/GDP, we have therefore concluded that the variables appear to be

nonstationary. Second, we used the Westerlund (2007) tests on cointegration to data on UR and NLG/GDP, with the results suggesting cointegration between the two variables. In order to avoid the likely objection that the countries considered are too different as for their individual economic policies and institutions, the tests have been repeated for a reduced sample of the 19 OEDC countries belonging to the European Union. Even in this case, the evidence supports the unit root hypothesis for both UR and NLG/GDP and cointegration between the two variables. Finally, we worked out the long run relations (in either direction) obtained for the 28 OECD countries and the 19 OEDC countries belonging to the European Union. The results show that increasing public deficits increases the unemployment rate, with the reverse estimated equation showing that the long run NLG/GDP increases are also explained by the increase of UR. The reduction of the sample to the 19 countries of the EU, shows a worsening of the effect of the public deficits on UR. The estimated coefficient in these relations passes from about 0.37 to about 0.43. On the reasons why in Europe high deficits have stronger negative effects on employment, additional research is certainly needed. Some factors may be the following. EU countries have generally a bigger public sector and, for any level of deficit, the product of the private sector is smaller and more taxed. EU countries' internal market is less homogeneous and more distant from the Asia Pacific developing area. This may reduce the effectiveness of fiscal stimulus to the demand *via* budgetary deficits. The NAIRUs of the EU economies are higher than those of the non EU area, Europe is ageing, while non European OECD countries (with the exception of Japan) are younger because of their population growth. The different results for EU and non EU countries may also help in explaining why European governments show less faith in the neo keynesian recipes of stimulus via fiscal deficit than the dominant consensus, which however seems now declining.

Jeffrey Sachs has recently argued that

"Governments are fighting for market credibility via draconian cut in spending. This too is the wrong approach. We should avoid a simplistic austerity to follow the simplistic stimulus of last year. Here are some suggested guidelines.

First, governments should work within a medium-term budget framework of five years, and within a decade-long strategy on economic transformation. Deficit cutting should start now, not later, to achieve manageable debt-to-GDP ratios before 2015.

Second, governments should explain, and the public should learn, that there is little that economic policy can do to create high-quality jobs in the short term. Good jobs result from good education, cutting-edge technology, reliable infrastructure and adequate outlays of private capital, and thus are the outcome of years of sustained public and private investments. Governments need actively to promote post-secondary education.

Third, governments must of course also ensure social safety nets: income support for the poor, universal access to basic healthcare and education, a scaling up of job training programmes and promotion of higher education.

Fourth, governments should steer their economies towards needed long-term structural transformation. External-deficit countries such as the US and UK will need to promote exports over the next few years, while all countries must promote clean energy and new transport infrastructure.(….)"

We subscribe these conclusions. Still new evidence is required on whether the fiscal stimulus policies are or not effective in promoting employment also in the short run, while, as seen, they tend increase it in the longer run also increasing the public debt burden. Truly the effects of fiscal stimulus on employment may be different from those on growth. Additional research is also required for the specific theme of GDP growth. However, a public policy that, by trying to stimulate GDP growth, aggravates unemployment and public debt does not seem to be pursued in developed countries by democratic governments, not even for the sake of keeping power.

References

Im, K. S., M. Peseran and Y. Shin (2003). Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics*, Vol. 115, pp. 53-74.

Persyn D. and J. Westerlund, (2008) Error-correction–based cointegration tests forpanel data, *The Stata Journal* 8, Number 2, pp. 232–241

Jeffrey Sachs (2010) Time to plan for post-Keynesian era, *Financial Time*, June 7,

Westerlund, J. 2007. Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics* 69: 709–748.