# Niurong as the target for NGDP targeting: Mario Draghi's nightmare?

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# Niurong as the target for NGDP targeting: Mario Draghi's nightmare?

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**Abstract**

NGDP targeting is presented by some macroeconomists as a good practice for central banks. But what should be the target value? I propose a relevant measure: the Non Increasing Unemployment Rate Of Nominal Growth (NIURONG). I use NIURONG to show how difficult would have been for European Central Bank to implement a relevant monetary policy for each Euro Area country in front of post-2008 economic downturn.

*Key words:*
NDGP targeting, monetary policy, Optimal Currency Areas

*JEL Classification:* E58

## Introduction

The relevance of nominal income as a target for central banks has been wildly discussed at least since Bean (1983) and Carlson (1984) advocated it 3 decades ago [2]. Recently, some macroeconomists, including Scott Sumner (Sumner (2011)), Paul Krugman [3] and Christina Romer (Romer (2011)) urged central bankers to adopt NGDP targeting in front of post-2008 economic downturn.

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The author is greatefull to Sandrine Noblet for her comments.
[2] See Jensen (2002) for instance.
[3] He defended that point on his blog at `http://krugman.blogs.nytimes.com/2011/10/19/getting-nominal/`

If NGDP is a good target, then what value should take this target? It seems reasonable to argue that a relevant target is one that promotes macroeconomic stability. I propose to consider unemployment stability as a good measure of macroeconomic stability. I present, in section 1, a formal definition of such a target, the *Non Increasing Unemployment Rate Of Nominal Growth* (NIURONG [4]).

Would have such a target helped ECB to implement a more accurate economic policy in front of 2008 economic downturn? A precise, reliable answer to this question would require a relevant macroeconomic model, which is beyond the scope of this paper. However, section 2 provides a naive statistical measure of the Niurong for the different countries of the Euro Area (EA). This measure suggests that EA countries are divided in three different subgroups in terms of Niurong. In other words, this measure underlies the structural difficulties to implement a unique monetary policy for EA countries. This point is discussed in section 3.

## 1 The Niurong

A *natural* way to define the target for NGDP would be to sum a rate of potential real growth and a 'good' inflation rate, such as 2% as in the Taylor rule (Taylor (1993)). However, I see two advantages to think rather in terms of unemployment stabilization:

1) unemployment stability is likely to give a more stable target value than real growth. Indeed, potential growth is driven by demography, technical progress and capital accumulation, which can have important variabilities over time. On the opposite, labor markets are likely to be more stable institutions, since labor market reforms are not undertaken every year on most countries. This point can be made more cautiously: *if* potential growth has a higher variability than the equilibrium rate of unemployment, *then* a target for NGDP growth based on unemployment stability is more relevant than one based on potential growth. I tend to believe that this condition is met, but this is an empirical matter.

2) A target based on unemployment stability is probably easier to estimate statistically than potential growth.

That said, I define, in a very general sense, the Niurong as the rate of growth of NGDP associated with a 0 growth in unemployment. More precisely, let $u_t$ be the unemployment rate at time $t$, $\Delta u_t \equiv u_t - u_{t-1}$, $\theta_t$ a set of parameters

[4] I shall write Niurong hereafter for aesthetic reasons.

and $g_t$ the rate of growth of NGDP at time $t$. $\theta_t$ can include productivity parameters, foreign prices, rates of time preference, and so forth.

If we assume that $E\left(\Delta u_t / g_t, \theta_t, t\right) = f(g_t, \theta_t, t)$, a Niurong at time $t$ is simply a rate of growth $g*\left(\theta_t\right)$ such as $f\left[g*\left(\theta_t\right), \theta_t, t\right] = 0$. This definition is very large. Any model that allows NGDP growth to impact unemployment can fit it. $f()$ can be considered as the reduced form of such models. In particular, this formulation allows multiple values for the Niurong, and non constant values. A New Classical model with perfect expectations will clearly have multiple Niurongs, since inflation have no impact on unemployment in those models [5]. In such models, $\theta_t$ will include current expectations about future inflation, or, more precisely, current actions from central bank that shape those expectations. An old school monetarist model with adaptive expectations will have a unique value for Niurong at each $t$, but this value increases over time if inflation is not stationary [6]. Here, $\theta_t$ includes current observations of past inflation rates. In any sort of models, $\theta_t$ should include parameters that characterize labor market, such as the importance of labor unions, the changes in minimum wages and so forth.

However, Niurong is a more relevant concept when its value is unique and stationary, or at least rather stable for a period. Presumably, this will happen in new Keynesian models [7], if labor market is not subject to major reforms. The measure proposed in section 2 assumes Niuron is constant, which is certainly an over-simplifying assumption. But, it is important to keep in mind that even in new classical models, a brutal (unexpected) shock in NGDP growth does have real effects. Lucas critique [8] does not deny the existence of a Philipps curve, it states that it is only valid for constant expectations. It follows that even a strong supporter of new classical models will encourage a central banker to let NGDP evolve in line with current expectations. In this context, Niurong will probably equate the currently expected NGDP rate of growth, which is not a stationary value, but certainly a unique one (at a given $t$).

The model tested in section 2 is neither a new classical nor a new Keynesian one. It is a simple statistic model, without microeconomic foundations, without equilibrium rules, without a description of technology, without assumptions about price stickiness, and so forth. This will not allow me to draw definitive conclusions from the results. It can be taken as a first step to measure Niurong. However, I hope that future research will give some credit to that first step by showing that at least some classes of macro models can justify this approach.

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[5] Barro and Gordon (1983)
[6] Friedman (1977)
[7] such as Smets and Wouters (2003) for instance.
[8] Lucas (1976)

## 2 Statistical measures of Niurong in Euro Area

I propose to estimate Niurong for 11 countries of the EA [9]. Quarterly data on NGDP and on unemployment rates in EA as a whole are given by Eurostat [10], whereas quarterly data on unemployment rates for individual countries are given by the International Labor Organisation (ILO) [11] [12]. Time span goes from $Q1$ 1998 to $Q2$ 2011.

For each quarter, I compute quarterly, half-yearly and yearly increases in unemployment rates and NGDP rates of growth. For each of those lengths of time, I run linear regressions, with, respectively: no lag on NGDP growth, 1 quarter lag and 2 quarters lags. Table 1 summarizes those 9 specifications. Each one is estimated with both Ordinary Least Square (OLS) and Cochrane-Orcutt (CO) methods to account for residual auto-correlation, which amounts to 18 regressions for each country.

The estimated relation writes [13]:

$$\Delta u_t = a - b g_\tau$$

where $a$ and $b$ are the parameters to be estimated, and $\tau = \{t; t-1; t-2\}$ according to the specification.

Obviously, Niurong is given by $g* = a/b$. Niurong is multiplied by 4 when quarterly rates of growth are used, and by 2 for half-yearly rates [14], in order to think in yearly terms. Tables 2, 3 and 4 report the results for individual countries. Table 5 reports the results for EA (12 countries) as a whole. I only report Niurongs for statistically significant regressions at the 5% level. When regressions are significant, niurong is not very sensistive to changes in specification. Moreover, Cochrane-Orcutt method corrects rather well auto-correlation, but does not change substantially the magnitude of Niurong. This leads me to simply use the mean of niurong values from all significant regressions as *the* niurong value for each country.

[9] The 12 first members of EA, without Luxembourg.
[10] `http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_databasetext`
[11] `http://laborsta.ilo.org/STP/guest`
[12] My dataset is downloadable as stata file at `http://dl.dropbox.com/u/23191237/niurongb.dta` , do-file of regressions at `http://dl.dropbox.com/u/23191237/niurong.do`.
[13] I do not write a subscript for countries, but parameters $a$ and $b$ are estimated for each country.
[14] Compound rates are negligible.

## 3 EA monetary policy puzzle

The estimates of Niurongs for EA members exhibit a great inter-country variability. Countries are divided in at least three subgroups:

(1) the low-Niurong countries: Germany (0.09%), Italy (1.56%), Finland (1.80%)
(2) the middle-Niurong countries: France (2.92%), Belgium (3.05%), Austria (3.77%), Netherland (4.61%)
(3) the high-Niurong countries: Spain (6.14%), Greece (6.39%), Portugal (7.10%), Ireland (10.92%)

EA (12) as a whole is close to the second group, with a Niurong of 3.10%.

Notice that the borders between the first 2 subgroups is somehow arbitrary. One could consider that there exists a continuum from Italy to Netherland, and that Germany is the unique member of a subgroup with virtually 0% Niurong.

Anyway, the only figure that should drive ECB actions is the Niurong for EA as a whole, namely 3.10%. A tough question is:

*What mechanism would translate a* 3.10% *NGDP growth in EA into a* 0.09% *growth in Germany and into a* 10.92% *growth in Ireland?*

This question is not the topic of this paper. Probably, convergence mechanisms would increase real GDP growth in peripheral countries, so that, even if inflation is common across the area, they would experiment a higher growth in NGDP. However, a central bank devoted to Irish stability would certainly be in a more comfortable position to target a 10.92% NGDP growth for Irish economy than ECB.

Especially if there is some endogeneity in monetary policy. Indeed, figure 6 shows money stock (M2 excluding currency) for 4 selected EA countries: Germany, Italy, Ireland and Greece. Ireland and Greece, that belong to the high-Niurong subgroup, and that experiment a very painful economic crisis, also experiment a fall in the money stock, which is probably a consequence of the fall in credit. Not only do those countries need a easier monetary policy than typical EA members, they also suffer from an endogenous mechanism that reduced their money stock when they need it to increase.

It is striking that the four members of the third subgroup are countries that were hurt by 2010 sovereign debt crisis. But this feature does not define this subgroup, since Italy, which has a bigger sovereign debt over gdp ratio than Ireland, is the closest country from Germany in terms of Niurong. This point is noteworthy: Italy is often compared to Greece as the next country to be hit

by Euro crisis. Nonetheless, two different problems should be distinguished:

(1) the sovereign debt sustainability.
(2) the lack of an appropriate monetary policy in front of economic downturn.

Clearly, Italy and Greece both suffer from problem 1), whereas it seems that only Greece suffers from problem 2): Greek required rate of nominal growth is clearly too high to be enforced by ECB. Italy seems, on the opposite, to have currently a macroeconomic behavior close to those of Germany and to EA as a whole. It follows that a reasonably accommodative monetary policy by ECB could help Italy to implement rigorous fiscal policy without falling into severe recession. Unfortunately for Greece, no such help can be expected from ECB, since a helpful monetary policy would be very inflationist for at least 7 EA members, including Germany, France and... Italy.

## Concluding remarks

To conclude, I would like to split the contribution of this paper in two.

The first contribution is the definition of Niurong. As I said, this definition is very general. Any macroeconomist who believes that brutal, unexpected changes in NGDP growth have harmful real effects should acknowledge that Niurong makes sense, at least on the short run, even if there can be disputes over the good underlying model.

The second contribution is Niurong statistical measures in EA. These measures have all the weaknesses of every non micro-founded statistical measure. In that sense, I want to be very cautious about the implications of the results. Especially, I do not claim that I have demonstrated that EA is not and will never be an optimal currency area.

Expectations surely play a crucial role in those results, and macroeconomic history shows that expectations can change. However, the data cover more than a decade in which all the countries in the sample knew they were sharing a unique monetary policy for, *a priori*, a very long time. It is arguable that EBC, by choosing an explicit NGDP target and by sticking to it, will make expectations converge over EA members.

Another key element behind these results is certainly the short term functioning of labor markets. It has been largely argued [15] that Germany had not experienced a surge in unemployment despite economic downturn because of its use of short-run cuts in working time. In this case, unemployment rate

[15] see especially Möller (2010).

might just be an inappropriate measure of actual shortage in labor demand: involuntary part-time labor should also be included in the measure.

Burda and Hunt (2011) argue that it is the abnormal non-increase in hiring in 2005-2007 in Germany that explains good labor performances since 2008. Whatever explanation is the correct one, in both cases, the figure found for Niurong in Germany is probably an understated target for NGDP growth.

Despite all those limits, I think this paper sheds the light on real deep difficulties that Mario Draghi will have to face in the conduct of EA monetary policy.

My further researches on the topic are twofold:

(1) The concept of Niurong should rely on a complete macroeconomic model. I want to verify if well-established models can indicate clear values of Niurong. I suspect that in the model presented in Eggertsson and Krugman (2010), the constraint in debt-income ratio is more likely to become binding when growth in NGDP is too low. This could lead to a theoretical definition of Niurong.
(2) I want to identify the mechanisms allowing or impeding a unique NGDP target for EA to translate into specific targets for individual EA members.

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## Tables and figures

| | | lag of NGDP | | |
|---|---|---|---|---|
| | | No lag | 1 quarter | 2 quarters |
| Length of time | quarter | c1 | l1 | ll1 |
| | half year | c2 | l2 | ll2 |
| | year | c4 | l4 | ll4 |

Fig. 1. the 9 different specifications

| | | Germany | | | | Italy | | | | Finland | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Niurong | F | R2 | DW | Niurong | F | R2 | DW | Niurong | F | R2 | DW |
| OLS | c1 | - | 0,34 | - | - | 1,71 | 6,32 | 0,11 | 2,18 | - | 2,01 | - | - |
| | c2 | -0,38 | 4,09 | 0,08 | 1,52 | 1,96 | 13,68 | 0,21 | 1,84 | 1,93 | 12,20 | 0,20 | 1,8 |
| | c4 | 0,07 | 18,93 | 0,28 | 0,39 | 1,76 | 70,68 | 0,60 | 0,84 | 2,11 | 190,69 | 0,80 | 0,6 |
| | l1 | - | 3,50 | - | - | - | 3,69 | - | - | - | 2,83 | - | - |
| | l2 | 0,52 | 7,93 | 0,14 | 1,68 | 1,69 | 6,66 | 0,12 | 1,91 | 2,11 | 11,97 | 0,20 | 1,8 |
| | l4 | 0,49 | 34,81 | 0,43 | 0,44 | 1,84 | 100,71 | 0,68 | 0,74 | 2,12 | 266,48 | 0,85 | 0,9 |
| | ll1 | - | 0,02 | - | - | - | 0,24 | - | - | - | 0,85 | - | - |
| | ll2 | - | 2,55 | - | - | - | 1,19 | - | - | 1,61 | 7,98 | 0,15 | 1,7 |
| | ll4 | 0,42 | 30,95 | 0,40 | 0,52 | 1,81 | 79,38 | 0,63 | 0,76 | 1,86 | 85,17 | 0,65 | 0,5 |
| CO | c1 | - | 2,90 | - | - | 1,71 | 7,86 | 0,14 | 2,07 | 1,91 | 8,56 | 0,15 | 2,2 |
| | c2 | - | 3,38 | - | - | 2,01 | 12,67 | 0,21 | 1,85 | 2,02 | 9,35 | 0,16 | 1,8 |
| | c4 | -0,35 | 7,37 | 0,14 | 1,49 | - | 0,63 | - | - | 1,75 | 57,83 | 0,56 | 1,8 |
| | l1 | 0,52 | 6,72 | 0,12 | 2,1 | - | 3,90 | - | - | 2,06 | 9,51 | 0,17 | 2,2 |
| | l2 | 0,63 | 6,42 | 0,12 | 1,69 | 1,68 | 6,13 | 0,11 | 1,9 | 1,96 | 11,84 | 0,20 | 1,9 |
| | l4 | 0,05 | 13,96 | 0,23 | 1,67 | 1,11 | 14,68 | 0,24 | 1,78 | 1,80 | 82,10 | 0,65 | 2,1 |
| | ll1 | - | 1,64 | - | - | - | 0,44 | - | - | 1,51 | 5,82 | 0,11 | 2,1 |
| | ll2 | - | 1,19 | - | - | - | 0,59 | - | - | 1,39 | 8,26 | 0,15 | 1,8 |
| | ll4 | -1,07 | 6,18 | 0,12 | 1,58 | 0,06 | 5,20 | 0,10 | 1,99 | 0,90 | 25,23 | 0,36 | 1,4 |
| Mean | | 0,09 | | | | 1,56 | | | | 1,80 | | | |

Fig. 2. Niurong estimates for low-Niurong countries

| | | France | | | | Belgium | | | | Austria | | | | Netherland | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Niurong | F | R2 | DW | Niurong | F | R2 | DW | Niurong | F | R2 | DW | Niurong | F | R2 | DW |
| | c1 | 2,58 | 4,09 | 0,07 | 2,11 | - | 0,00 | - | - | - | 0,00 | - | - | 3,59 | 4,11 | 0,07 | 1,6 |
| | c2 | 2,95 | 11,04 | 0,18 | 1,77 | - | 2,12 | - | - | - | 0,30 | - | - | 3,99 | 7,89 | 0,14 | 1,4 |
| | c4 | 3,01 | 84,62 | 0,64 | 0,42 | 3,20 | 17,33 | 0,27 | 1,04 | 3,63 | 9,09 | 0,16 | 0,9 | 4,22 | 33,82 | 0,41 | 0,2 |
| | l1 | - | 3,98 | - | - | - | 1,13 | - | - | - | 1,54 | - | - | 4,10 | 4,66 | 0,09 | 1,8 |
| OLS | l2 | 3,04 | 11,75 | 0,19 | 1,73 | - | 3,99 | - | - | - | 1,14 | - | - | 4,34 | 10,71 | 0,18 | 1,6 |
| | l4 | 3,03 | 102,36 | 0,69 | 0,64 | 3,28 | 26,24 | 0,36 | 1,06 | 3,69 | 19,65 | 0,29 | 0,8 | 4,38 | 51,01 | 0,52 | 0,2 |
| | ll1 | 2,81 | 4,55 | 0,09 | 2,08 | - | 0,61 | - | - | - | 0,03 | - | - | 4,42 | 4,69 | 0,09 | 1,8 |
| | ll2 | 2,91 | 11,05 | 0,19 | 1,7 | 2,76 | 8,89 | 0,16 | 1,49 | - | 0,72 | - | - | 4,48 | 10,71 | 0,18 | 1,6 |
| | ll4 | 3,02 | 63,36 | 0,58 | 0,55 | 3,24 | 21,18 | 0,32 | 1,14 | 3,82 | 12,20 | 0,21 | 1,1 | 4,48 | 50,44 | 0,52 | 0,2 |
| | c1 | 2,84 | 4,78 | 0,09 | 2,05 | - | 1,48 | - | - | - | 0,00 | - | - | - | 2,84 | - | - |
| | c2 | 3,01 | 8,55 | 0,15 | 1,73 | - | 0,17 | - | - | - | 0,21 | - | - | 4,45 | 4,17 | 0,08 | 1,7 |
| | c4 | 2,95 | 35,40 | 0,43 | 1,99 | - | 3,92 | - | - | - | 1,51 | - | - | 6,39 | 6,11 | 0,12 | 0,9 |
| | l1 | 2,88 | 5,98 | 0,11 | 2,11 | - | 3,29 | - | - | - | 1,20 | - | - | - | 3,57 | - | - |
| CO | l2 | 2,89 | 10,01 | 0,17 | 1,84 | - | 1,40 | - | - | - | 1,03 | - | - | 4,50 | 6,49 | 0,12 | 1,7 |
| | l4 | 3,00 | 25,55 | 0,36 | 2 | 3,24 | 11,31 | 0,20 | 2,25 | 3,95 | 13,69 | 0,23 | 1,8 | 5,25 | 19,38 | 0,30 | 1,3 |
| | ll1 | 2,68 | 6,36 | 0,12 | 2,04 | 2,72 | 6,96 | 0,13 | 1,88 | - | 0,21 | - | - | - | 3,59 | - | - |
| | ll2 | 2,79 | 8,97 | 0,16 | 1,66 | 2,80 | 5,83 | 0,11 | 1,86 | - | 0,64 | - | - | 4,43 | 6,61 | 0,12 | 1,7 |
| | ll4 | 2,97 | 11,73 | 0,21 | 1,68 | 3,17 | 6,22 | 0,12 | 2,35 | - | 1,77 | - | - | 5,08 | 23,62 | 0,34 | 1,7 |
| Mean | | 2,92 | | | | 3,05 | | | | 3,77 | | | | 4,61 | | | |

Fig. 3. Niurong estimates for middle-Niurong countries

| | | Spain | | | | Greece | | | | Portugal | | | | Ireland | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Niurong | F | R2 | DW | Niurong | F | R2 | DW | Niurong | F | R2 | DW | Niurong | F | R2 | DW |
| | c1 | 5,98 | 33,43 | 0,40 | 1,7 | 6,05 | 6,79 | 0,14 | 1,83 | 6,58 | 8,08 | 0,14 | 2,2 | 12,28 | 5,76 | 0,10 | 2 |
| | c2 | 6,00 | 68,94 | 0,58 | 1,2 | 5,72 | 18,13 | 0,31 | 1,52 | 6,24 | 25,81 | 0,34 | 1,2 | 8,69 | 41,29 | 0,45 | 1,4 |
| | c4 | 6,03 | 185,22 | 0,79 | 0,46 | 5,83 | 82,39 | 0,68 | 0,57 | 6,20 | 44,56 | 0,48 | 0,5 | 8,53 | 131,13 | 0,73 | 1,1 |
| | l1 | 6,20 | 22,52 | 0,31 | 1,48 | 6,29 | 11,92 | 0,22 | 2,09 | 7,45 | 9,26 | 0,16 | 2,1 | 11,98 | 9,22 | 0,16 | 2 |
| OLS | l2 | 6,17 | 41,58 | 0,46 | 1,02 | 6,06 | 29,96 | 0,42 | 1,6 | 6,95 | 19,87 | 0,29 | 1,1 | 8,96 | 34,55 | 0,41 | 1,2 |
| | l4 | 6,20 | 100,96 | 0,68 | 0,32 | 6,17 | 97,18 | 0,71 | 0,58 | 6,43 | 47,33 | 0,50 | 0,5 | 8,99 | 121,96 | 0,72 | 1 |
| | ll1 | 6,38 | 13,36 | 0,21 | 1,35 | 7,04 | 7,00 | 0,15 | 1,93 | - | 0,88 | - | - | 12,19 | 7,70 | 0,14 | 1,8 |
| | ll2 | 6,33 | 25,72 | 0,35 | 0,88 | 6,49 | 19,69 | 0,33 | 1,51 | 7,49 | 12,88 | 0,21 | 1,2 | 9,72 | 27,85 | 0,37 | 1 |
| | ll4 | 6,46 | 48,86 | 0,52 | 0,3 | 6,46 | 81,13 | 0,68 | 0,5 | 6,61 | 41,02 | 0,47 | 0,6 | 9,59 | 88,45 | 0,66 | 0,7 |
| | c1 | 5,80 | 27,39 | 0,35 | 1,89 | 6,58 | 7,45 | 0,15 | 1,97 | 7,41 | 8,43 | 0,14 | 1,9 | 13,58 | 5,03 | 0,09 | 2 |
| | c2 | 5,85 | 31,45 | 0,39 | 1,59 | 6,21 | 14,39 | 0,26 | 1,74 | 7,43 | 8,25 | 0,14 | 1,5 | - | 0,09 | - | - |
| | c4 | 6,01 | 28,18 | 0,37 | 1,54 | - | 0,53 | - | - | 8,81 | 5,84 | 0,11 | 1,6 | - | 0,82 | - | - |
| | l1 | 5,94 | 14,17 | 0,22 | 1,83 | 6,38 | 14,34 | 0,26 | 2,07 | 6,92 | 11,90 | 0,20 | 2 | 12,11 | 8,29 | 0,14 | 1,9 |
| CO | l2 | 6,02 | 11,95 | 0,20 | 1,46 | 6,25 | 21,72 | 0,35 | 1,77 | 6,97 | 9,61 | 0,17 | 1,6 | - | 0,57 | - | - |
| | l4 | 6,53 | 15,70 | 0,25 | 1,23 | - | 0,77 | - | - | 7,41 | 9,69 | 0,17 | 1,4 | - | 2,15 | - | - |
| | ll1 | 6,18 | 4,39 | 0,08 | 1,73 | 7,19 | 6,36 | 0,14 | 1,95 | - | 2,49 | - | - | 15,82 | 4,40 | 0,08 | 2,1 |
| | ll2 | - | 0,96 | - | - | 6,75 | 11,04 | 0,22 | 1,65 | - | 0,49 | - | - | - | 0,68 | - | - |
| | ll4 | - | 0,97 | - | - | - | 2,11 | - | - | - | 0,42 | - | - | - | 3,26 | - | - |
| Mean | | 6,14 | | | | 6,39 | | | | 7,10 | | | | 10,92 | | | |

Fig. 4. Niurong estimates for high-Niurong countries

| | | EA | | | |
|---|---|---|---|---|---|
| | | Niurong | F | R2 | DW |
| OLS | c1 | 2,73 | 15,85 | 0,41 | 2,06 |
| | c2 | 3,02 | 30,98 | 0,58 | 1,83 |
| | c4 | 3,14 | 213,19 | 0,91 | 0,45 |
| | l1 | 2,78 | 8,85 | 0,28 | 2,16 |
| | l2 | 3,08 | 21,05 | 0,49 | 1,99 |
| | l4 | 3,15 | 388,38 | 0,95 | 1,42 |
| | ll1 | - | 1,47 | - | - |
| | ll2 | 3,34 | 5,78 | 0,21 | 1,65 |
| | ll4 | 3,21 | 63,57 | 0,74 | 0,51 |
| CO | c1 | 2,92 | 18,24 | 0,45 | 2,07 |
| | c2 | 3,16 | 26,91 | 0,56 | 1,84 |
| | c4 | 2,77 | 76,28 | 0,80 | 1,4 |
| | l1 | 3,07 | 12,53 | 0,36 | 2,2 |
| | l2 | 3,26 | 21,42 | 0,50 | 1,99 |
| | l4 | 3,10 | 287,59 | 0,94 | 1,96 |
| | ll1 | - | 1,08 | - | - |
| | ll2 | - | 2,92 | - | - |
| | ll4 | 3,34 | 10,96 | 0,37 | 1,25 |
| Mean | | 3,10 | | | |

Fig. 5. Niurong estimates for EA (12 countries)

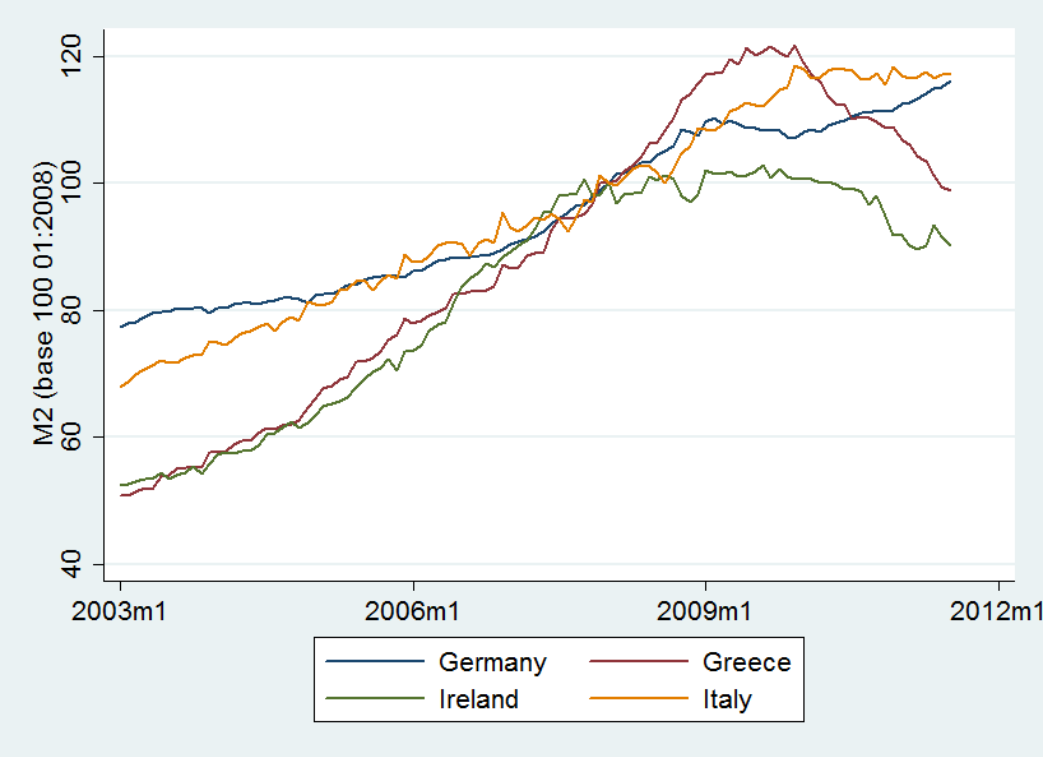


Fig. 6. M2 excluding currency for 4 EA countries (source: central banks of these countries)