RUHR

ECONOMIC PAPERS

Ansgar Belke

Jens Klose

Equilibrium Real Interest Rates and Secular Stagnation − An Empirical Analysis for Euro Area Member Countries

#621

Imprint

Ansgar Belke and Jens Klose

Equilibrium Real Interest Rates and Secular Stagnation – An Empirical Analysis for Euro Area Member Countries

Bibliografische Informationen
der Deutschen Nationalbibliothek

Die Deutsche Bibliothek verzeichnet diese Publikation in der deutschen National-
bibliografie; detaillierte bibliografische Daten sind im Internet über:
http://dnb.d-nb.de abrufbar.

Ansgar Belke and Jens Klose[1]

Equilibrium Real Interest Rates and Secular Stagnation – An Empirical Analysis for Euro Area Member Countries

Abstract

Is secular stagnation a valid concern for Euro Area countries? We tackle this question using the well-established Laubach-Williams model to estimate the unobservable equilibrium real interest rate and compare it to the actual real rate. We apply our approach to twelve Euro Area countries, since heterogeneity among member countries has become considerably extensive since the beginning of the financial crisis. Hence, the question of secular stagnation has to be answered at the country level. Our results indicate that secular stagnation does not appear to be a significant threat to most Euro Area countries. But there is one exception: Greece.

_____

1 Ansgar Belke, UDE; Jens Klose, THM Business School. – All correspondence to: Jens Klose, THM Business School, Eichgärtenallee 6, D-35390 Gießen, Germany, e-mail: Jens.Klose@w.thm.de

1   Introduction

Will we observe a sustained period of low growth in Euro Area countries? As in other industrialized countries, the growth rates have declined in the wake of the financial crisis and appear to have moved to a lower trajectory since that time. To account for this phenomenon, the secular stagnation hypothesis has been reinvented (Summers, 2014a). For a survey and deeper analysis of this issue see Teulings and Baldwin (2014).

At the center of this hypothesis is a difference between the real interest rate, being the decisive variable for investment and consumption decisions, and its equilibrium value. When the latter is too low to be reached by the real rate we may face secular stagnation. However, the equilibrium real rate is an unobservable variable. But there is a straightforward way to estimate this. Laubach and Williams (2003) introduced a model for estimating it in the US. We will apply this model to twelve Euro Area countries. Moreover, we will compare our results to ex-ante and ex-post real interest rates to determine whether some Euro Area countries are confronted with secular stagnation.

With our analysis, we go beyond other papers in this field. To the best of our knowledge, those have estimated the equilibrium real rate at an Euro Area wide level (Mesonnier and Renne, 2007; Garnier and Wilhelmsen, 2009; Belke and Klose, 2013; Beyer and Wieland, 2015). While knowing the equilibrium real rate for the whole Euro Area is certainly an asset for the European Central Bank (ECB) it is, in our view, too rough a measure for the identification of secular stagnation. The reason is simply that we observe a considerable degree of probably even structural heterogeneity in economic fundamentals among the Euro Area countries, i.e. in GDP growth and unemployment rates. So we suppose that the question of whether secular stagnation is present also has to be answered at the country level. We therefore proceed along these lines in the remainder of this paper.

But heterogeneity among Euro Area member countries also has implications for the Euro Area as a whole, i.e. for the common monetary policy. If we identify secular stagnation only in some member countries, while others return to solid growth, the ECB has to decide how to deal with this issue in the sense of applying the best monetary policy to the whole Euro Area. However, this may in such an environment not be optimal for every member country. For example, if the ECB decides to help countries in secular stagnation through an accommodative monetary policy, other countries may soon face inflation pressures. If, on the other hand, the ECB steers its monetary policy along the lines of the non-secular-stagnation countries, thus employing a restrictive monetary policy, the countries experiencing secular stagnation might become even more depressed.

This paper proceeds as follows: first, the role of the real interest rate and its equilibrium value in the context of secular stagnation are explained and possible drivers of secular stagnation discussed. Secondly, the Laubach-Williams model is introduced, which is needed to estimate the unobserved equilibrium real rate. Thirdly, the data is explained. And fourthly, we present and discuss our results. The final section concludes.

2 Equilibrium Real Interest Rates and Secular Stagnation

The financial crisis of 2008/09 depressed output in leading developed countries considerably. But even after the most severe tensions had vanished, output growth seemed to be persistently lower than before the crisis. This phenomenon may be explained by a permanent drop in potential output and has been referred to as 'secular stagnation' (Summers, 2014a, 2014b, 2014c; Teulings and Baldwin, 2014).[1]

---

[1]In fact, Summers was not the first to detect a secular stagnation. This name goes back to the 1930s, where Hansen (1939) first developed this theory in a presumably similar situation.

The secular stagnation hypothesis focuses on the real interest rate and its equilibrium value. Under normal circumstances, both should be equalized at the point where aggregate investments equal aggregate savings. However, in a crisis period, and even afterwards, this may no longer be the case. The reason for this is quite simple. While the equilibrium real rate freely floats, the actual real rate faces a lower bound. The latter is due on the one hand to the zero lower bound on nominal interest rates, because individuals can hold excess savings in cash rather than at their bank accounts, thus generating a nominal interest rate of zero. On the other hand, inflation rates or, more precisely, inflation expectations are too low to generate significantly negative real rates. For example, in the Euro Area, inflation expectations are mainly anchored at about two percent, being the inflation target of the ECB.[2]

- Figure 1 about here -

However, if the equilibrium real interest rate falls below the lower bound of the actual real rate of about minus two percent, as in the case of the Euro Area, there is no longer an equilibrium of aggregate investments and savings (Figure 1). Instead, excess savings occur, depressing output or, more precisely, potential output permanently. In other words, even more negative real interest rates are needed to equate savings and investments (Teulings and Baldwin, 2014).

The secular stagnation hypothesis assumes that with the financial crisis either aggregate investments have fallen or aggregate savings have risen to levels which imply an equilibrium interest rate too low for the real rate to reach. Several determining factors for this have been identified.

Firstly, a high degree of private and public debt depresses investment even at low rates because individuals and fiscal authorities need to consolidate. Moreover,

---

[2]This being said, one way to significantly lower the actual real rates is to increase the inflation target. For example Blanchard et al. (2010) proposed increasing the target to about four percent. But no central bank, i.e. not the ECB, has followed such an approach up to now.

savings are increased in order to reduce the level of debt. However, supporters of the secular stagnation hypothesis see the key to breaking the vicious circle of permanently lower growth rates in reducing the pressure to consolidate. They tend to propose consolidation to a lesser extent and instead to go for public investment (Summers, 2014a; Krugman, 2014 and Koo, 2014).

Secondly, a high degree of regulation in product markets may cause investments to be permanently depressed. However, these regulations can also be changed by the political parties. This can have a large effect especially in the Euro Area (Jimeno et al., 2014 and Barnes et al., 2013). The same holds with respect to labor market reforms, which tend to increase employment. Moreover, long-term unemployment leads to skill atrophy (Eurosclerosis, Blanchard and Summers, 1986), thus permanently lowering the potential rate of employment[3] and potential growth (hysteresis).

Thirdly, rising income inequality permanently increases savings, as individuals with high incomes have a higher marginal rate of saving (Summers, 2014b). This in turn tends to lower the equilibrium real rate, all else being equal.

Fourthly, we observe a fall in investment prices, leading by construction to a downward shift in the investment curve (Summers, 2014b or Glaeser, 2014). These lower investment prices are simply due to the altered structure of investment goods. In a nutshell, investments in IT-technologies such as social networks, for example, are not as expensive as investments in industrial machinery.

Fifthly, demographics are a crucial determinant, influencing both aggregate savings and investments. On the one hand, savings change according to the life-cycle hypothesis, which proposes that savings are highest in economies with a relatively large proportion of the population being close to retirement. Moreover, savings may rise with increasing life expectancy and uncertainty about future pension payments, irrespectively of the life-cycle (Jimeno et al., 2014). On the other hand, investments

---

[3]In the current context see Draghi (2014), who explicitly mentions hysteresis in unemployment when discussing the necessity of a "two-handed" approach, consisting of structural reforms and expansionary macro policies.

fall in aging economies because revenue expectations drop when the population is about to shrink (Gros, 2014). According to Krugman (2014), this problem is especially severe in Euro Area countries.

Finally, a low degree of innovation, measured as increases in total factor productivity, is observed in several industrial economies. If this is the case, investments should also be low because new machinery does not generate a significant benefit in comparison with older equipement. Gordon (2014), however, believes that low total factor productivity is the new normal rather than a temporary exception. This is why growth rates are supposed to be lower. However, forecasting total factor productivity is a difficult task. Mokyr (2014) and Glaeser (2014), for example, argue that some innovations still have the potential to boost total factor productivity, such as information technology, biotechnology or new materials.

But whether one or several of the factors are indeed able to lower the equilibrium real interest rate to levels too low for the actual real rate to reach is mainly an empirical question. For this purpose, we employ the model most widely used in estimating the equilibrium real rate, that is the Laubach-Williams model.

3 The Laubach-Williams Model

The equilibrium real interest rate is an unobservable variable. Thus, it has to be estimated. Laubach and Williams (2003) established an estimation method for this variable which employs a state-space approach. It still is the most important model in the context of equilibrium real interest rate determination. Besides the unobservable equilibrium real interest rate, the unobservable potential output is also estimated in this procedure. The method is frequently used to estimate the equilibrium real interest rate.[4] Also for the Euro Area Mesonnier and Renne (2007),

---

[4]See e.g. Trehan and Wu (2004), Clark and Kozicki (2005), Kiley (2015) or Laubach and Williams (2015) for the US. Holston et al. (2016) estimate the model for the US, Canada, the UK and the Euro Area.

Garnier and Wilhelmsen (2009), Belke and Klose (2013), Beyer and Wieland (2015) and Holston et al. (2016) used the model to find a measure of the equilibrium real interest rate. But to the best of our knowledge, up to now no one has employed this model for the various Euro Area countries to account for possible heterogeneity in the monetary union. In the following we will try to fill this gap.

Our model consists of two signal equations and three state equations. All variables are measured as quarterly growth rates. The signal equation (1) is an IS-curve measuring the effect of the first two lags of the real interest rate gap $(r - r^*)$ on the output gap $(Y - \bar{Y})$. Additionally, two lags of the output gap are added to the equation. Equation (2) is the second signal equation, which measures a Phillips curve estimating the influence of the output gap on prices (π). Moreover, the prices are supposed to vary with lagged energy prices (π^o) since those are a crucial input factor in the production process.[5] Again, lagged values of the dependent variable are added. In this case, and strongly in line with Laubach and Williams (2003), we add eight lags assuming the second to fourth and fifth to eighth lags to have the same influence. Moreover, the coefficients of the lagged inflation rates are restricted to unity, in line with the seminal paper.

$$
\begin{aligned}
Y_t - \bar{Y}_t =& \alpha_{y,1}(Y_{t-1} - \bar{Y}_{t-1}) + \alpha_{y,2}(Y_{t-2} - \bar{Y}_{t-2}) \\
& + \alpha_r[(r_{t-1} - r^*_{t-1}) + (r_{t-2} - r^*_{t-2}) + \epsilon_{1,t}
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
\pi_t =& \beta_{\pi,1}\pi_{t-1} + \frac{\beta_{\pi,2}}{3}(\pi_{t-2} + \pi_{t-3} + \pi_{t-4}) + \frac{1 - \beta_{\pi,1} - \beta_{\pi,2}}{4}(\pi_{t-5} + \pi_{t-6} + \pi_{t-7} + \pi_{t-8}) \\
& + \beta_y(Y_{t-1} - \bar{Y}_{t-1}) + \beta_o(\pi^o_{t-1} - \pi_{t-1}) + \epsilon_{2,t}
\end{aligned}
\tag{2}
$$

---

[5]Laubach and Williams (2003) also use import prices as a variable in the Phillips curve. We are unable to proceed in that manner here because import price data for most of the Euro Area countries under study are not available from 1970 onwards. This would have shortened our sample period considerably, leading to imprecise estimates owing to low degrees of freedom. Garnier and Wilhelmsen (2009) face the same problem when estimating the model for the Euro Area. Moreover, Laubach and Williams (2003) added hours worked to their Phillips curve as a robustness check. We also refrain from adding this specification because of data availability and are thus again in line with Garnier and Wilhelmsen (2009).

$$\bar{Y}_t = \bar{Y}_{t-1} + g_{t-1} + \epsilon_{3,t} \tag{3}$$

$$g_t = g_{t-1} + \epsilon_{4,t} \tag{4}$$

$$z_t = z_{t-1} + \epsilon_{5,t} \tag{5}$$

$$r_t = i_t - \pi_{t-1} \tag{6}$$

$$r_t^* = cg_t + z_t \tag{7}$$

The state equations model the time-series generating process of the two unobservable variables, potential output and equilibrium real interest rate. The potential output $\bar{Y}$ is a function of its lagged own value and its unobservable growth rate g (Equation (3)). The growth rate of the potential output is in itself a state variable following a random walk (Equation (4)) as well as the last state variable z (Equation (5)), measuring additional determinants of the equilibrium real rate, such as the time preference of households. The last two equations, (6) and (7), show how the real rate and its equilibrium value are built. In order to save degrees of freedom, the inflation expectations in the real rate are modelled simply by the using adaptive expectations, thus being the lagged inflation rate. The equilibrium real rate is generated in line with Laubach and Williams (2003), representing the sum of trend growth and any additional factors. These additional factors are restricted to having an influence of unity on the equilibrium real rate.

However, Laubach and Williams (2013) point out that the error terms in the state equations (4) and (5) are biased towards zero if the model is estimated in one

step. This is due to the so-called pile-up-problem (Stock, 1994).[6] They therefore recommend estimating the model in sequential steps and computing the median unbiased estimator (Stock and Watson, 1998) to solve this problem. We follow this procedure strictly, estimating the model in four steps.

Firstly, both signal equations are estimated separately via OLS to generate reliable starting values. Potential output is proxied by the HP-filter of Y (Hodrick and Prescott, 1997). In the IS-equation the real interest rate gap is omitted at this stage.

Secondly, the signal equations are estimated with the Kalman filter, assuming the growth rate of potential output is constant. With these results we are able to compute the median unbiased estimator $\lambda_g = \frac{\sigma_4}{\sigma_3}$.

This relationship is used in the third step as a starting point. There we also add the real interest rate gap to the IS-equation and model the growth rate of potential output as a time-varying variable. Based on these results, we compute the median unbiased estimator for the additional variables affecting the equilibrium real interest rate as $\lambda_z = \frac{\sigma_5}{\sigma_1} \cdot \frac{\alpha_r}{\sqrt{2}}$.

In the fourth and final step we estimate the whole model via maximum likelihood, using the two signal-to-noise ratios.

4   The data issue

We estimate the model with respect to twelve Euro Area countries, i.e. the eleven founding members of the Euro Area,[7] and Greece, which was the first country to join the monetary union in 2001. For the remaining seven current Euro Area member countries we were unable to find time series for all variables that dated long enough

---

[6]The pile-up-problem emerges when pure maximum likelihood methods tend to estimate the standard deviations equal to zero. Given that this is very likely to be the case in our random-walk equations (4) and (5), we have to correct for this.

[7]Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain.

into the past to give us reliable estimates. For some of our twelve countries in the sample we obtained quarterly data dating back to 1970. However, this applies only to Finland, France, Germany, Italy, Luxembourg, Netherlands and Portugal, while the sample period begins for Belgium in 1975Q3, for Ireland in 1976, for Spain in 1977, for Austria in 1980 and for Greece in 1989. All sample periods proved to be long enough to generate reliable results. The end of the sample period is 2015Q4 for all countries under investigation, owing to data availability.

For each of these countries we have collected the data on real GDP, consumer prices, energy prices and interest rates. All data is seasonally adjusted and taken from the OECD database. As the relevant interest rate we use the three-month interbank rate in line with studies in this field. Since the countries in question have not had their own interbank rates since the Euro Area was established, we added the data of the three month EURIBOR for all dates where each respective country was a member of the monetary union, that is, from 1999 for the eleven founding members and from 2001 for Greece.

The interpretation of our results is based on a comparison of the estimated equilibrium real rate and the observed real rate. For this purpose, we make use of two concepts in measuring the latter: ex-ante and ex-post real rates. The former represents the nominal interest rate minus the expected inflation, which in our case are adaptive expectations and thus lagged inflation rates ($r_t = i_t - \pi_{t-1}$), while the latter is formulated as the interest rate minus the observed inflation rate until maturity ($r_t = i_t - \pi_t$).[8] Even though the real interest rates differ depending on the concept used, this will have only a minor influence on the results, i.e. whether secular stagnation may be a relevant problem in a Euro Area member country or not.

---

[8]See also Hamilton et al. (2015) on this issue.

5 Results

In this section we present the estimation results of our model for the equilibrium real interest rate[9] and compare these to the observed real interest rates. We have restricted the two coefficients α_r and c to lying in the range of -0.3 to 0 and 0.5 to 1.5, respectively. With this restrictions we are well in line with the findings of previous studies where all estimated coefficient parameters fall within these margins.

- Table 1 about here -

Our results (Table 1) indicate that these restrictions are generally valid, since none of the estimated coefficients hits the boundary set by us. However, especially with respect to α_r, the influence of the real interest rate gap on output, we are unable to find significantly parameter estimates. But note that other studies (Mesonnier and Renne, 2007 and Garnier and Wilhelmsen, 2009) face similar problems when estimating the model. Only for Italy and Luxembourg do we indeed find a significantly negative coefficient. But the point estimates, with about -0.15 in most of the cases, are very stable over the various countries. With respect to the parameter c, the influence of potential growth on the equilibrium real rate, we find at least some significance for four countries. Moreover, the point estimates vary widely, with a range of 0.5 to 1.46. Our median unbiased estimators λ_g and λ_z are generally in line with estimates for other countries in previous studies. This holds for the remaining parameter estimates and variances as well. Thus, we feel legitimized in concluding at this stage that the parameter estimates are generally comparable to other studies. We can therefore proceed to our estimates of the unobserved variables.

As in Laubach and Williams (2003), we will present the results for the unobserved variables using a one-sided (predicted) measure and a two-sided (smoothed) version. One-sided estimates make use only of the data prior to the respective point

---

[9]Only the final estimates of the fourth step are presented here. The results for the previous steps are available from the authors upon request.

in time, while the two-sided version uses data from the whole sample period. Although the estimated time series differ depending on which method is used, the policy implications remain the same for both indicators. We proceed by showing the results separately for the unobserved state variables, starting with the potential output/output gap, before turning to the ex-ante and ex-post equilibrium real interest rates.

5.1   Output gap

Our estimates of the output gaps, starting for most countries in the 1970s, are given in Figure 2. We do not wish to comment too much on the results gained for the whole sample period. Instead, we restrict our analysis to the recent financial crisis period beginning in 2008/09. Note, moreover, that the results do not depend on whether a one-sided or two-sided approach is chosen, but that our estimation results are rather robust across specifications.

- Figure 2 about here -

As becomes obvious, several countries produced above potential before 2008, so the output gap was positive. These countries comprised Spain and Ireland, which would later on become crisis countries, but also Luxembourg and the Netherlands. However, with the financial crisis unfolding its full strength in 2009, all output gaps turn negative. Moreover, all countries exhibit a rebound in their output gap in 2010. But during the European debt crisis we see a more heterogeneous evolution of the output gap in the countries under investigation. While the Greek output gap in particular remains negative until the end of the sample, this holds for other crisis countries to a lesser extent. What is more, in some other crisis countries there seems to be a turnaround in 2012/13, so output gaps start rising again, being now even positive, as in the case of Ireland and Spain. Besides Greece, at the end of the sample period only Finland shows a substantially negative output gap, while

14

for most of the other countries the output gap seems to be closed. On the other hand, Spain, Ireland, Luxembourg and Germany tend to reveal the highest positive output gaps by the end of 2015.

5.2   Ex-ante real interest rates

We now turn to a comparison of the ex-ante real interest rate and its equilibrium value. Figure 3 shows the one-sided estimates. Even though the results for some countries may differ, we try to extract the main similarities across countries. First of all, ex-ante real interest rates were much higher in the last century, especially in the 1980s, and declined for most countries from the mid-1990s.

- Figure 3 about here -

Secondly, in the wake of the financial crisis of 2008/09, real interest rates became negative for all countries, at least in some quarters. The lowest real interest rate was about -2 percent which may be considered as the empirical lower bound as indicated in Section 2.[10] However, negative real rates are far from being rare in the history of the Euro Area countries. In the 1970s in particular we frequently observe negative real interest rates in all countries where we have data for this longer sample period.

This overall trend of low rates in the 1970s, higher rates in the 1980s and early 1990s and afterwards declining rates, is also mirrored by our estimates of the equilibrium real rates. With these findings we are in line, for example, with those of Laubach and Williams (2003) for the US and Mesonnier and Renne (2007) for the Euro Area. This being said, it is clear that the real rates and their equilibrium values do not differ very much. Apart from some countries in some periods (e.g. Belgium, Finland and Luxembourg in the 1980s or Italy in the 1970s), the observed real rates are mainly found to lie within the one standard deviation band of the equilibrium

---

[10]Note again that this empirical lower bound is consistent with a zero nominal interest rate and an inflation rate of about 2 percent, as in the case of the ECBs inflation target.

real interest rate.[11] This holds especially since the financial crisis period began. We observe in most countries that the real rates and the equilibrium values fell in this period further, although the reduction in the former was even more pronounced. This does not come as a surprise, since the real rates are by definition more volatile than their equilibrium (or structural) counterparts. At the end of the sample, the equilibrium real interest rate is estimated to be slightly above zero for most countries. So there is, in our view, no indication that interest rates cannot fall as low as the equilibrium value, as the secular stagnation hypothesis would suggest. In addition, for most countries real rates seem to be lower than the equilibrium values, reinforcing our conclusion that a phenomenon such as secular stagnation is absent for most Euro Area countries.

There is one exception, however: that of Greece. For this country, we indeed observe a real rate which is substantially higher than the equilibrium value. Moreover, the value of the equilibrium rate is estimated to be around an exceptional value of -10 percent. Real rates can clearly not reach these low levels under the circumstances in Greece: a European monetary policy with already zero interest rates and a price environment characterized by deflation rather than inflation owing to falling personal incomes. So we have to conclude that Greece may indeed face some kind of secular stagnation, even though we also estimate that the equilibrium rate has been rising since 2013 but still remains negative.

When we estimate the model and smooth the results via a two-sided filter, the results do not change significantly (Figure 4). The only difference is that estimates of the equilibrium real rate are less volatile, which is exactly what we expect when smoothing the time series.

- Figure 4 about here -

---

[11]Note, however, that this band is quite large for several countries, implying a large dispersion. But the finding is in line with other studies in this field so far (see e.g. Mesonnier and Renne, 2007; Garnier and Wilhelmsen, 2009 or Beyer and Wieland, 2015).

Hence, our conclusion remains valid, i.e. that secular stagnation is, with the exception of Greece, no problem for the remaining Euro Area countries because the real rates are in fact even (significantly) lower than the equlibrium real interest rates.

5.3   Ex-post real interest rates

When we employ ex-post realized real interest rates instead of ex-ante rates, the estimates for the equilibrium rates are almost unchanged. More precisely, they are only shifted backwards by four quarters, but the estimates themselves remain the same (see Figure 5 for the one-sided time-series, Figure 6 for the two-sided estimates). However, the empirical realizations of the real interest rates might be different. While we observe that the values are indeed altered as compared to the ex-ante data, the overall results remain robust. We still observe the three phases of real interest rate development over time, namely, low and negative rates in the 1970s, high and positive rates in the 1980s and early 1990s, and declining rates thereafter, leading to values of below zero in the recent crisis period. This being said, our main conclusion remains unchanged in comparison to those derived in the previous subsection. There is no evidence of secular stagnation for any of the Euro Area countries under investigation with the exception of Greece.

- Figures 5 and 6 about here -

6   Conclusions

In this paper we have tried to answer the question of whether Euro Area countries have been facing symptoms of secular stagnation since the beginning of the financial crisis in 2008/09 - a period of persistently lower growth. Based on our analysis of the difference between the real interest rate and its equilibrium value, we arrive at a surprisingly clear answer: most Euro Area member countries do not face such

a phenomenon. This is the case even though the equilibrium real rates have been falling since the mid-1990s, turning even as low as about minus two percent in the wake of the crisis. This is because the actual real rate, in principle, can also, and de facto has reached these low levels. So there is no reason to fear that "excess savings" may occur, because aggregate investments and savings cannot be equalized through the real interest rate.

But there is one exception to this. For Greece, we indeed find equilibrium real rates of about minus ten percent, which are clearly too low to be reached through the actual real interest rate. Greece may therefore face secular stagnation. What can be done about this? A European-wide policy, for example via a monetary stimulus, is clearly not appropriate in adressing a specific problem that only one member country faces. So a national effort should be made to get rid of this problem.

Key to this are the determinants which may cause secular stagnation. At least two of these can be directly influenced by national governments: restrained fiscal policies and a lack of international competitiveness due to a lack of internal deval-uation and excessive regulation. However, in the case of Greece there is no leeway to expand public debt even further because nominal (external) debt is already high (Belke et al., 2014). Investors would be deterred even more from investing in the country because they anticipate future bail-ins or bail-outs. So, Greece should clearly focus on the second determinant and take care that reforms are implemented on the ground which stifle export growth again.

References

[1] Barnes, S., Bouis, R., Briard, P., Dougherty, S. and Eris, M. (2013): The GDP Impact of Reforms - A Simple Simulation Framework, OECD Economics Department Working Papers, No. 834.

[2] Belke, A. and Klose, J. (2013): Modifying Taylor-Reaction Functions in the Presence of the Zero-Lower-Bound - Evidence for the ECB and the Fed, Economic Modelling, Vol. 35, pp. 515-527.

[3] Belke, A., Gros, D., Alcidi, C., Coutinho, L. and Giovannini, A. (2014): State-of-Play in Implementing Macroeconomic Adjustment Programmes in the Euro Area, Policy Note, Directorate General for Internal Policies, Economic Governance Support Unit, European Parliament, Brussels, February, und Economic Policy, CEPS Paperbacks, Centre for European Policy Studies, Brussels, March.

[4] Beyer, R.C.M. and Wieland, V. (2015): Schätzung des mittelfristigen Gleichgewichtszinses in den Vereinigten Staaten, Deutschland und dem Euro-Raum mit der Laubach-Williams-Methode, SVR-Working Paper No. 03/2015.

[5] Blanchard, O., Dell'Ariccia G. and Mauro, P. (2010): Rethinking Macroeconomic Policy, IMF Staff Position Note 10/03.

[6] Blanchard, O. and Summers, L. (1986): Hysteresis and the European Unemployment Problem, in NBER Macroeconomics Annual, Vol. 1, pp. 15-78.

[7] Clark, T.E. and Kozicki, S. (2005): Estimating Equilibrium Real Interest Rates in Real Time, The North American Journal of Economics and Finance, Vol. 16(3), pp. 395-413.

[8] Draghi, M. (2014): Unemployment in the Euro Area, Speech at the Annual Central Bank Symposium in Jackson Hole, 22. August 2014.

[9] Garnier, J. and Wilhelmsen, B.J. (2009): The Natural Rate of Interest and the Output Gap in the Euro Area: A Joint Estimation, Empirical Economics, Vol. 36, pp. 297-319.

[10] Glaeser, E. (2014): Secular Joblessness, in "Secular Stagnation: Facts, Causes and Cures", VoxEU, pp. 69-82.

[11] Gordon, R. (2014): The Turtle's Progress: Secular Stagnation Meets the Headwinds, in "Secular Stagnation: Facts, Causes and Cures", VoxEU, pp. 47-60.

[12] Gros, D. (2014): Investment as the Key to Recovery in the Euro Area, CEPS Policy Briefs, 18. November 2014, Brussels.

[13] Hamilton, J.D., Harris, E.S., Hatzius, J. and West, K.D. (2015): The Equilibrium Real Funds Rate: Past, Present and Future, NBER Working Paper, No. 21476.

[14] Hansen, A. (1939): Economic Progress and Declining Population Growth, American Economic Review, Vol. 29(1), pp. 1-15.

[15] Hodrick, R. and Prescott, E. (1997): Post-War Business Cycles: An Empirical Investigation, Journal of Money, Credit and Banking, Vol. 29 , pp. 1-16.

[16] Holston, K., Laubach, T. and Williams J.C. (2015): Measuring the Natural Rate of Interest: International Trends and Determinants, FRBSF Working Paper, 2016-11.

[17] Jimeno, J., Smets, F. and Yiangou, J. (2014): Secular Stagnation: A view from the Eurozone, in "Secular Stagnation: Facts, Causes and Cures", VoxEU, pp. 153-164.

[18] Kiley, M.T. (2015): What Can the Data Tell Us About the Equilibrium Real Interest Rate?, Finance and Economics Discussion Series 2015-077, Board of Governors of the Federal Reserve System.

[19] Koo, R. (2014): Balance Sheet Recession is the Reason for Secular Stagnation, in "Secular Stagnation: Facts, Causes and Cures", VoxEU, pp. 131-142.

[20] Krugman, P. (2014): Four Observations on Secular Stagnation, in "Secular Stagnation: Facts, Causes and Cures", VoxEU, pp. 61-68.

[21] Laubach, T. and Williams J.C. (2003): Measuring the Natural Rate of Interest, The Review of Economics and Statistics, Vol. 85(4), pp. 1063-1070.

[22] Laubach, T. and Williams J.C. (2015): Measuring the Natural Rate of Interest Redux, FRBSF Working Paper, 2015-16.

[23] Mesonnier, J.S. and Renne, J.P. (2007): A Time-Varying "Natural" Rate of Interest for the Euro Area, European Economic Review, Vol. 51, pp. 1768-1784.

[24] Mokyr, J. (2014): Secular Stagnation? Not in your life, in "Secular Stagnation: Facts, Causes and Cures", VoxEU, pp. 83-90.

[25] Stock, J. (1994): Unit Roots, Structural Breaks and Trends, in Engle, R. and McFadden, D., Handbook of Econometrics, Vol. 4, pp. 2739-2841, Amsterdam.

[26] Stock, J. and Watson, M. (1998): Median Unbiased Estimator of Coefficient Variance in a Time-Varying Parameter Model, Journal of the American Statistical Association, Vol. 93, pp. 349-358.

[27] Summers, L. (2014a): U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound, Business Economics, Vol 49(2), pp. 65-73.

[28] Summers, L. (2014b): Reflections on the "New Secular Stagnation Hypothesis", in "Secular Stagnation: Facts, Causes and Cures", VoxEU, pp. 27-38.

[29] Summers, L. (2014c): Low Equilibrium Real Rates, Financial Crisis and Secular Stagnation, in "Across the Great Divide: New Perspectives on the Financial Crisis", pp. 37-50.

[30] Trehan, B. and Wu, T. (2004): Time Varying Equilibrium Real Rates and Monetary Policy Analysis, FRBSF Working Paper, 2004-10.

[31] Teulings, C. and Baldwin, R. (2014): Secular Stagnation: Facts, Causes and Cures, VoxEU.

Table

Table 1: Parameter estimates

	AT	BE	DE	FI	FR	GR	IR	IT	LU	NL	PT	SP
IS − curve												
$\alpha_{y,1}$	1.22***	1.37***	1.70***	1.73***	1.68***	0.16	0.44**	1.40***	0.89	1.47***	1.40***	1.83***
	(0.14)	(0.24)	(0.11)	(0.13)	(0.10)	(0.11)	(0.22)	(0.08)	(0.81)	(0.09)	(0.16)	(0.15)
$\alpha_{y,2}$	-0.47***	-0.42*	-0.75***	-0.76***	-0.72***	0.73***	0.38**	-0.58***	0.20	-0.47***	0.32*	-0.83***
	(0.15)	(0.24)	(0.10)	(0.11)	(0.10)	(0.10)	(0.19)	(0.09)	(0.92)	(0.07)	(0.16)	(0.12)
α_r	-0.15	-0.15	-0.15	-0.16	-0.16	-0.15	-0.15	-0.16***	-0.06***	-0.15	-0.15	-0.15
	(0.15)	(0.13)	(0.18)	(0.14)	(0.15)	(0.12)	(0.15)	(0.02)	(0.01)	(0.11)	(0.17)	(0.16)
c	1.07	0.62	0.76	0.50	0.82	1.37***	1.46***	0.69**	0.51***	1.28	0.50	0.81
	(1.14)	(1.32)	(1.35)	(1.07)	(1.24)	(0.20)	(0.21)	(0.23)	(0.07)	(1.06)	(1.02)	(1.12)
Phillips − curve												
$\beta_{\pi,1}$	-0.03	0.48***	0.40***	0.62***	0.68***	0.32**	0.35***	0.06	0.76***	0.38***	-0.47*	0.36***
	(0.17)	(0.11)	(0.08)	(0.07)	(0.08)	(0.14)	(0.07)	(0.09)	(0.00)	(0.08)	(0.24))	(0.11)
$\beta_{\pi,2}$	0.27*	0.31***	0.41***	0.25**	0.16*	0.34**	0.53***	0.10	-0.79***	0.58***	0.90***	0.32**
	(0.14)	(0.11)	(0.11)	(0.11)	(0.09)	(0.17)	(0.13)	(0.06)	(0.00)	(0.13)	(0.12)	(0.15)
$1 - \beta_{\pi,1} - \beta_{\pi,2}$	0.76	0.21	0.19	0.13	0.16	0.34	0.12	0.84	1.03	0.04	0.57	0.32
β_y	0.46***	0.02	0.03	0.00	0.03*	0.10*	-0.07	-0.60***	0.18***	0.00	-0.19	-0.00
	(0.18)	(0.02)	(0.02)	(0.01)	(0.02)	(0.05)	(0.04)	(0.13)	(0.00)	(0.02)	(0.24)	(0.00)
β_o	-0.20	-0.15	-0.14	-0.30**	-0.29***	-0.95***	0.72	-0.04***	1.47***	-0.41*	-0.00	-0.26
	(0.13)	(0.12)	(0.13)	(0.11)	(0.07)	(0.31)	(0.54)	(0.01)	(0.00)	(0.23)	(0.03)	(0.24)
Variance												
σ_1	0.0731	0.2207	0.0612	0.1288	0.0534	0.0039	0.8433	0.1166	0.8987	0.0000	0.0044	0.0000
σ_2	0.0699	0.1668	0.1190	0.1507	0.1400	0.2696	0.6036	0.2023	0.0028	0.1274	0.0000	0.2094
σ_3	0.3997	0.1536	0.6665	0.9408	0.1085	1.1946	0.5164	0.3187	0.0038	1.2125	1.4487	0.3797
σ_4	0.0011	0.0005	0.0012	0.0011	0.0002	0.0096	0.0016	0.0059	0.0000	0.0004	0.0016	0.0060
σ_5	0.0000	0.0010	0.0003	0.1485	0.0006	0.0000	0.0004	0.0000	0.0000	0.0000	0.1154	0.0000
λ_g	0.0531	0.0594	0.0431	0.0335	0.0431	0.0894	0.0548	0.1357	0.0232	0.0184	0.0333	0.1262
λ_z	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0060	0.0001	0.1244	0.0001
log −likelihood	-191.08	-227.89	-291.43	-268.35	-184.87	-235.89	-441.13	-339.13	-629.29	-334.16	-635.17	-244.60

Notes: ML-estimation; AT=Austria, BE=Belgium, DE=Germany, FI=Finland, FR=France, GR=Greece, IR=Ireland, IT=Italy, LU=Luxembourg, NL=Netherlands, PT=Portugal, SP=Spain; standard errors in parenthesis; ***/**/* means significance at the 1%/5%/10% level.
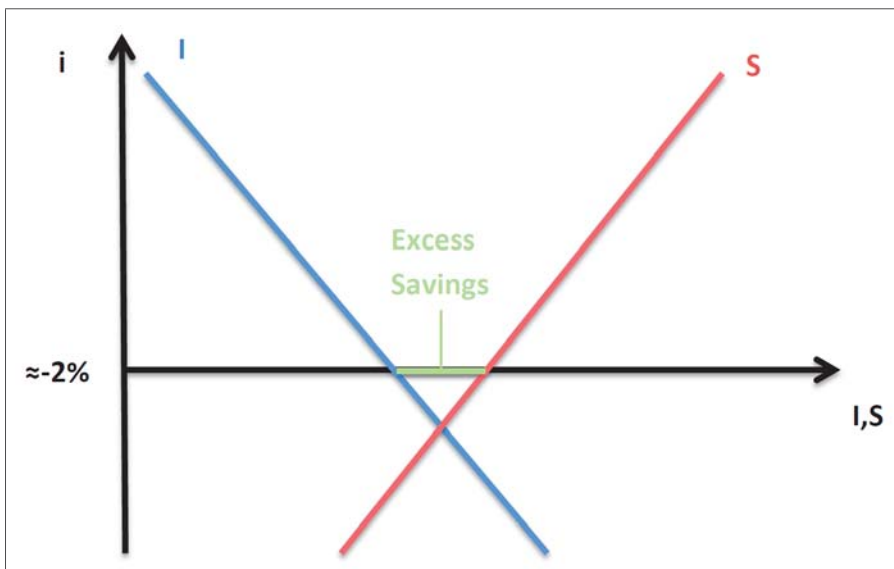
Figures

Figure 1: Real interest rates and secular stagnation; *Notes*: i=real interest rate, I=aggregate investments, S=aggregate savings, approximately -2 percent as intercept is chosen because the minimum should be given at a zero nominal rate minus the ECB inflation target of about two percent.
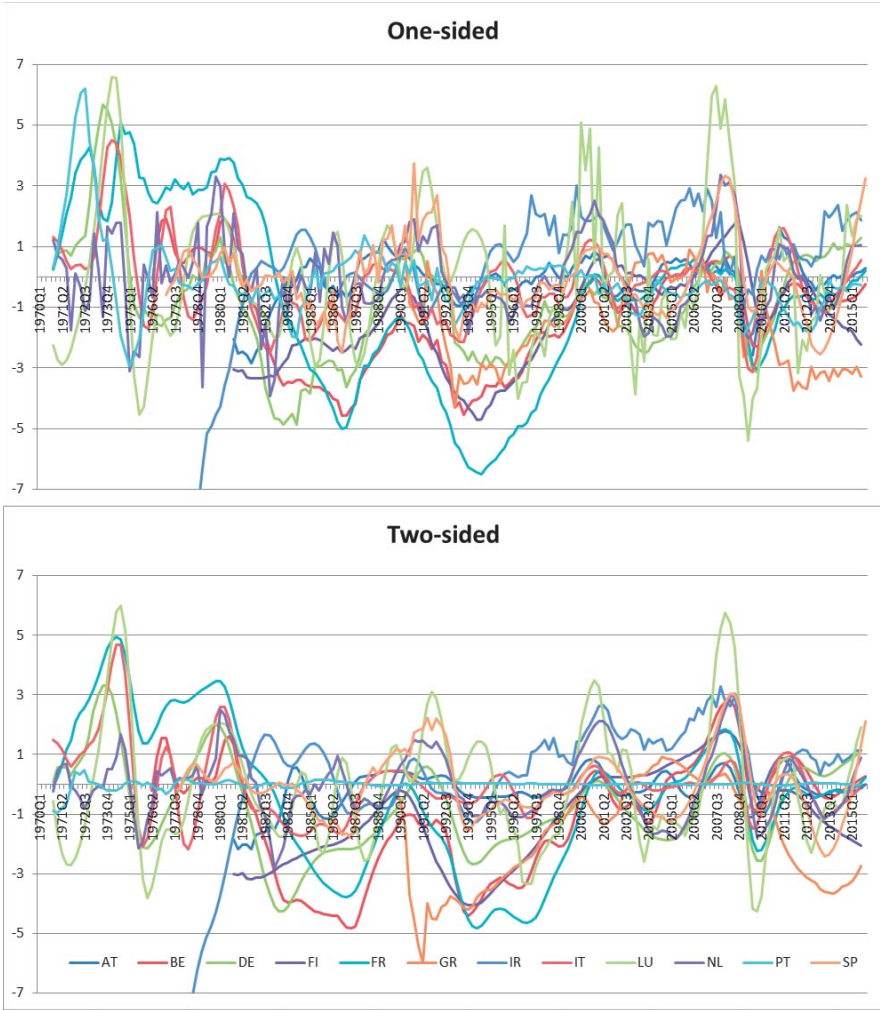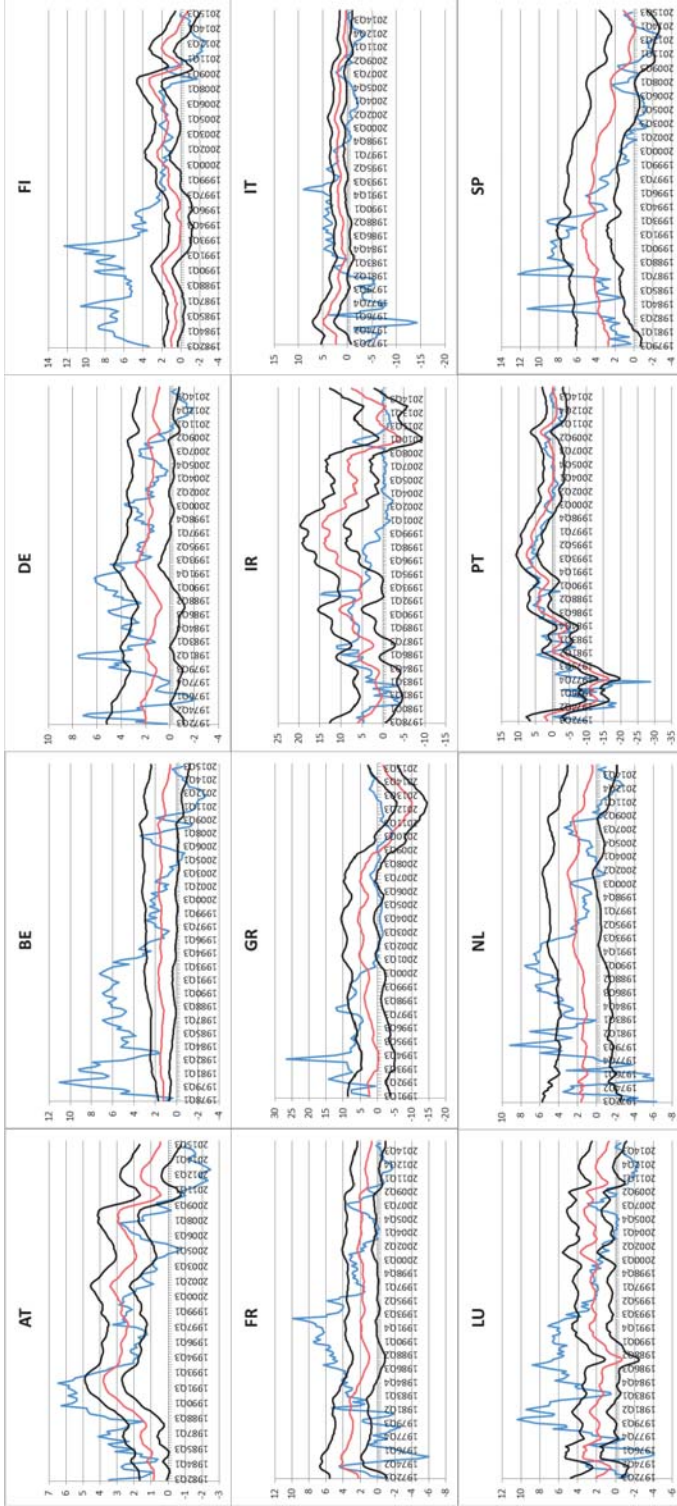
Figure 2: One- and two-sided output gap estimates; *Notes*: One-sided=predicted estimates, two-sided=smoothed estimates; AT=Austria, BE=Belgium, DE=Germany, FI=Finland, FR=France, GR=Greece, IR=Ireland, IT=Italy, LU=Luxembourg, NL=Netherlands, PT=Portugal, SP=Spain.
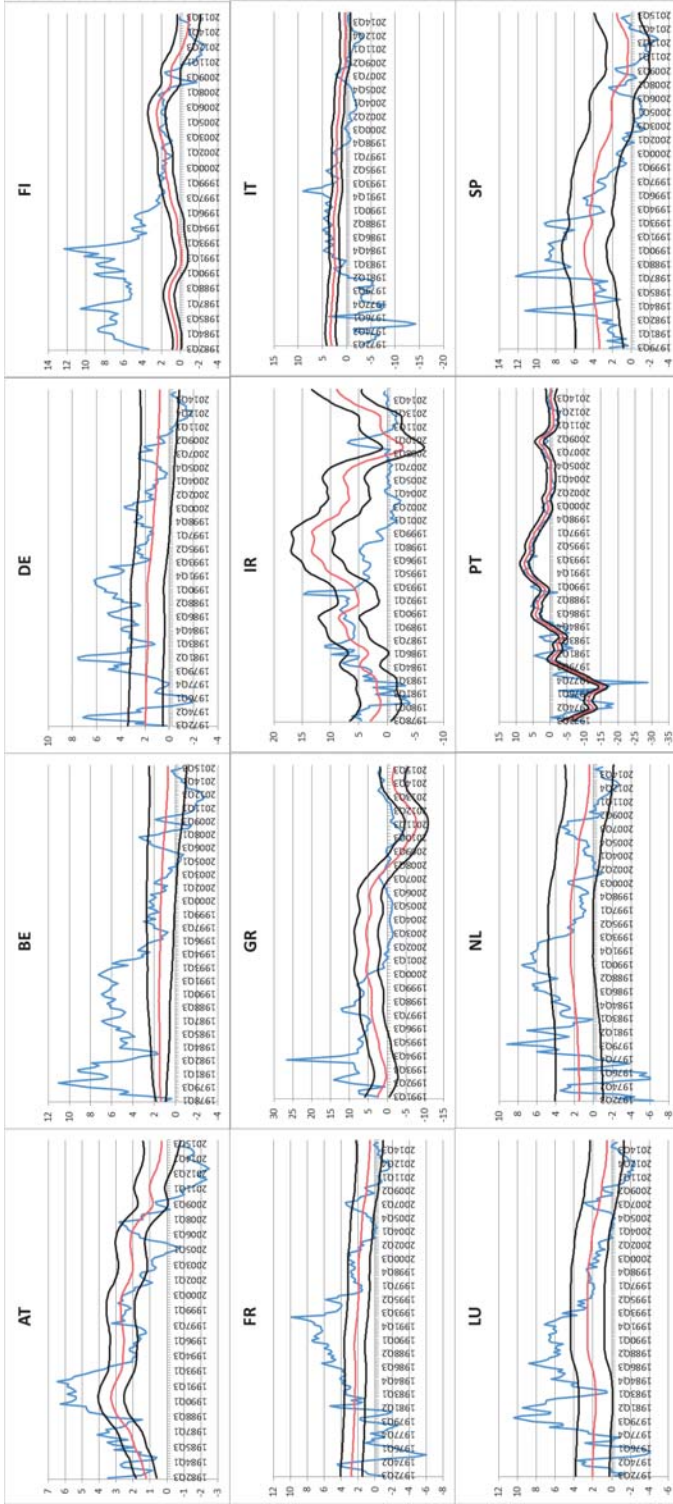
Figure 3: Ex-ante real rates and one-sided equilibrium estimates; *Notes*: Blue line=real rate, red line=equilibrium real rate, black lines=+/- one standard deviation equilibrium real rate; AT=Austria, BE=Belgium, DE=Germany, FI=Finland, FR=France, GR=Greece, IR=Ireland, IT=Italy, LU=Luxembourg, NL=Netherlands, PT=Portugal, SP=Spain.

Figure 4: Ex-ante real rates and two-sided equilibrium estimates; *Notes*: Blue line=real rate, red line=equilibrium real rate, black lines=+/- one standard deviation equlibrium real rate; AT=Austria, BE=Belgium, DE=Germany, FI=Finland, FR=France, GR=Greece, IR=Ireland, IT=Italy, LU=Luxembourg, NL=Netherlands, PT=Portugal, SP=Spain.
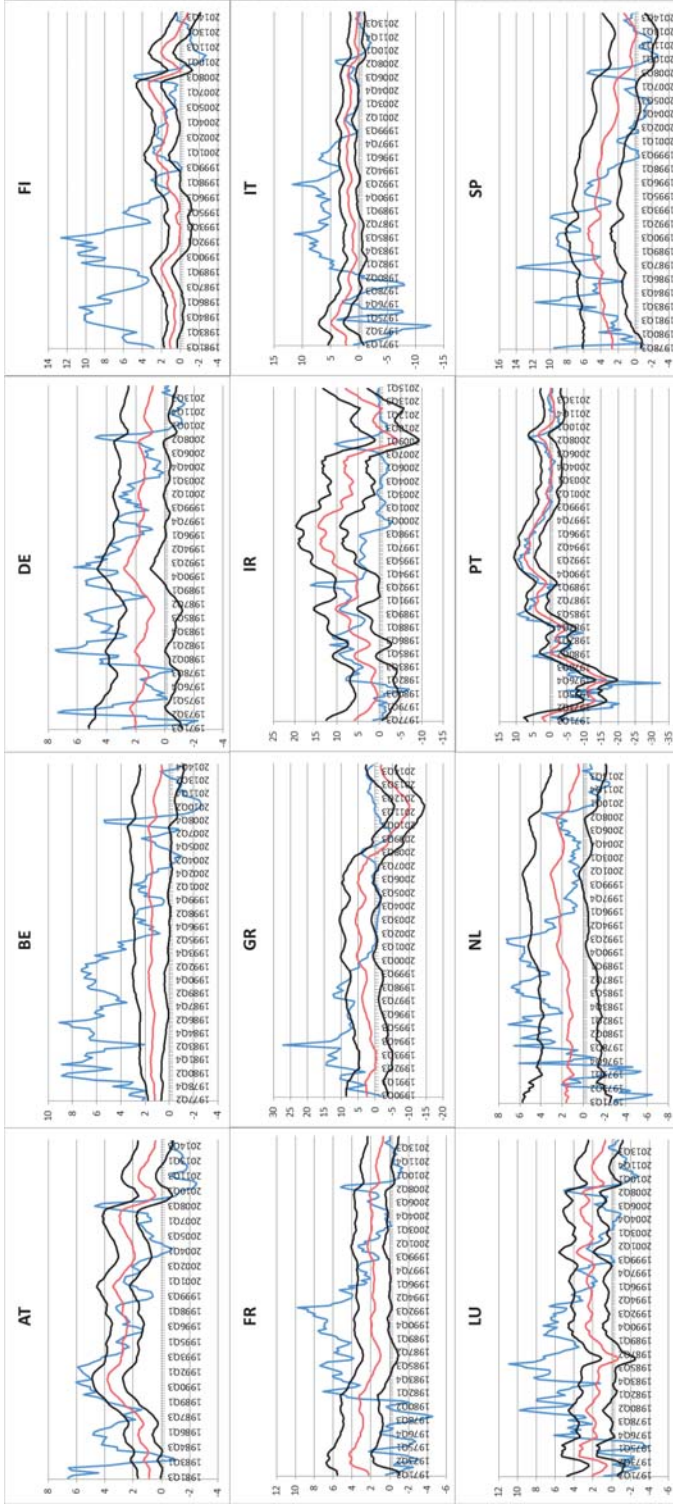
Figure 5: Ex-post real rates and one-sided equilibrium estimates; *Notes*: Blue line=real rate, red line=equilibrium real rate, black lines=+/- one standard deviation equilibrium real rate; AT=Austria, BE=Belgium, DE=Germany, FI=Finland, FR=France, GR=Greece, IR=Ireland, IT=Italy, LU=Luxembourg, NL=Netherlands, PT=Portugal, SP=Spain.
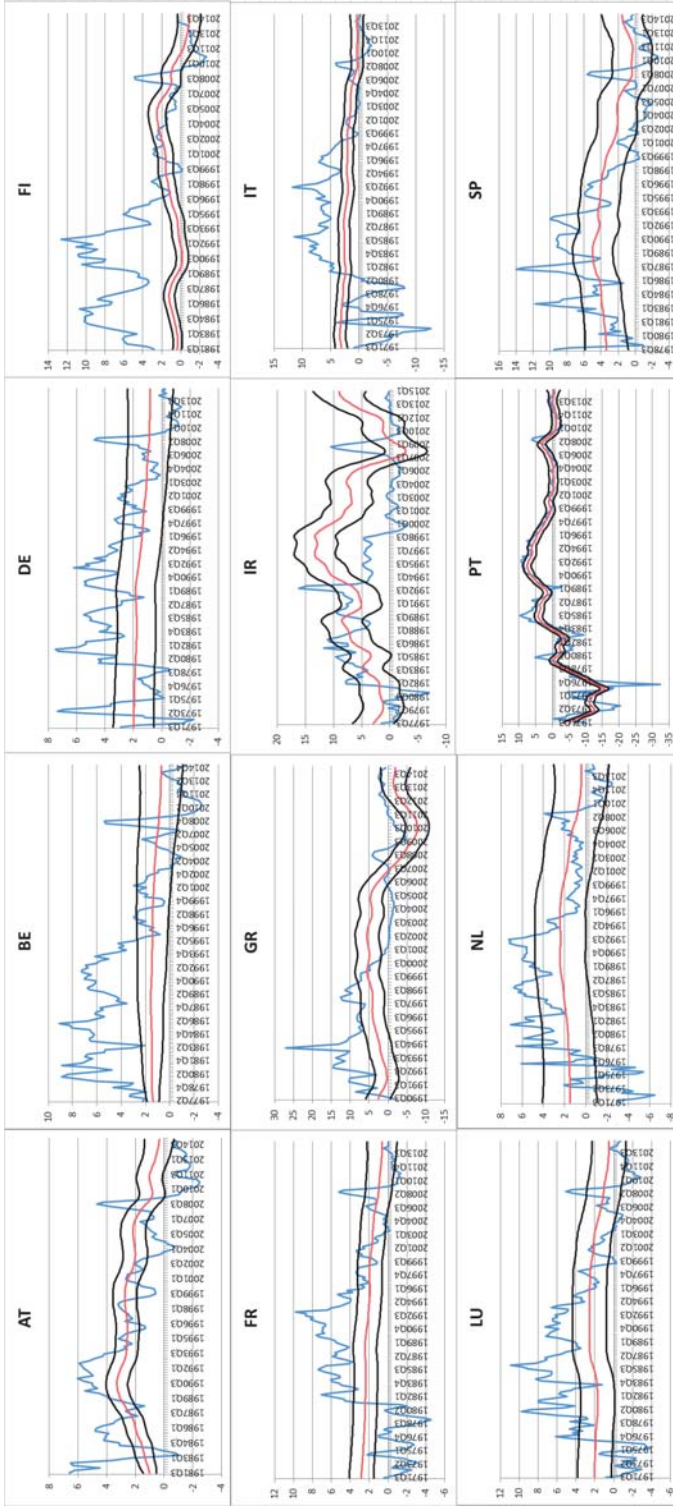
Figure 6: Ex-post real rates and two-sided equilibrium estimates; *Notes*: Blue line=real rate, red line=equilibrium real rate, black lines=+/- one standard deviation equilibrium real rate; AT=Austria, BE=Belgium, DE=Germany, FI=Finland, FR=France, GR=Greece, IR=Ireland, IT=Italy, LU=Luxembourg, NL=Netherlands, PT=Portugal, SP=Spain.