Monetary Policy, Fiscal Policy, and Secular Stagnation at the Zero Lower Bound. A View on the Eurozone

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Abstract: This paper delivers a contemporary estimate of the Eurozone's natural real rate of interest. While it is found that the natural real rate has declined substantially between 1997 and 2015, it has not become negative. Thus, even in the presence of low inflation and nominal interest rates at the zero lower bound, the Eurozone does not face an acute threat of secular stagnation as defined by Lawrence Summers. Similarly, it is deemed unlikely that a number of 'headwinds' or a demise of technological growth will lead to a secular decline of the Eurozone's economic growth. At the same time, it is found that the Eurozone faces a rather profound threat of 'diversity stagnation', as large inter-state differences impair the efficiency of its single monetary policy. Combined with the insufficient enforcement of fiscal rules, this erodes the Eurozone's economic potential as well as its stability. Far-reaching reforms of the monetary and fiscal framework could overcome the detrimental status quo. However, conflicting economic and political incentives among the different member states and governments render the implementation of a necessary reform unlikely.

Keywords: Secular stagnation; natural rate of interest; zero lower bound; land; headwinds; innovation stagnation; Taylor rule; public debt; tragedy of the commons.

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List of Abbreviations

BEA	Bureau of Economic Analysis
BLS	Bureau of Labor Statistics
BMF	Bundesministerium der Finanzen, *Federal Ministry of Finance (Germany)*
bn	Billion
BoJ	Bank of Japan
CeN	Central and Northern European Currency (Hypothetical)
e.g.	Exempli gratia, *for example*
EAPP	Expanded Asset Purchasing Programme
ECB	European Central Bank
EDP	Excessive Deficit Procedure
EFSF	European Financial Stability Facility
EFSI	European Fund for Strategic Investment
EIB	European Investment Bank
EMU	Economic and Monetary Union
EPO	European Patent Association
ESM	European Stability Mechanism
EU	European Union
EUFTA	European Free Trade Agreement (Hypothetical)
et al.	Et alii, *and others*
Fed	Federal Reserve System
FRBSF	Federal Reserve Bank of San Francisco
GDP	Gross Domestic Product
GFS	Government Financial Statistics
HP	Hodrick-Prescott
i.e.	Id est, *that is to say*
IMF	International Monetary Fund
ISA	Interdistrict Settlement Account
IT	Information Technology
MRO	Main Refinancing Operations
n.a.	Not available
NAIRU	Non-Accelerating Inflation Rate of Unemployment
OCA	Optimum Currency Area
OECD	Organization for Economic Co-Operation and Development
OLS	Ordinary Least Squares
Pop.	Population
PPP	Purchasing Power Parity
PRA	Property Rights Alliance
QE	Quantitative Easing

R&D	Research and Development
SD	Standard Deviation
SGP	Stability and Growth Pact
SNA	System of National Accounts
R.o.W.	Rest of the World
TARGET	Trans-European Automated Real-Time Gross Settlement Express Transfer System
TFEU	Treaty on the Functioning of the European Union
TFP	Total Factor Productivity
UK	United Kingdom
UN	United Nations
USA	United States of America
WACC	Weighted Average Cost of Capital
WIPO	World Intellectual Property Organization
ZLB	Zero Lower Bound

List of Symbols

g	GDP growth rate
I	Demand for loanable funds
i^S	Short-term (3 month) nominal interest rate
i^L	Long-term nominal interest rate
i^{MRO}	Main refinancing operations rate
i^R	Risky nominal interest rate
i^T	Taylor rate
i^{WACC}	Weighted average cost of capital (WACC) rate
$\overline{i^S}$	Average short-term (3 month) nominal interest rate
$\overline{i^L}$	Average long-term nominal interest rate
k	Time lag factor
n	Number of observations
p	Value of significance
r	Real interest rate
r^N	Natural real interest rate (unfiltered)
r^*	Natural real interest rate (filtered)
$\tilde{r}^N$	Real interest rate gap (unfiltered)
$\tilde{r}^*$	Real interest rate gap (filtered)
s	Monetary policy 'stress'
S	Supply of loanable funds
t	Observation Period
T	Number of observation periods
u	Unemployment rate
u^*	Non-accelerating inflation rate of unemployment (NAIRU)
$\tilde{u}$	Unemployment gap
y	(Logarithm of) GDP
y^*	(Logarithm of) Potential GDP
$\tilde{y}$	Output gap (as % of GDP)
α	Yield curve spread (term premium)
β, δ	Intercept, if subscript =0. Regression coefficient, if subscript >0.
ε, ς	Error term
λ	Smoothing parameter
π	Inflation rate (year-on-year)
π^e	Expected inflation rate (year-on-year)
π^T	Inflation target
$\tilde{\pi}$	Inflation gap

τ	Trend component
$*, \dagger$	Level of significance (*** 0.1%, ** 1%, * 5%, † 10%)
ø	Simple Average

1. Introduction

1.1 Problem Statement

When the global financial crisis reached its peak seven years ago, the Western world entered what is known today as the 'Great Recession': A prolonged period of slow growth whose impact is still painfully felt in many economies. While the academic world struggled to explain the unusually slow recovery from the crisis, Lawrence Summers (2014a) added a new momentum to the debate when he reintroduced Hansen's (1938) 'secular stagnation' hypothesis. According to this theory, the 'natural' real rate of interest (the rate which equates savings and investment under full employment) may have become negative in some Western economies. If the inflation rate is low and the nominal interest rate – which is restricted by the zero lower bound – cannot be lowered further, this would prevent conventional monetary policy from adequately stimulating demand and, hence, economic growth. The economy could then fall into a self-enforcing era of economic stagnation unless bold monetary and fiscal stimuli and far-reaching structural reforms are implemented.

While an academic consensus on the occurrence of secular stagnation has yet to be reached, many observers agree that the Eurozone is much more susceptible to this threat than any other Western economy (with the possible exception of Japan). In most of its member countries, levels of GDP per capita are still lower than they were before the crisis. Rates of inflation and economic growth remain low despite nominal interest rates close to the zero lower bound. Levels of public debt and unemployment, on the other hand, have reached alarming levels. In addition to that, large differences among the Eurozone's member states complicate the implementation of adequate monetary and fiscal policies to counter these developments. Because of this, a vibrant debate has recently emerged on whether the Eurozone might suffer from secular stagnation as defined by Summers (2014a).

However, while many scholars argue that the Eurozone's natural real rate of interest might have become negative, their proposals often remain largely theoretical and lack sufficient empirical backing. The present analysis aims to fill this gap by delivering a contemporary estimate of the Eurozone's natural real rate. Doing so will deliver two important contributions to the debate on secular stagnation. Firstly, a comparison of this result with the 'actual' real rate and the inflation rate will allow for a formal test of the occurrence of secular stagnation in the Eurozone. And secondly, as the natural real rate is an important determinant in the monetary policy rule defined by Taylor (1993), the author's estimates may also be used as a benchmark for assessing whether the ECB's single monetary policy constitutes an adequate response to the threat of secular stagnation. If it is found that the Eurozone is in fact ill-

equipped to counter this threat, the present analysis will additionally aim at identifying appropriate monetary and fiscal policy measures.

While the empirical estimation of the Eurozone's natural real rate should be regarded as the main contribution of the present analysis, the threat of secular stagnation will also be investigated under alternative definitions. Some scholars have argued that, even if the Eurozone should not be subject to a persistently negative natural real rate, it might still be threatened by secular stagnation if the latter is defined as a long-term decrease of potential output growth per capita. Gordon (2012) has proposed that such a decrease might be triggered by a number of 'headwinds' (such as a decline in working-age population growth), and authors such as Kasparov and Thiel (2012) consider a slowdown of technological growth as a likely cause. Hence, in order to investigate the threat of secular stagnation in the Eurozone in its entire magnitude, these alternative definitions are tested as well.

Based on these considerations, the present paper aims at bringing some clarity to the vivid debate on secular stagnation. Specifically, the following research questions will be addressed:

1. Does the Eurozone face a serious threat from secular stagnation
   a. in the short to medium term due to a decline in the natural real rate of interest?
   b. in the long run due to a number of 'headwinds' or slow technological growth?
2. What are the implications of a declining natural real rate for the Eurozone's monetary policy?
3. To what extent is the Eurozone's monetary and fiscal policy affected by the large degree of diversity among its members?
4. Can the Eurozone's economic outlook be improved by means of monetary and/or fiscal reform?

1.2 Structure of the Analysis

After this first section has defined the objective and primary research questions of the present paper, the subsequent analysis is structured as follows. Section 2 delivers an overview of Summers' (2014a) secular stagnation hypothesis and explains how this theory is linked to shifts in the natural rate of interest. An investigation of the main drivers of the natural rate shows why the threat of secular stagnation is often regarded as particularly acute in the case of the Eurozone. Based on these considerations, Section 3 offers a contemporary estimate for the Eurozone's natural real rate and a subsequent discussion of the implications for the threat of secular stagnation. The adequacy of these results is underlined by a variety of robustness checks and by a number of additional considerations, such as the inclusion of *land*.

Section 4 investigates whether the Eurozone is likely to experience a long-term decrease of potential output growth per capita due to Gordon's (2012) headwinds or a slowdown in technological growth. Section 5 assesses the appropriateness of the ECB's single monetary policy against the background of a declining natural rate. The analysis is conducted for the Eurozone as a whole as well as on the aggregated group level and the individual country level. The term 'diversity stagnation' is coined in order to define the primary weakness of the Eurozone's monetary framework. Based on these findings, Section 6 additionally highlights the shortcomings of the Eurozone's fiscal policies and investigates whether the Eurozone could benefit from a far-reaching reform of its monetary and fiscal framework. Several possible scenarios are presented, and the likelihood of their implementation is discussed by means of the theorem of the 'tragedy of the commons'. Section 7 concludes the analysis and delivers recommendations for future research.

Throughout the paper, many of the Eurozone's most important macroeconomic developments are analyzed in detail. As these developments often strongly vary among its 19 different member countries, it was deemed necessary to aggregate them into adequate country groups. Accordingly, the following arrangement has been maintained in the remainder of the analysis. The *Core* group contains the long-term members whose economies have been rather successful in overcoming the financial crisis and the Great Recession. The *Periphery* group includes the long-term members who experienced the most significant economic hardships during these periods. Finally, the *New* group consists of those members who consecutively acceded to the Eurozone following the year 2007. An exception has been made for Cyprus: while it became a member country in 2008, it was deemed to be rather comparable to the countries of the *Periphery*. Hence, the three groups were organized as follows:

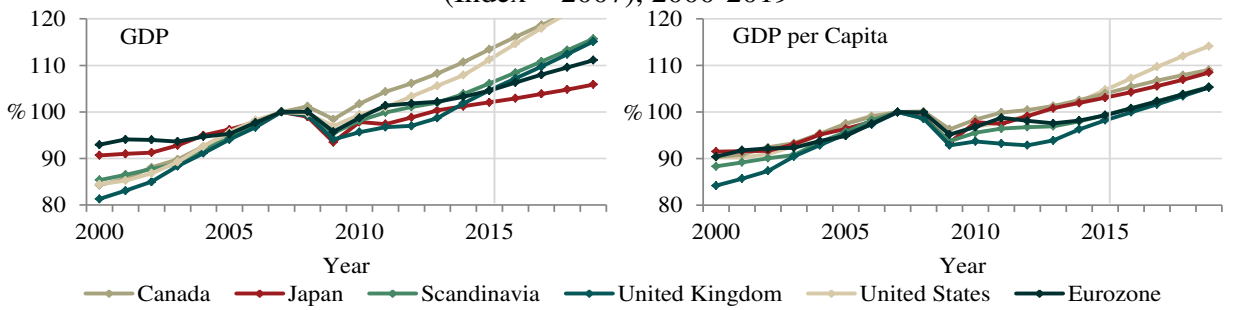
The Core group:	Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands
The Periphery group:	Cyprus, Greece, Ireland, Italy, Spain and Portugal
The New group:	Estonia, Latvia, Lithuania, Malta, Slovakia and Slovenia

2. The Threat of Secular Stagnation in the Eurozone

2.1 The Great Recession and Weak Economic Recovery

From the year 2007 onwards, the unfolding of the US subprime mortgage crisis and the global financial crisis paved the way for a significant decline in the world economy. However, the impact of this decline was unequally felt across the globe. While many developing and emerging countries – most notably India and China – saw their economic growth largely unimpaired, most Western economies experienced the worst financial crisis since the Great Depression (Stiglitz 2010). Consequently, in order to depict the analogy to the global crisis of the 1930s, the resembling downturn of our time has been labelled the 'Great Recession'.[1] Figure 1 illustrates its impact on economic growth in the developed world:[2]

Figure 1: Change in GDP and GDP per Capita for Major Developed Economies (Index = 2007), 2000-2019



Source: Author's calculations; based on data provided by the IMF (2015)

Not only did the economies displayed in Figure 1 experience a significant contraction following the year 2007, but their growth rates also remained low after the initial decline was overcome. As a result, it took all of these economies several years to reach their pre-crisis level of economic performance. Canada experienced the fastest economic recovery, as its

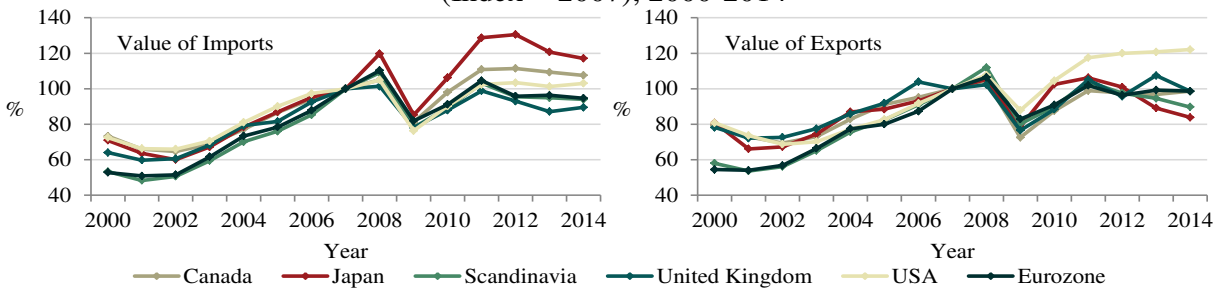
[1] While it has become common among academics and the media to refer to the aftermath of the financial crisis as the Great Recession, it has to be noted that the term is not always used synonymously. In its academic sense, a recession only refers to the contraction phase of a business cycle (Claessens, Kose and Terrones 2009). As such, the Great Recession lasted from 2007 to 2009 in the case of the USA (and similarly for many other Western countries) and was a true global recession only in the year 2009 (IMF 2009). On the other hand, a wide range of authors define the Great Recession more broadly as the time period during which the impact of the global financial crisis continued to weight on the Western economies. According to this logic, the Great Recession lasted much longer and might still be ongoing, as many economic hardships continue to persist in the aftermath of the actual contraction. As these hardships are particularly felt in the Eurozone (as will be shown in Section 2.3), the present analysis defines the Great Recession in its broad sense as the time period since the global financial crisis.

[2] Estimations start after 2011 for the United Kingdom, after 2012 for the United States and after 2013 for the remaining countries. *Scandinavia* is defined in its strictest sense and hence only consists of Denmark, Norway, and Sweden. The Eurozone's composition was adjusted over the time period displayed in Figure 1, as almost half of its current member countries have entered the monetary union after the year 2000. In the case of Scandinavia and the Eurozone, each member country has been weighted according to the relative size of its GDP in each year. Unless stated otherwise, the same procedure has been chosen for all subsequent charts.

GDP reached the pre-crisis level in the year 2010. The remaining economies did not achieve this task until the years 2011 (Eurozone and USA), 2012 (Scandinavia), 2013 (Japan) and 2014 (United Kingdom). The recovery required even more time in the case of GDP per capita – as of 2015, three major economies (the Eurozone, Scandinavia, and the United Kingdom) have not yet reached their respective pre-crisis level.

The significant reduction in economic performance reflects unfavorable developments in most economic indicators, such as an increase in unemployment and a decrease in investment and international trade. As shown by Figure 2, the value of goods traded by the Western economies experienced a much larger decrease than their GDP and GDP per capita. Post-crisis growth was low as well, and many of those economies still traded less in 2014 compared to 2007:[3]

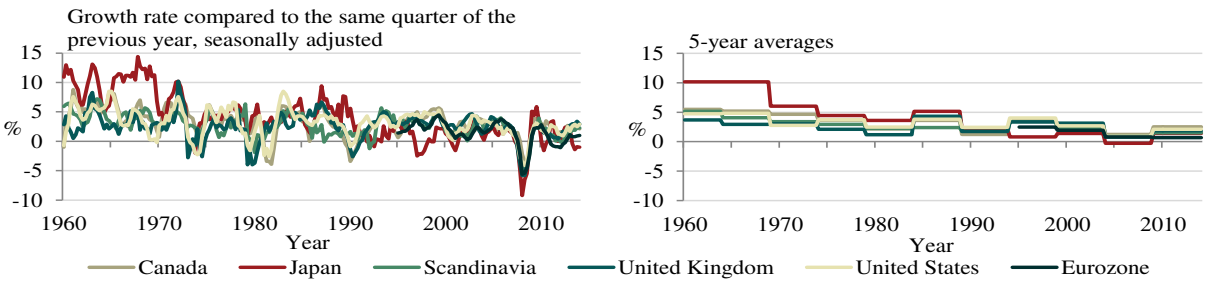
Figure 2: Change in Imports and Exports for Major Developed Economies (Index = 2007), 2000-2014



Source: Author's calculations; based on data provided by UN Comtrade (2015) and the St. Louis Fed (2015)

Many economists expressed astonishment regarding the recovery of most Western economies, which was widely considered as unusually slow even after allowing for the severe impact of the financial crisis (Goodwin et al. 2013). While severe recessions had taken place in the preceding decades as well, the same economies had always resumed their pre-crisis growth rates after a much shorter period of time:

Figure 3: GDP Growth Rates for Major Developed Economies, 1960-2015



Source: Author's illustration; based on data provided by the OECD (2015)

[3] The trade flows include the total of all HS commodities. All values were initially expressed in current US$ and have been adjusted using data on headline inflation provided by the Federal Reserve Bank of St. Louis (2015). A detailed analysis of this "mystery of the missing world trade growth" is provided by Armelius, Belfrage and Stenbacka (2014).

Figure 3 highlights a number of earlier recessions, such as the 1970s energy crisis or the recessions of the 1980s and 1990s. In all of these cases, economic growth in the Western economies recovered relatively fast, often even surpassing pre-crisis growth rates after a short time. This illustrates the severity of the Great Recession in a historical context and justifies the analogy with the Great Depression of the 1930s. But Figure 3 also delivers a second important insight: for most Western economies, average growth has continuously declined during the previous decades. Eight years after the global financial crisis, these economies seemingly remain trapped within an equilibrium of slow growth.

2.2 The Secular Stagnation Hypothesis and its Recent Popularity

Against this background, Summers (2014a) expressed the concern that Western economies might suffer from more profound constraints than just from a 'normal' cycle of slow growth. Referring to a theory formulated by Hansen (1938), he reintroduced the term 'secular stagnation' in order to describe what he considered as a long-term decline in the potential of Western economies. This theory is intrinsically tied to developments in the natural real rate of interest introduced by Wicksell (1898), which equates savings and investment under full employment.[4] The difference between the natural real rate and the real rate of interest (the nominal rate of interest minus the inflation rate) determines to which degree the central bank's monetary policy stimulates the economy. Table 1 highlights how the relationship between real rate r and natural real rate r^* influences an economy's inflation gap ($\tilde{\pi}$), output gap ($\tilde{y}$), and unemployment gap ($\tilde{u}$):[5]

Table 1: The Natural Real Rate of Interest and Monetary Policy

	$r = r^*$	$r < r^*$	$r > r^*$
$\tilde{\pi}$	0	$\uparrow$	$\downarrow$
$\tilde{y}$	0	$\uparrow$	$\downarrow$
$\tilde{u}$	0	$\downarrow$	$\uparrow$

Source: Woodford (2003)

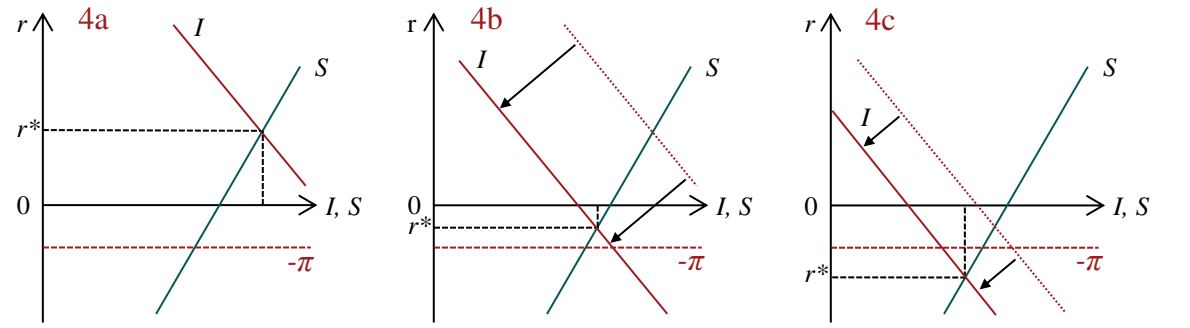
Only if the real rate corresponds to the natural real rate, the economy operates at potential. In this case, inflation is at target and the output and unemployment gaps are closed. If the real rate falls short of the natural real rate, the result is an increase in inflation and output gap, and

[4] The natural rate is also known by a variety of other names, such as equilibrium rate, neutral rate, or Wicksellian rate. While all of these designations are common in the prevalent literature, this analysis only refers to it as the natural (real) rate of interest.

[5] The inflation gap is defined as actual inflation minus the inflation target. The output gap is specified as GDP minus potential GDP. The unemployment gap corresponds to the unemployment rate minus the non-accelerating inflation rate of unemployment (NAIRU).

vice versa (Woodford 2003).[6] As the natural real rate is not directly observable, the central bank has to rely on estimations when deciding upon the optimum policy rate.[7] Within this setting, Summers (2014a) formulated his (new) secular stagnation hypothesis. He argues that a chronic excess of savings over investment (or, to put it differently, a prolonged shortfall in aggregate demand) cannot be reversed by conventional monetary policy if the natural real rate of interest has become significantly negative, trapping the economy in a state of sluggish growth. This problem can be illustrated by a simple loanable funds model:[8]

Figure 4: Secular Stagnation in the Loanable Funds Model



Source: Author's illustration following Krugman (2000) and Summers (2014a)

Let I and S denote the demand for investment and the supply of savings at full employment. Furthermore, r is the real interest rate, r^* is the natural real interest rate and π is the inflation rate. In Figure 4a, I and S intersect in the positive area and r^* is significantly larger than 0. If r^* and π are correctly estimated by the central bank, it can set a nominal interest rate which equates savings and investment at full employment. In Figure 4b, the demand for investment decreases – triggered, for instance, by a decline in the working age population or by a lack of profitable investment opportunities. If the decrease is large enough, it is possible that I and S now intersect in the negative area. The result is a negative r^*, but as it is still located above the inverted inflation rate, it can be targeted by the central bank as well. But if investment demand falls even further, the economy can enter a situation where r^* lies below the inverted inflation rate (see Figure 4c). As the nominal interest rate is

6 Woodford (2003) dedicates an entire chapter of his work to an analysis of the natural rate of interest in the context of monetary policy. He shows how "increases in output gaps and in inflation result from increases in the natural rate of interest that are not offset by a corresponding tightening of monetary policy […], or alternatively from loosenings of monetary policy that are not justified by declines in the natural rate of interest." He does not mention the unemployment gap, but due to the tradeoff between unemployment and losses in a country's GDP (Okun 1962), this variable was included nevertheless.

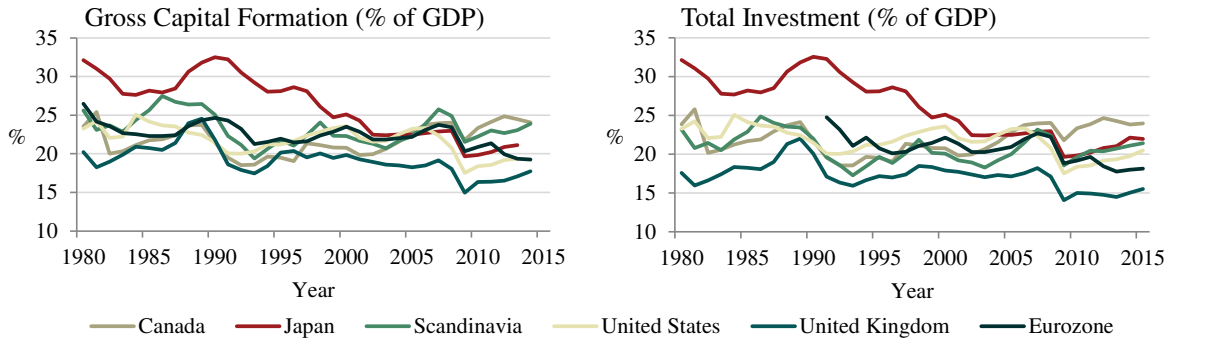
7 However, as will be further elaborated in Section 3, estimates of the natural rate are surrounded by a high degree of uncertainty.

8 While emanating from different considerations, the secular stagnation hypothesis shares many features with the 'liquidity trap' hypothesis, such as the focus on low inflation and the zero lower bound on nominal interest rates. The similarity of both concepts has also been acknowledged by Krugman (2013, 2014). For this reason, Figure 4 is based on the notation used in Krugman (2000). A more in-depth representation of secular stagnation using the loanable funds model has been provided by Eggertsson and Mehrotra (2014).

constrained by the zero lower bound (ZLB), there is no achievable real interest rate which equates savings and investment at full employment. Hence, conventional monetary policy cannot provide sufficient stimulus to elevate the economy from a state of low demand. Economic growth remains sluggish and the economy will continue to operate below potential, leading to disinflation and leaving output and unemployment gap open. This is what Summers (2014a) defines as secular stagnation.[9]

The reintroduction of the secular stagnation theory by Summers (2014a) has been met with widespread recognition, as many scholars regard it as a comprehensible explanation for the weak performance of most Western economies.[10] A vivid debate has emerged on the optimum policy response, as only unconventional measures – such as raising inflation (expectations) through quantitative easing (QE) or boosting demand through expansionary fiscal policy – may lift an economy from a state of secular stagnation (Duprat 2015). In this analysis, it is argued that the sudden rise of the theory's popularity can be explained by at least four factors. Firstly, the global financial crisis has indeed resulted in a tremendous decline in the Western countries' demand for investment, as illustrated in Figure 5:

Figure 5: Investment-to-GDP Ratios for Major Developed Economies, 1980-2015



Source: Author's illustration; based on data provided by the IMF (2015) and the World Bank (2015)

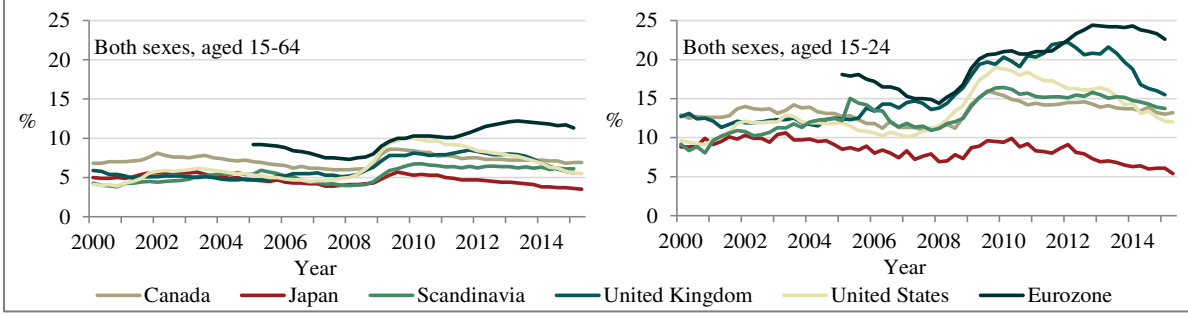
[9] However, it has to be recognized that the term 'secular stagnation' is not always used synonymously – as Eichengreen (2014) put it, "Secular Stagnation […] is an economist's Rorschach test. It can mean different things to different people." In the prevalent literature, there exist at least two interpretations of secular stagnation apart from the one provided by Hansen-Summers. The first one defines secular stagnation as a long-term decrease in potential output growth due to a number of 'headwinds'. This interpretation is delivered by Gordon (2012), who argues for the existence of six 'headwinds' (in Gordon 2014, he reduces the number to four – demographics, education, inequality, and government debt). The second interpretation focuses on the inhibitive effect of balance sheet recessions on economic growth. Authors such as Koo (2011, 2014) and Lo and Rogoff (2015) argue that unsustainable levels of debt in the years leading to the financial crisis have triggered an extensive process of deleveraging, and that economic growth will remain sluggish as long as this process prevails. While the three different interpretations share many common characteristics, they also differ in important aspects. A detailed comparison is provided by Pradhan et al. (2015), who also show that the three interpretations are mutually exclusive (the authors label this phenomenon as the "impossible trinity" of secular stagnation). In the present analysis, the term 'secular stagnation' is always used in the sense intended by Hansen (1938) and Summers (2014a) unless explicitly stated otherwise.

[10] However, it has also received a significant degree of criticism, as will be laid out in Section 2.3.

On average, the share of investment in GDP has dropped by 19.7% (gross capital formation) and 21.4% (total investment) between 2007 and 2009. As of 2015, Canada is the only economy where the ratios have reached their pre-crisis levels, and growth remains low in all of the economies. In a simple loanable funds model (see Figure 4), this would constitute a significant shift of the demand curve to the left.

Secondly, unfavorable developments in many of the drivers of investment demand – both in the short and in the long run – indicate that aggregate demand may continue to grow at low levels. As an example of a short-term development, Figure 6 displays the surge in unemployment following the financial crisis:

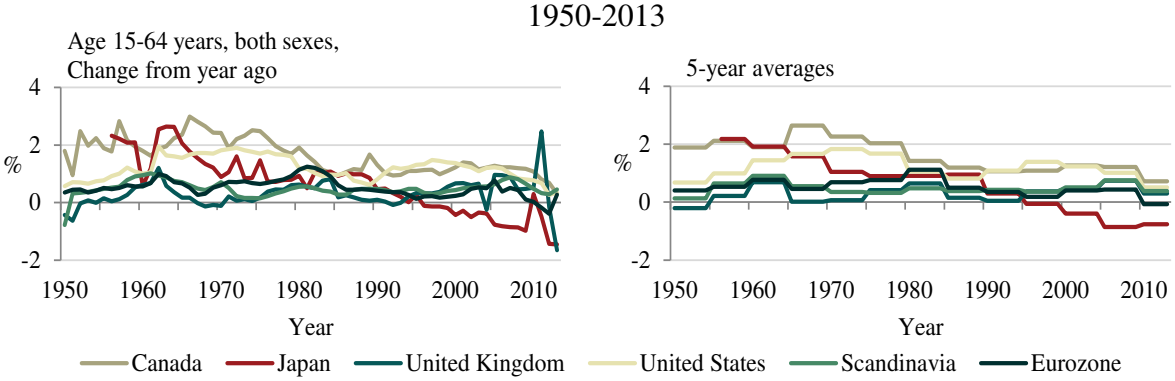
Figure 6: Change in Unemployment and Youth Unemployment Rates for Major Developed Economies, 2000-2015



Source: Author's illustration; based on data provided by the OECD (2015)

Beginning in the year 2008, all of the economies listed in Figure 6 experienced significant increases in their unemployment rates, especially in youth unemployment. While these rates have largely decreased between 2010 and 2015 (with the exception of the Eurozone, which saw a second increase following the beginning of the sovereign debt crisis), they still remain above the pre-crisis rates for all economies but Japan. As a contrast to the short-term increase in unemployment rates, Figure 7 presents the decline in working age population growth rates, which is a long-term evolution common to all major Western economies:

Figure 7: Working Age Population Growth Rates for Major Developed Economies, 1950-2013

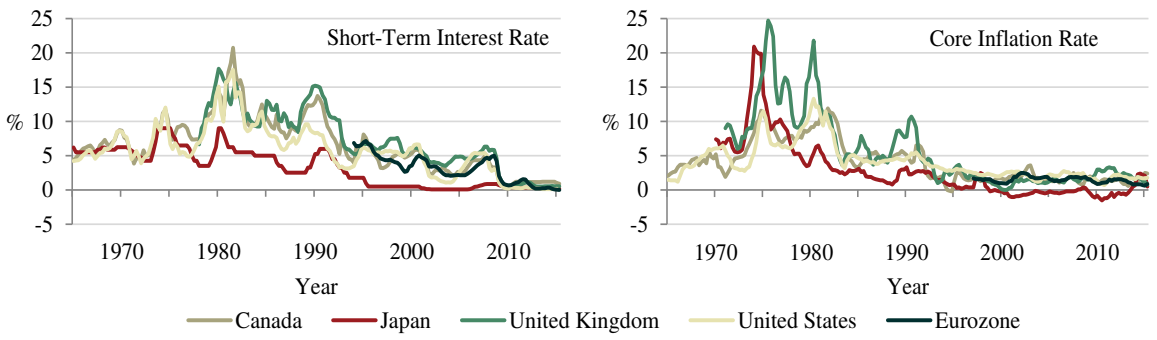


Source: Author's illustration; based on data provided by the OECD (2015)

As of 2013, the working age population was either declining or growing at very low levels for all economies displayed above.[11] As can be seen from the 5-year averages, this does not represent a cyclical, but rather a truly secular development which is unlikely to be reversed in the near future. As demand for consumption and investment is primarily driven by the working age population, higher unemployment rates[12] and a decline in the working age population growth indicate a lower growth of aggregate demand in the short and long run. Hence, both of these short- and long-term developments suggest that a significant shortfall of demand may require a long time to be reversed.

Thirdly, all major Western economies exhibit low inflation rates and even lower short-term nominal interest rates, as illustrated by Figure 8:[13]

Figure 8: Nominal Interest Rates and Core Inflation Rates for Major Developed Economies, 1965-2015



Source: Author's illustration; based on data provided by the BoJ (2015), Eurostat (2015), the OECD (2015) and the St. Louis Fed (2015)

After the onset of the Great Recession, short-term nominal rates were sharply reduced in all major Western economies. As of 2015, Canada and the United Kingdom display the highest rates, at 0.89% and 0.54%, respectively. The remaining economies have reduced their rates to levels close to the zero lower bound. Core inflation rates are low as well, amounting to 2.4% and 1.8% for Canada and the USA and to less than 1% for the remaining economies. As has been illustrated in Figure 4, low inflation coupled with nominal interest rates close to the zero lower bound may be problematic if the natural real rate declines. If actual real rates

[11] In the case of the Eurozone, data for all current member countries has been aggregated (with the exception of Cyprus, Malta, Latvia, and Lithuania). Each member country has been weighted according to the relative size of its population (as has also been done in the case of Scandinavia). In order not to distort the implications drawn from the trend growth line, the increase in working age population due to the German reunification is not reflected in Figure 7.

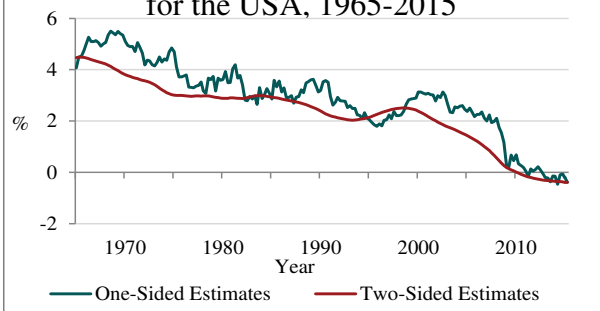
[12] Higher unemployment leads to lower demand not only among the unemployed, but also among the employed population, as those who still have a job reduce consumption and investment as well if they sense a higher degree of uncertainty on the labor market. Hence, the inhibitive effect of unemployment on growth may be much larger than indicated by the unemployment rate only.

[13] As they do not form a monetary union, aggregating the Scandinavian countries' interest and inflation rates would deliver a misleading result. Therefore, these countries are not represented in Figure 8.

cannot be reduced to the level of a significantly negative natural real rate, conventional monetary policy may be deprived of its chances of stimulating the economy.

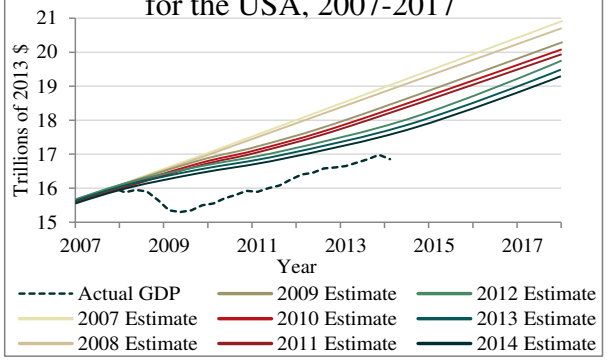
As has been shown so far, recent developments indicate that a decline in the natural real rate may have taken place in the Western countries, that such a development is unlikely to be reversed in the near future, and that these countries are ill-equipped to counter negative natural rates due to low inflation and the zero lower bound on nominal rates. A final factor in explaining the popularity of the secular stagnation hypothesis can be found in the detailed information available for the USA, especially concerning the development of the natural rate. Figure 9 presents Laubach and Williams' (2003) updated estimate of the natural rate. According to these authors, the US-American natural real rate has experienced a continuous decline during the past 50 years and has even dropped into the negative territory after the onset of the Great Recession. When taking both the zero lower bound on nominal interest rates and low core inflation rates into account (see Figure 8), this signifies that a further decline in either the natural rate or the inflation rate would pose a threat of secular stagnation (see Figure 4).

Figure 9: Time-Varying Natural Rate for the USA, 1965-2015



Source: Laubach and Williams (2003)

Figure 10: Potential GDP Estimates for the USA, 2007-2017



Source: Summers (2014b)

Summers (2014b) shows how this development coincided with a sequential downward trend in the predictions made on the U.S. economy's potential GDP (see Figure 10), which he considers as indicative for the inhibitive effect of a declining natural rate on economic growth.[14] Hence, the current experiences of the US-American economy seem to support the secular stagnation hypothesis.

[14] While it was estimated in the year 2007 that the economic potential would amount to almost 21 Trillion US$ in the year 2018, this estimate was since reduced to about 19.3 Trillion US$. Hence, Summers argues that the reduction in the US-American output gap has not been achieved by an increase in economic performance, but rather by a downward correction of its potential GDP.

2.3 The Case of the Eurozone

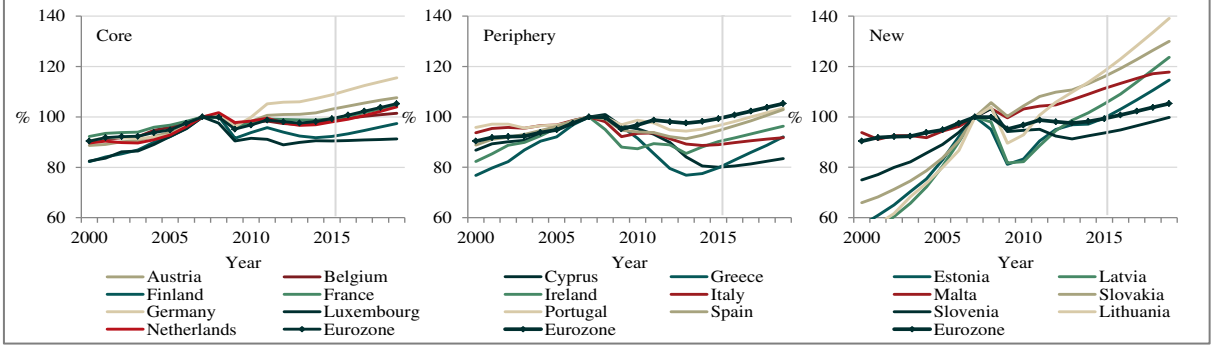
The previous section has delivered an overview of the secular stagnation hypothesis reintroduced by Summers (2014a). It has also been shown that the theory's popularity can be explained by the fact that it delivers a comprehensible – and seemingly empirically backed – explanation to what is perceived as unsatisfactory performance and outlook in many developed economies. However, compliance with this view is not unanimous, and a number of prominent economists – such as Bernanke (2015), Hamilton et al. (2015), Mokyr (2014a), and Taylor (2014)[15] – have argued against the case of secular stagnation. But while no consensus has yet been reached on the threat of secular stagnation for the Western world as a whole, there seems to be a rather strong agreement on a certain point – namely, that the Eurozone is much more vulnerable than other developed economies.[16] In the present section, it will be investigated to what extent this presumption is justified.

To begin with, Figure 1 has already shown that the Eurozone's recovery from the financial crisis was much slower compared to most other Western economies. The impact of the Great Recession – coupled with the sovereign debt crisis – continues to weigh heavily on many of its members, particularly on the Periphery countries:

[15] While all of these – and a number of other authors – reject the proposal of secular stagnation, they avail themselves of very different arguments in doing so. Bernanke (2015) considers not a decline in aggregate demand for investment, but rather a global increase in desired savings – the 'savings glut' – as causative for weak economic growth. Within the loanable funds model (see Figure 4), this would translate into a rightward shift of the *S*-curve instead of a leftward shift of the *I*-curve. Hamilton et al (2015) argue that a state of a low (or even negative) natural real rate is not necessarily self-enforcing, and that the natural real rate may evolve back to a higher 'normal' level without the aid of extraordinary policy measures. Mokyr (2014a) brings forward that current technological progress (especially within fields such as nanotechnology, genetic engineering, and artificial intelligence) may lead to a boost in the productivity of Western economies. He argues that the effects are widely underestimated today, since aggregate statistics such as GDP and TFP – which "were designed for a steal and wheat economy" – do not properly capture productivity gains stemming from these fields. Finally, Taylor (2014) considers inefficient economic policies as the main reason for the financial crisis and the weak recovery of most Western economies. He puts forward that the market was deeply disrupted before the crisis by the Fed's low interest policy and the loose enforcement of financial regulations as well as by a large number of policy measures which were implemented afterwards. He argues that the financial crisis and the Great Recession – and, consequently, the fear of secular stagnation – would have turned out less severe without these "deviations from rule-based policies that had worked in the past."

[16] Buiter, Rahbari and Seydl (2014) analyze the risk of secular stagnation for the Eurozone, Japan, the UK, the USA, and a number of emerging markets and conclude that "the threat […] is probably most serious in the Euro area". Crafts (2014) regards the Eurozone as "much more vulnerable" to the threat of secular stagnation than the USA, concluding that the Europeans "should be much more afraid than the Americans". While they consider most of the developed world to be in danger of secular stagnation, Posen and Ubide (2014) argue that the Eurozone "has made that situation worse for itself" by means of counterproductive policy measures. And Duprat (2015) considers the Eurozone "not well equipped to manage the challenge" and identifies a real "danger for Europe of falling into a protracted stagnation." Krugman (2014) and Rawdanowicz et al. (2014) highlight the similarities to the Japanese experience and argue that secular stagnation could ensure a European version of the 'lost decades' if appropriate policy measures are not swiftly implemented.

Figure 11: Change in GDP per Capita in the Eurozone (Index = 2007), 2000-2019

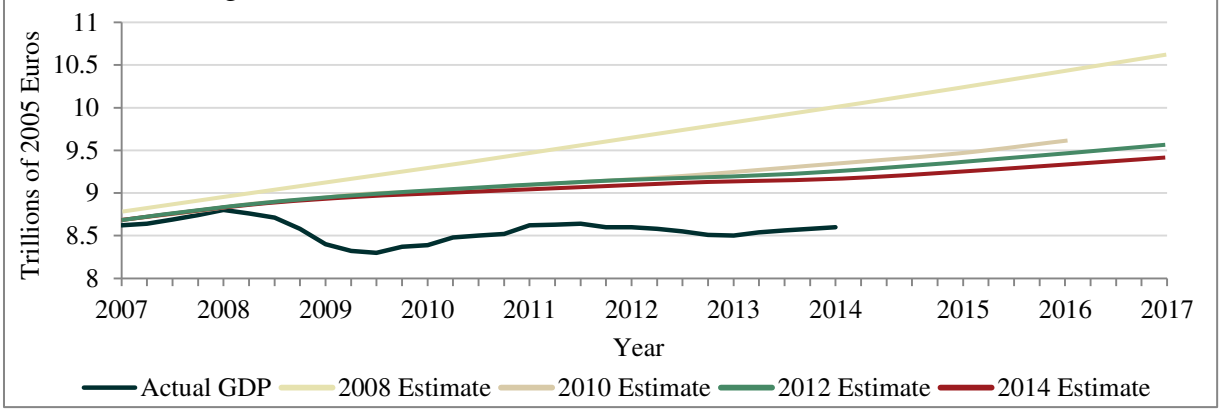


Source: Author's calculations; based on data provided by the IMF (2015)

The New country group experienced the fastest recovery from the financial crisis: as of 2015, only Slovenia has yet to reach its pre-crisis level of GDP per capita. The developments were less favorable in the Core countries, as five out of seven countries have not yet reached their pre-crisis level and growth remains low in all countries except Germany. But these economic hardships seem to fade when compared to those of the Periphery group, whose members all display significantly lower GDP per capita levels compared to 2007. In fact, the IMF (2015) expects that the recovery will take until the year 2018 in the case of Portugal and Spain, and much longer for the remaining countries in this group.

This evidence illustrates that slow economic growth is not only significant for the Eurozone as a whole, but that its 19 member countries have been subject to the economic hardships following the financial crisis to a strongly varying degree. This distinct heterogeneity (which will be addressed more explicitly in Section 5) is one of the (many) reasons for which the Eurozone is often seen as particularly vulnerable towards secular stagnation. First evidence on this threat came from Summers (2014b) himself, who has shown that the Eurozone's economic performance was not only far below its potential during recent years, but that its potential GDP has also continuously been corrected downwards:

Figure 12: Potential GDP Estimates for the Eurozone, 2007-2017

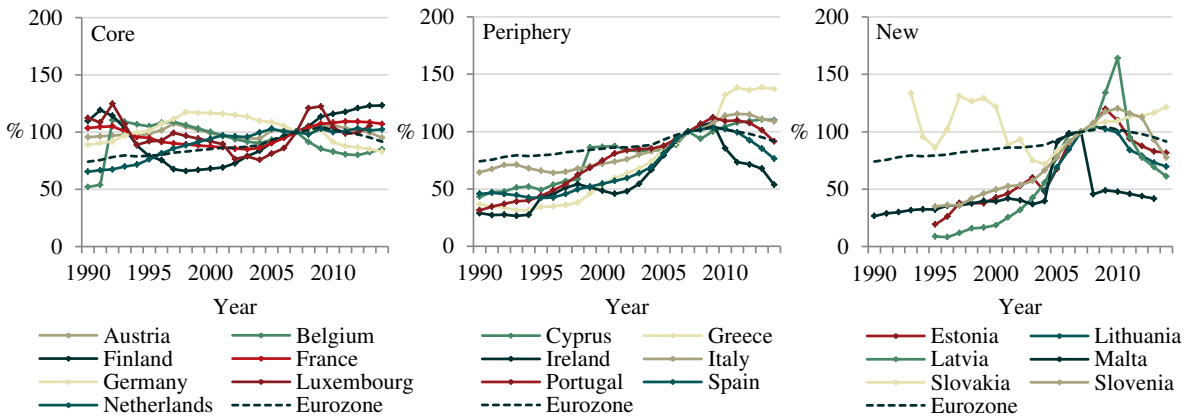


Source: Summers (2014b)

In the year 2008, the IMF and Bloomberg databases (on which Summers 2014b bases his illustration) expected the Eurozone's potential GDP to reach more than 10.5 trillion euros by the year 2017 (measured in 2005 euros). This estimate was consecutively reduced to less than 9.5 trillion euros, which will probably still be much larger than the Eurozone's actual GDP in the year 2017. According to Summers (2014b), this large decrease in the monetary union's economic potential cannot only be explained by the aftermath of the global financial crisis, but is likely to reflect a long-term decline in the natural real rate.[17] In the following, it will be examined whether such a decline may indeed have occurred. According to the formal model provided by Eggertsson and Mehrotra (2014), four factors are primarily accountable for such a decline: (1) a deleveraging shock, (2) a slowdown in population growth, (3) an increase in income inequality, and (4) a fall in the relative price of investment.[18]

A deleveraging shock takes place if the simultaneous deleveraging effort of a significant number of economic entities – either in the private sector, the public sector, or both – creates adverse effects for the country's economic activity. In the case of some Eurozone countries, rapid credit expansion in the years leading to the financial crisis resulted in unsustainable levels of debt in the non-financial private sector (Cuerpo et al. 2014). After the financial crisis and the onset of the Great Recession, this resulted in a significant deleveraging shock in these member countries:[19]

Figure 13: Domestic Credit to the Private Sector in the Eurozone (Index = 2007), 1990-2014



Source: Author's calculations; based on data provided by the World Bank (2015)

[17] As has taken place in the USA, see Figures 9 and 10.

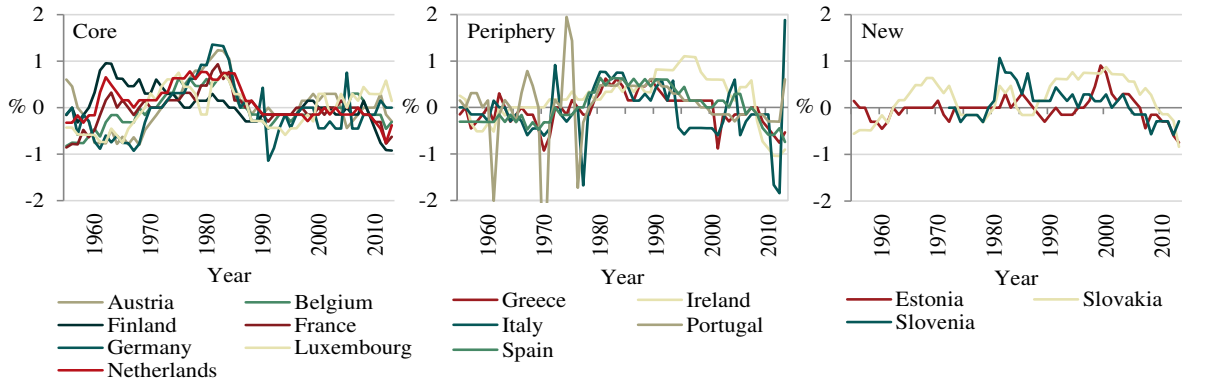
[18] There are certainly a number of additional factors playing a role as well. For instance, Eichengreen (2015) considers the global integration of emerging markets as a major reason for an increase in savings and a decrease in investment demand. And Andréz, López-Salido and Nelson (2009) show how the natural real rate can be driven down by a technology shock. For the sake of feasibility, however, this analysis considers only the primary factors which have been identified by Eggertsson and Mehrotra (2014).

[19] Initially, the World Bank's (2015) measure of domestic credit to the private sector was expressed as % of GDP, with levels ranging from 41.1% (Lithuania) to 252.5% (Cyprus) in the year 2014.

As can be seen from Figure 13, the percentage increase in domestic credit in the years leading to the financial crisis was particularly large for the Periphery countries and the New countries (except Slovakia), but also for some Core countries (such as Finland and the Netherlands). Most Eurozone countries (14 out of 19) experienced private sector deleveraging between 2007 and 2014. The percentage change was particularly large (above 20%) in the case of Belgium, Estonia, Germany, Ireland, Latvia, Lithuania, Malta, Slovenia and Spain. Since private sector deleveraging shocks translate into a significant reduction of consumption and investment (Cuerpo et al. 2014), it can be assumed that this development has exerted considerable downward pressure on the Eurozone's natural rate of interest.

Concerning the slowdown in population growth (the second factor mentioned by Eggertsson and Mehrotra 2014), Figure 7 has already illustrated that the Eurozone's working age population was growing slower than those of Canada, Scandinavia, the United Kingdom and the United States. The severity of this development is further illustrated by Figure 14, which delivers the growth rate in the population aged 15 to 64 for each Eurozone country. It is found that most member countries are currently experiencing a long-term decline in their growth rate, which can roughly be traced back until the 1980s. As of 2013 only Italy, Luxembourg, and Portugal recorded a positive growth in their working age population (and in the case of Italy and Portugal, this seems to have represented a cyclical deviation from the significant decline which they had recorded in the preceding years):

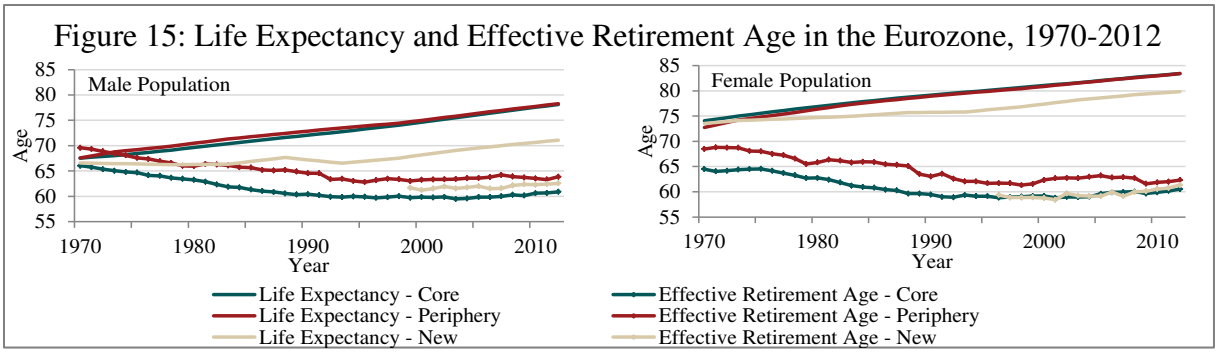
Figure 14: Working Age Population Growth Rates for the Eurozone, 1955-2013



Source: Author's calculations; based on data provided by the World Bank (2015)

As has been laid out in Section 2.2, the decline in the working age population growth indicates a lower growth of aggregate demand for loanable funds in the long term. For the Eurozone, this is further exacerbated by the increasing discrepancy between life expectancy and retirement age, as can be seen from Figure 15:[20]

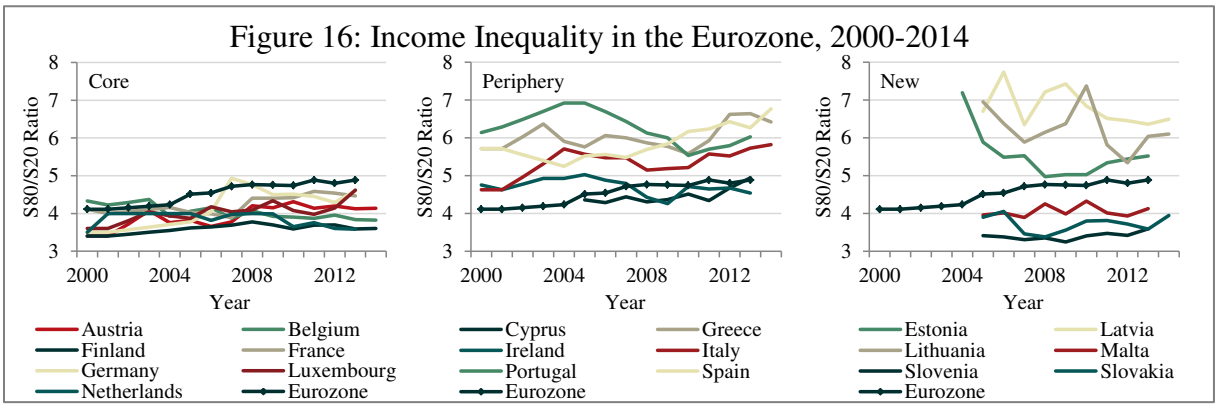
[20] In each of the three different country groups, the respective member countries have been weighted according to their relative size of their GDP in each year. If information on GDP was not available for a given year,



Source: Author's calculations; based on data provided by the OECD (2012) and the UN (2013)

For each group of countries, the life expectancy of both the male and the female population experienced a considerable increase during the last four decades. At the same time, the average effective retirement age was continuously reduced until about 1995 and has remained low until 2012. As a result, the gap between both indicators has widened in almost every year since 1970. This means that the average worker now spends a larger percentage of his lifetime being a retiree and a smaller percentage belonging to the working age population. Similar to the decrease in working age population growth, this development can be expected to reduce demand for investment and consumption, leading to a decline in the natural rate of interest.

While these demographic factors highlight unfavorable developments in almost all member countries, the case of income inequality (the third factor mentioned by Eggertsson and Mehrotra 2014) delivers a more differentiated picture. Figure 16 illustrates the income ratio of the richest quintile relative to the poorest quintile for each Eurozone country:



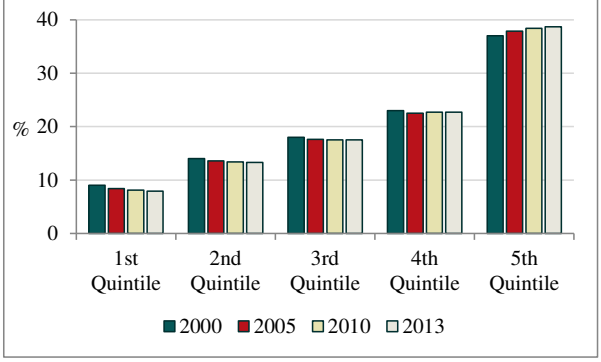
Source: Author's calculations; based on data provided by Eurostat (2015)

As can be seen from Figure 16, income inequality strongly varies among the different country groups. Most Periphery countries demonstrate a much higher inequality compared to the Core countries, and the three Baltic states are far more unequal than the remaining countries in the New group. The development between 2007 and 2013/14 displayed

simple averages were calculated instead. Comparative tests have shown that doing so did not significantly alter the results. Unless stated otherwise, the same procedure has been chosen for all subsequent charts.

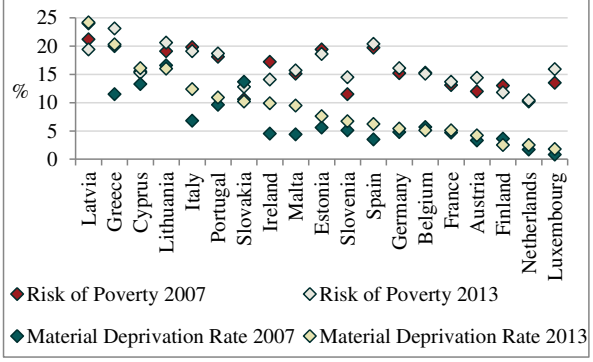
significant differences between the countries as well, as inequality decreased in five member countries (Germany, Ireland, Netherlands, Portugal, and Finland) and remained at a comparable level for two additional member countries (Belgium and Estonia). In the remaining countries, however, the income distribution became more unequal. As a result, the inequality increased by 3.6% between 2007 and 2013 for the Eurozone as a whole (and by 18.9% from 2000 to 2013). Further detail on this development is provided by Figure 17. Between 2000 and 2013, the Eurozone experienced not only a decrease in the share of national income held by the first quintile, but also a decrease in the share held by the second, third, and fourth quintile (albeit to a lesser extent). Only the share held by the fifth quintile increased significantly. Hence, it can be taken that the Eurozone's income distribution has continuously become more unequal during the most recent years. And, as noted by Eggertsson and Mehrotra (2014), such a development may have a negative impact on the aggregate demand for investment and hence reduce the natural real rate of interest.[21]

Figure 17: Income Distribution in the Eurozone by Quintile, 2000-2013



Source: Author's illustration; based on data provided by Eurostat (2015)

Figure 18: Material Deprivation and Risk of Poverty in the Eurozone, 2007 vs. 2013



Source: Author's illustration; based on data provided by Eurostat (2015)

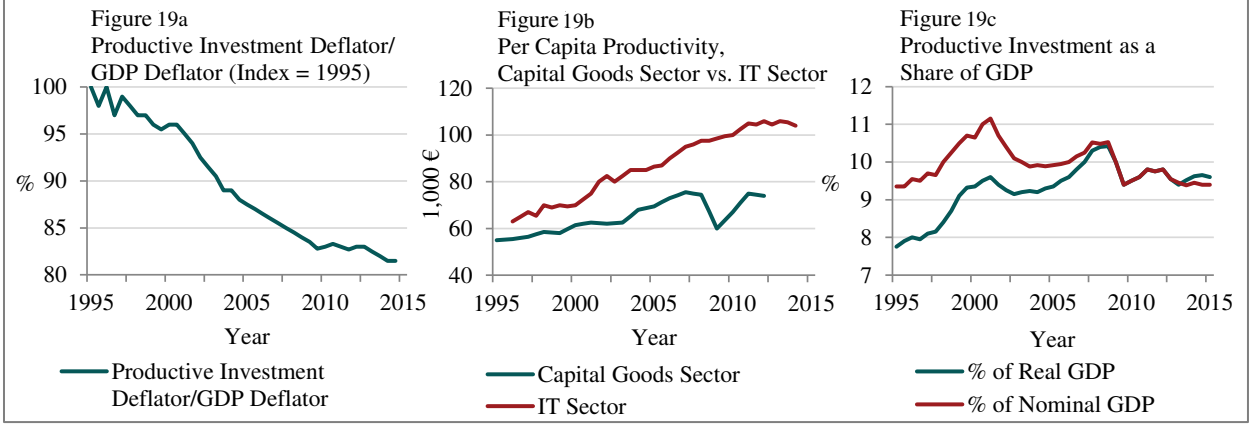
In addition to that, a higher degree of income inequality has often been found to be associated with a higher risk of poverty and an increase of material deprivation (see, for instance, Lelkes et al. 2009 and Calvert and Nolan 2012). As shown in Figure 18, the risk of poverty has increased in 15 out of 19 member countries since the global financial crisis. The material deprivation rate has increased in 12 countries. If households are exposed to a higher risk of poverty, this translates into a lower demand for investment and consumption (especially among risk-averse agents). Similarly, as the material deprivation rate reflects the

[21] Specifically, Eggertsson and Mehrotra (2014) distinguish between two types of income equality which may put downward pressure on the natural real rate: inequality within generations and inequality across generations. Information on the Eurozone's income distribution across different age groups can be obtained from Eurostat (2015). However, this data is only available for the years 2005-2014, which was deemed insufficient for adequately investigating changes in intergenerational distributions. As a result, the present analysis only focuses on inequality within generations.

"inability to afford a selection of items that are considered to be necessary or desirable" (Eurostat 2015), such as not being able to finance a car, an increase in this rate reflects a reduction in investment demand. Therefore, it can be concluded that the economic consequences of increased income inequality have recently led to a downward pressure on the Eurozone's natural rate of interest.

Finally, Eggertsson and Mehrotra (2014) argue that a decline in the relative price of investment represents the fourth major reason for a decline in the natural rate of interest. According to this rationale, a lower relative price of investment (for instance, due to productivity gains owed to advances in information technology and the computer age) reduces the required savings rate, as less savings are needed for building the same stock of capital (Karabarbounis and Neiman 2014). This in turn drives down the natural rate of interest. Figure 19 highlights the decline in the relative price of investment within the Eurozone:

Figure 19: The Declining Relative Price of Investment in the Eurozone, 1995-2015



Source: Artus (2015)

As can be seen from Figure 19a, the relative price of productive investment (e.g., investment in information technology) has been reduced by almost 20% during the last two decades. The reduction in the relative price of investment led to falling prices and higher productivity in the sectors which produce capital goods and IT products, as illustrated in Figure 19b. Per capita productivity has significantly increased in both sectors, but even more so in the IT sector (which also was much less affected by the financial crisis). Figure 19c shows that the nominal investment rate has been falling relative to the real investment rate since the year 1995, with both rates coinciding in the year 2006. This implies that a given growth in GDP and capital in real terms could be achieved with a smaller nominal capital stock (Artus 2015). Therefore, it can be assumed that the fall in the relative price of investment – just as the three factors analyzed before – has led to a reduction of the demand for loanable funds, resulting in downward pressure on the Eurozone's natural rate.

The present section has highlighted the thread of secular stagnation in the Eurozone based on the remarks of Eggertsson and Mehrotra (2014), who argue that four factors may be causative for a decline in the natural rate of interest. It was shown that, in recent years, the Eurozone has been subject to unfavorable developments in all four of these factors. It is therefore concluded that the Eurozone's natural rate is likely to have declined, which is an essential prerequisite for secular stagnation as defined by Summers (2014a). Based on these considerations, Section 3 provides a detailed assessment of the Eurozone's natural real rate in order to empirically assess the threat of secular stagnation.

3 The Natural Real Rate and Secular Stagnation in the Eurozone

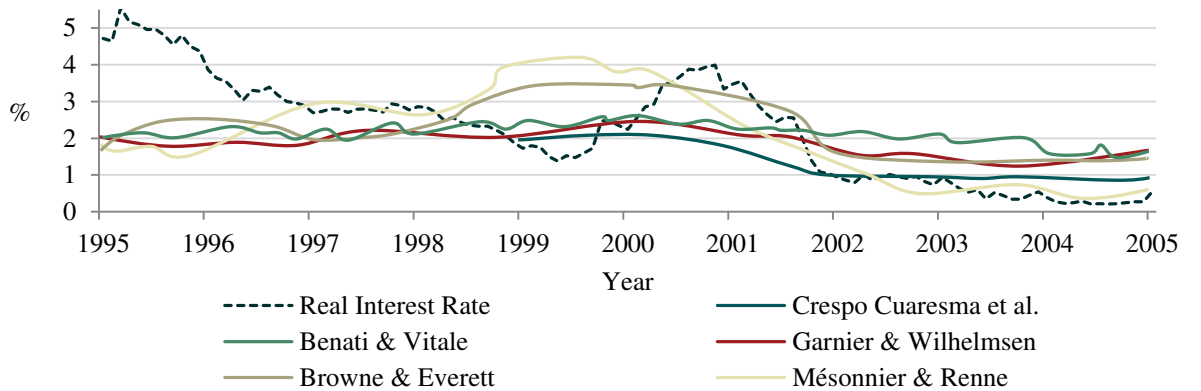
3.1 A Contemporary Estimate of the Eurozone's Natural Real Rate

3.1.1 Existing Studies

As has been laid out in Section 2.2, Summers' (2014a, 2014b) definition of secular stagnation is intrinsically tied to developments in the natural real rate of interest. Specifically, a decline in the natural real rate coupled with low inflation rates may prevent the real rate of interest from becoming sufficiently negative (given the ZLB as a lower limit for the nominal rate of interest) to drive the real rate gap below zero. Hence, secular stagnation is formally defined as a permanently positive real rate gap coupled with low inflation (Pedersen 2015). It follows that, in order to draw conclusions on the presence of secular stagnation in the Eurozone, a contemporary estimate of the natural real rate is required.

Unfortunately, the natural real rate is not directly observable, and its estimation is surrounded by a high degree of complexity and uncertainty. So far, no consensus has been reached on the optimum methodology, and a number of scholars have offered different estimations of the natural real rate for the Eurozone. Commonly applied methods were, among others, multivariate structural time series models (Crespo Cuaresma, Gnan, and Ritzberger-Gruenwald 2004), consumption-based capital asset pricing models (Browne and Everett 2005), as well as variants of Laubach and Williams' (2003) Kalman filter approach (Garnier and Wilhelmsen 2005, Benati and Vitale 2007, Mésonnier and Renne 2007). Figure 20 summarizes the findings of these studies:

Figure 20: Estimates of the Natural Rate of Interest for the Eurozone, 1995-2005



Source: Benati & Vitale (2007), Browne & Everett (2007), Crespo Cuaresma et al. (2004), Garnier & Wilhelmsen (2005), Mésonnier & Renne (2007), Eurostat (2015), and OECD (2015)

Unfortunately, all of these studies offer estimates of the natural real rate only until the year 2005 (with initial years ranging from 1965 to 1999), and one would certainly assume that significant shifts have occurred since then (see Section 2.3). Nevertheless, Figure 20 is useful

for the present analysis since it illustrates a central complication within the estimation of natural rates of interest: the results are very sensitive to changes in methodology, assumptions, and time frame.[22] This is peculiarly true for the time period during which the euro was introduced: from 1999 to 2002, the estimates differ by up to 2.2%. And for the year 2005, despite some preceding convergence, the differences still amount to up to 1%. These variations are substantial if one were to consider the natural real rate as a benchmark for monetary policy. But while attempts to detect the "true" natural rate among the variety of results may be in vein, Figure 20 still offers an important insight: all of these studies indicate a significant decline in the natural rate following the year 2000. If this decline has continued since the year 2005 (as suggested by the developments highlighted in Section 2.3), this would deliver support for the secular stagnation hypothesis. Summers (2014a) argues that this may indeed have happened, and many other economists have expressed similar concerns (see, for instance, Bouis et al. 2013, Jimeno, Smets and Yiangou 2014, Crafts 2015, Rawdanowicz et al. 2014, Ubide 2014, and von Weizsäcker 2014).

3.1.2 Determining the Eurozone's Natural Real Rate

However, the latest estimates of the Eurozone's natural real rate – at least to the knowledge of the author – were those of Bouis et al. (2013), who offer results for the years 1980-2012.[23] Since information on the years 2013-2015 was needed as well in order to evaluate the risk of secular stagnation in the Eurozone, a contemporary estimate of the natural real rate has been obtained. The chosen methodology was that of Basdevant, Björksten and Karagedikli (2004). Implementing a rational expectation hypothesis, these authors define the real interest rate gap as the term premium in time *t* as compared to the average term premium over the entire period:

$$\tilde{r}_t^N = i_t^S - i_t^L - (\overline{i^S} - \overline{i^L}), \tag{1}$$

where i_t^S and i_t^L are the short-term (3-month) and the long-term nominal interest rates, respectively, and $\overline{i^S}$ and $\overline{i^L}$ are the average rates over the entire period. The *N* in the exponent of the real interest rate gap has been added in order to distinguish it from a second measure which was derived at a later point of the analysis. In a subsequent step, the natural real rate

[22] Crespo Cuaresma et al. (2005) apply the estimation methodology of a number of other scholars on Eurozone data for the years 1999-2005. They show that, while the choice of an identical time horizon and comparable underlying data may correct for some variation, the different methods still deliver strongly divergent results.

[23] These authors, while not explicitly focusing on the Eurozone, estimate its natural real rate alongside those of Canada, Japan, the United Kingdom, the United States, Sweden, and Switzerland. They conclude that the Eurozone's natural real rate has indeed become negative following the year 2010.

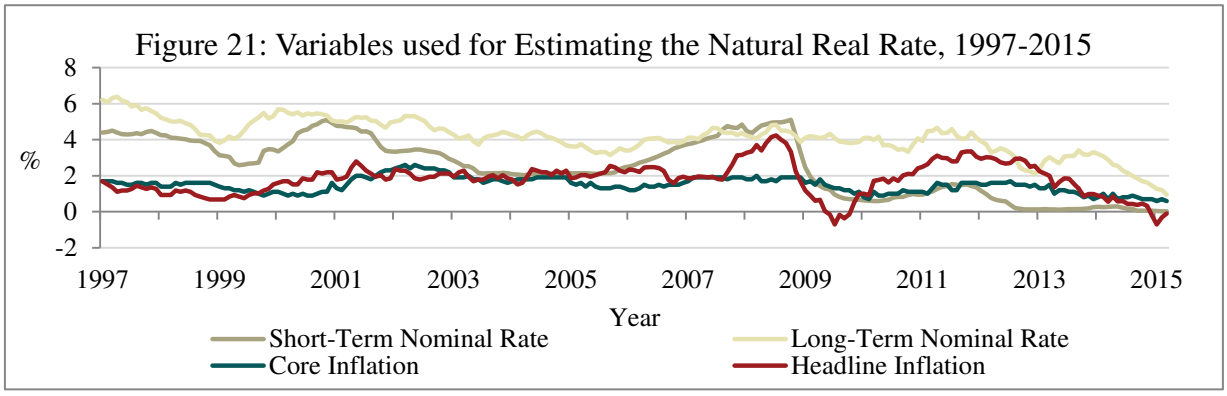
was constructed by subtracting both the real interest rate gap and expected inflation one year ahead from the short-term nominal rate:

$$r_t^N = i_t^S - \tilde{r}_t^N - \pi_t^e \qquad (2)$$
$$= i_t^L - (\bar{i}^L - \bar{i}^S) - \pi_t^e,$$

with π_t^e being the 12-month ahead inflation expectations formed in period t. The idea behind equation (2) is that a simultaneous shift in the long-term and the short-term rate may be interpreted as a shift in the natural real rate if inflation is low and stable (provided that cyclical fluctuations are accounted for). Monthly data on i_t^S and i_t^L has been obtained from the OECD (2015) for the time period from 01/1995 to 03/2015 (T=243).[24] Unfortunately, reliable and comprehensive monthly data on inflation expectations was not available, but Garnier and Wilhelmsen (2005) argue that actual inflation may be taken as a proxy if the observation period is sufficiently large and fluctuations are not extreme. Hence, the following assumption – which was subject to a subsequent sensitivity analysis (see Section 3.2.3) – was made for all subsequent estimations:

$$\pi_t^e = \pi_t. \qquad (3)$$

Information on harmonized inflation and core inflation[25] was taken from Eurostat (2015), which reduced the time period to 01/1997-03/2015 (T=219). Figure 21 summarizes the variables used in the subsequent analysis:



Source: Eurostat (2015), OECD (2015)

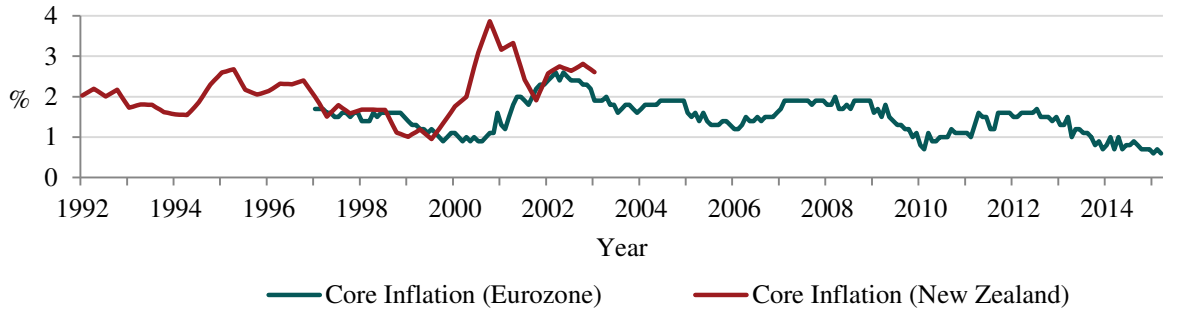
Initially, a choice had to be made concerning the most suitable measure of inflation. As mentioned earlier, Basdevant et al. (2004) consider their methodology as appropriate for observation periods with low and stable inflation. Hence, core inflation was preferred since it exhibited a much lower mean (1.49 vs. 1.81), range (2.00 vs. 4.93) and standard deviation (0.43 vs. 0.90) compared to headline inflation, which is also in line with the recommendations

[24] 01/1995 was chosen as a starting point for the analysis in order to allow for comparisons with earlier studies (see Figure 20).

[25] The overall index excluding food, energy, alcohol and tobacco.

of Crespo Cuaresma et al. (2004). In Figure 22, the Eurozone's core inflation for the years 1997-2015 is compared to New Zealand's core inflation for the years 1992-2003 (the data range chosen by Basdevant et al. 2004):

Figure 22: Core Inflation in New Zealand and the Eurozone, 1992-2015



Source: Eurostat (2015), Statistics New Zealand (2015)

When comparing both measures for the given observation period, the core inflation rate displayed a higher mean (2.08 vs. 1.49), range (2.92 vs. 2.00), and standard deviation (0.62 vs. 0.43) for New Zealand than for the Eurozone. As Basdevant et al. (2004) considered their measure of inflation to be sufficiently low and stable, it was taken that the Eurozone's core inflation rate – which was both lower and less volatile – justified the implementation of the chosen methodology.

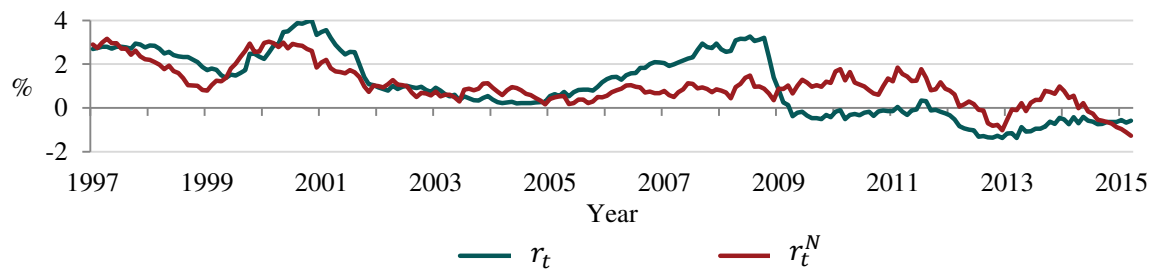
Based on the data displayed in Figure 21, the natural real rate of interest r_t^N was calculated from an average yield curve spread using equation (2) and (3). It was then compared to the real rate of interest r_t, which was calculated by subtracting core inflation from the short-term nominal rate:

$$r_t = i_t^S - \pi_t. \tag{4}$$

As shown by Figure 23, it was found that both interest rates followed a similar pattern between 1997 and 2005. From early 2005 onwards, the real interest rate increased from 0.54% to 3.21% in October 2008, after which it experienced a sharp drop into the negative territory. The natural real rate, on the other hand, increased from 0.16% in 2005 to 1.85% in early 2011.[26] Subsequently, it dropped into the negative territory as well where, apart from an upturn in 2013/14, it was still located as of 03/2015. Hence, Figure 23 provides some support for the proposition of a negative natural real rate of interest in the Eurozone.

[26] This may seem surprising, as many of the economic hardships associated with the Great Recession (such as the deleveraging shock, see Figure 13) had already set in following the year 2008. However, it could also indicate that the natural real rate is less sensitive to short-term developments when calculated from the framework developed by Basdevant et al. (2014).

Figure 23: Time-Varying Natural Rate for the Eurozone, 1997-2015



Source: Author's calculations following Basdevant et al. (2004); based on data provided by Eurostat (2015) and the OECD (2015)

However, before discussing the relevance of these results for the Eurozone's monetary policy, a more robust estimate of r_t^N was obtained by implementing a Kalman filter (as recommended by Basdevant et al. 2004). This filter was applied on the initial estimates by allowing both the natural real interest rate and the yield curve spread to fluctuate. The signal (observed) equations of the model were defined as

$$i_t^S = r_t^N + \pi_t + \varepsilon_{1,t} \tag{5}$$

$$i_t^L = r_t^N + \alpha_t + \pi_t + \varepsilon_{2,t}, \tag{6}$$

and the state (unobserved) equations were given as

$$r_t^N = r_{t-1}^N + \varsigma_{1,t} \tag{7}$$

$$\alpha_t = \delta_0 + \delta_1 \alpha_{t-1} + \varsigma_{2,t}, \tag{8}$$

with r_t^N following a random walk and α_t, which denotes a term premium, following an AR(1) process. An important distinction has been made compared to Basdevant et al. (2004): whereas these authors considered expected inflation to be constant over the entire period, assuming a time-varying rate was deemed more justifiable in the case of the Eurozone. Expected inflation was then proxied by actual inflation as described in equation (3). In its state-space form, the estimation framework was expressed as

$$\begin{pmatrix} i_t^S \\ i_t^L \end{pmatrix} = \begin{pmatrix} \beta_1 & 0 & \beta_2 \\ \beta_3 & \beta_4 & \beta_5 \end{pmatrix} \begin{pmatrix} r_t^N \\ \alpha_t \\ \pi_t \end{pmatrix} + \begin{pmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \end{pmatrix} \tag{9}$$

and

$$\begin{pmatrix} r_t^N \\ \alpha_t \end{pmatrix} = \begin{pmatrix} \beta_6 & 0 & 0 \\ 0 & \beta_7 & \delta_1 \end{pmatrix} \begin{pmatrix} r_{t-1}^N \\ \delta_0 \\ \alpha_{t-1} \end{pmatrix} + \begin{pmatrix} \varsigma_{1,t} \\ \varsigma_{2,t} \end{pmatrix}. \tag{10}$$

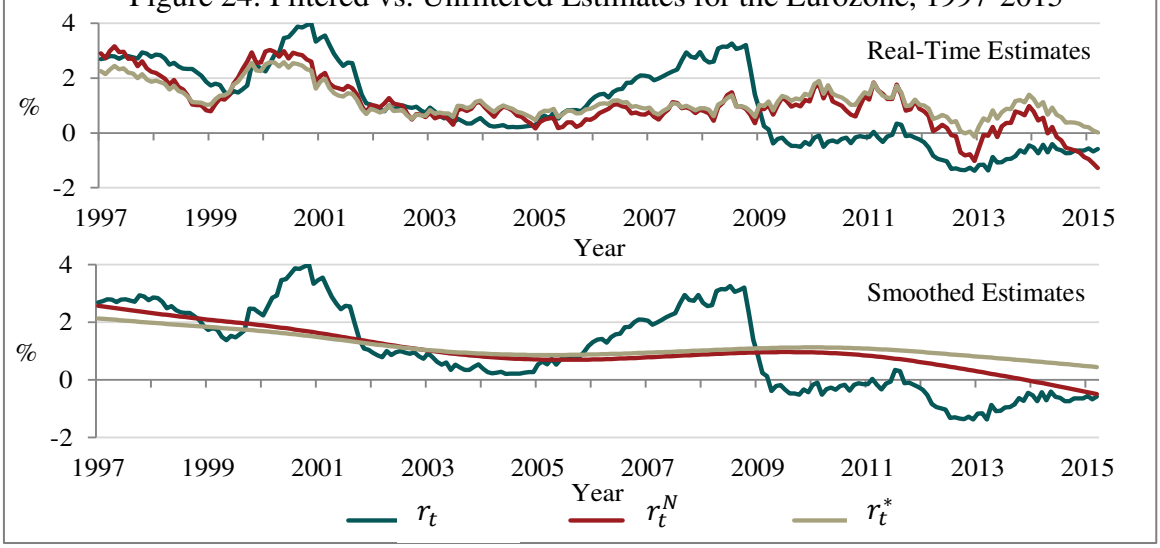
The resulting estimates were not altered significantly by different assumptions on δ_0 and δ_1, but constraining them jointly at 0 led to a much better convergence of the model. Therefore, the term premium was assumed to be constant over the entire period of

observation. For comparison, the resulting real-time estimates were smoothed using a Hodrick-Prescott (HP) Filter which removed the trend component τ_t from r_t^N by solving:[27]

$$\min_{\tau}\left(\sum_{t=1}^{T}(r_t^N-\tau_t)^2+\lambda\sum_{t=2}^{T-1}[(\tau_{t+1}-\tau_t)-(\tau_t-\tau_{t-1})]^2\right). \tag{11}$$

As recommended for monthly data (Ravn and Uhlig 2002), λ was set equal to 129,000. Figure 24 compares the filtered estimates of the natural real rate to the previously obtained unfiltered estimates. In order to distinguish it from the previously calculated r_t^N, the natural real rate obtained from the Kalman filter methodology has been denoted as r_t^*.

Figure 24: Filtered vs. Unfiltered Estimates for the Eurozone, 1997-2015



Source: Author's calculations following Basdevant et al. (2004); based on data provided by Eurostat (2015) and the OECD (2015)

Both the filtered and unfiltered estimates generally followed the same path during the entire observation period. At the same time the filtered estimates were, on average, higher than the unfiltered ones (1.16% vs. 1.03%). This was even more profound if only the time since the onset of the 'Great Recession' was considered: for the time period from 01/2008 to 03/2015, the average value of the filtered estimates was 0.94%, compared to 0.57% for the unfiltered ones. Based on these findings, the estimated values for r_t^* were used as a benchmark for evaluating the threat of secular stagnation in the Eurozone, instead of the less robust and conservative estimates of r_t^N. These results show that the Eurozone's natural real rate has indeed decreased in recent years, just as proposed by Summers (2014a) and indicated by a number of economic developments (see Section 2.3). Hence, the findings of the present section deliver valuable insights on the threat of secular stagnation in the Eurozone.

[27] For a detailed description, see the original paper of Hodrick and Prescott (1997). The notation was taken from Gerdesmeier and Roffia (2003).

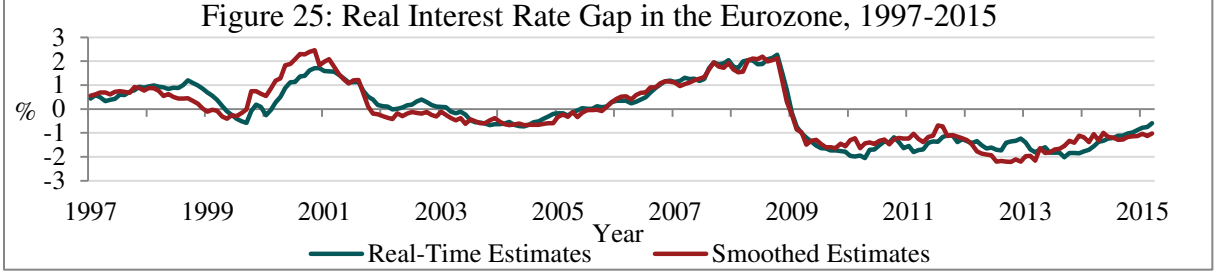
3.1.3 Implications for the Discussion on Secular Stagnation in the Eurozone

As has been laid out in Section 2.2, Summers' (2014a, 2014b) definition of secular stagnation is directly linked to developments of the natural real rate. If this rate drops into negative territory and the actual real rate – constrained by low inflation and the zero lower bound on nominal rates – cannot fall below the natural rate, this could lead the economy into a trap of permanent depression. Hence, conclusions on the threat of secular stagnation for the Eurozone require an investigation of the real interest rate gap, which is defined as

$$\tilde{r}_t^* = r_t - r_t^*. \tag{12}$$

In the previous section, it has been shown that the Eurozone's natural real rate experienced a significant decline since the beginning of the Great Recession. Despite this decline, however, r_t^* was found to be still larger than 0 as of 2015, while r_t had almost continuously been below 0 since the year 2009. Consequently, the author's calculations (both real-time and smoothed) suggest that the real interest rate gap has been negative during the past 6 years:

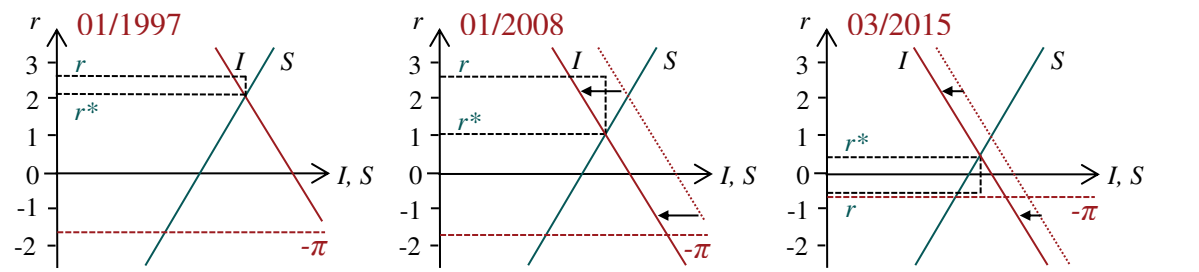
Figure 25: Real Interest Rate Gap in the Eurozone, 1997-2015



Source: Author's calculations following Basdevant et al. (2004); based on data provided by Eurostat (2015) and the OECD (2015)

According to the Hansen-Summers definition of secular stagnation, a permanently positive real rate gap constitutes a necessary premise for the occurrence of this phenomenon (Pedersen 2015). Figure 25 clearly shows that this condition has not been met in recent years. Hence, the decrease in the Eurozone's natural real rate and the zero lower bound on its short-term interest rate have not led to a scenario where conventional monetary policy would become inefficient. This is highlighted by Figure 26, which translates the author's findings into a simple loanable funds model:

Figure 26: The Threat of Secular Stagnation in the Eurozone (Author's Estimates)



Source: Author's illustration following Krugman (2000) and Summers (2014a); based on the author's calculations

From 1997 to 2015, the demand for loanable funds has declined, as represented by the leftward shift of the *I*-curve. The natural real rate, which equates savings and investment under full employment, was driven down as a result.[28] Following the year 2008, the reduction of the short-term interest rate to the zero lower bound led to a sharp drop in the real rate. This was partly offset by a corresponding decrease in core inflation, which fell from 1.8% to 0.6%. As of 03/2015, the (smoothed) natural real rate had decreased to 0.45%, down from 2.14% in 01/1997. Neither did the *I*-curve and the *S*-curve intersect in the negative area, nor was the natural real rate driven below the actual real rate (in fact, it was still located more than one percentage point above the actual real rate).

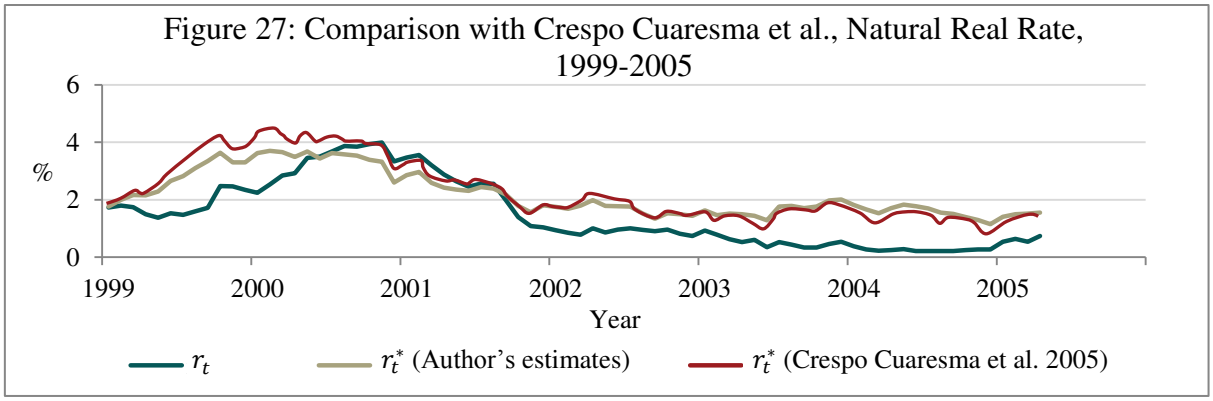
As a conclusion, the author's estimates of the Eurozone's natural real rate deliver three important implications. Firstly, the natural real rate has indeed declined in recent years and was much lower in 2015 compared to the year 2005 (see Figure 24). Secondly, this decline was associated with a decrease in core inflation and a reduction of the short-term interest rate to the zero lower bound, which are two important premises for the occurrence of secular stagnation. But thirdly (and most importantly), the decline in the natural real rate was by no means sufficient to fulfill the criteria of a permanently positive real rate gap. As a result, it was concluded that the threat of secular stagnation (as defined by Summers 2014a) was not imminent for the Eurozone as of 2015. Since this conclusion is in contrast to the proposition of Summers (2014a, 2014b), a number of robustness checks have been conducted in order to test for the adequacy of the author's results.

3.2 Robustness Checks

3.2.1 Comparison with Existing Studies

As a first robustness check, the estimates obtained in Section 3.1 were compared to the existing literature on the Eurozone's natural real rate. Self-evident first candidates for comparison were the estimates of Crespo Cuaresma et al. (2005), who applied the same framework on Eurozone data for the years 1999-2005. To this end, the calculations were repeated using only data for this shorter time period, and the results closely matched those of Crespo Cuaresma et al. (2005):

[28] To be precise, downward pressures on the natural real rate may not only stem from a decrease in the demand for loanable funds, but also from an increase in the supply (a rightward shift of the *S*-curve). While the exact shifts of both curves are unknown, it can be expected that neither of them has remained unaltered during the recent 18 years, and that the decrease in the natural real rate was likely to be associated with shifts in both curves. As Summers (2014a) has identified demand shortages as the main driver of secular stagnation, Figure 26 relates the drop in the natural real rate only to a leftward shift in the *I*-curve – but it has to be kept in mind that this is likely to represent only a simplified illustration of the actual development.



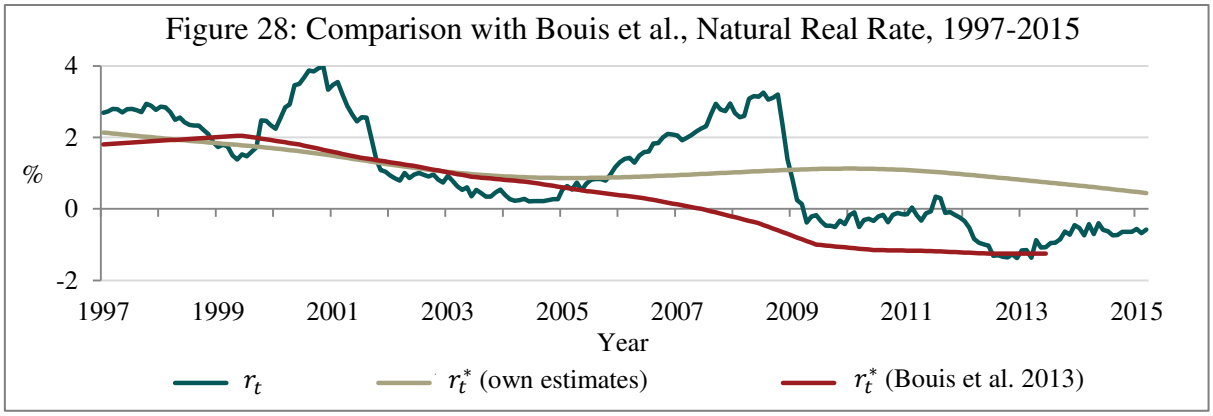
Source: Crespo Cuaresma et al. (2004) and author's calculations following Basdevant et al. (2004); based on data provided by Eurostat (2015) and the OECD (2015

As deviations between both estimates of r_t^* were small and may be attributed to differences in the underlying data, it was taken that the author's calculations were an accurate implementation of the framework provided by Basdevant et al. (2004).

Following this, it was investigated whether the results of Section 3.1 also bear comparison with those derived from different estimation methods. For this purpose, they were compared to a range of estimates provided by other scholars (see Figure 20) for the years 1997 (the first observation point in the author's data) to 2005. It was found that the resulting estimates for r_t^* – a decline in the natural real rate from 2.25% to 1.56% – lay within the range of the findings reported by Benati and Vitale (2007), Browne and Everett (2007), Crespo Cuaresma et al. (2004), Garnier and Wilhelmsen (2005), and Mésonnier and Renne (2007). Hence, it was concluded that the author's calculations delivered a convenient approximation of the Eurozone's natural real rate until the year 2005.

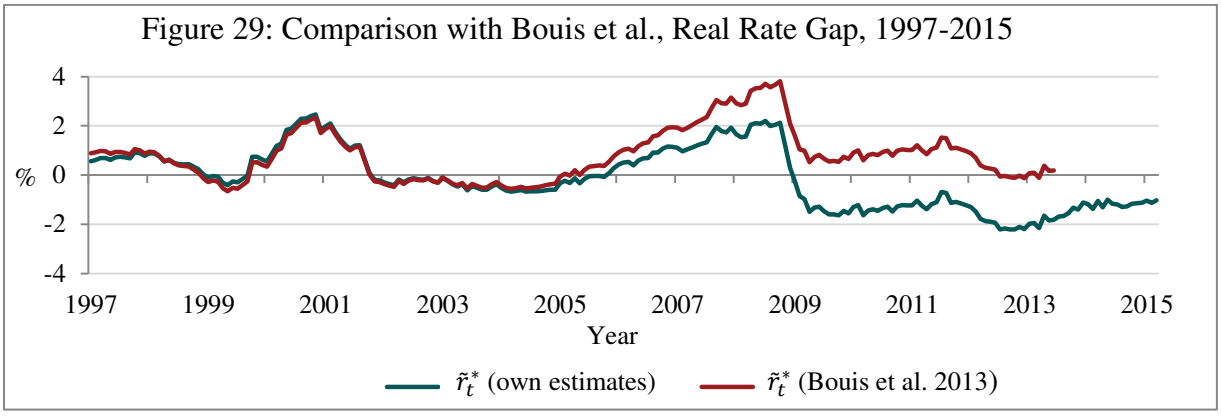
However, the evaluation of the current threat of secular stagnation in the Eurozone depends on the development of the natural real rate after 2005, especially since the onset of the Great Recession. As has been mentioned earlier, information on this matter is scarce. Figure 28 compares the results of Section 3.1 to the only available contemporary estimates (to the knowledge of the author), which are those published by Bouis et al. (2013) and updated by Rawdanowicz et al. (2014).[29] As can be seen from Figure 28, both estimates of r_t^* closely followed the same path until the year 2005. Afterwards, however, they rapidly diverged, with the natural real rate reported by Bouis et al. (2013) sharply dropping into the negative territory:

[29] As the dataset used in Bouis et al. (2013) and Rawdanowicz et al. (2014) was not publicly available, the information was taken from the charts provided by these authors. Hence, the data provided by Figures 28 and 29 might deviate a little from the 'true' results obtained by these authors. However, these differences can be expected to be only marginal and do not alter the conclusions drawn from Figure 28 and 39.



Source: Bouis et al. (2013), Rawdanowicz et al. (2014) and author's calculations following Basdevant et al. (2004); based on data provided by Eurostat (2015) and the OECD (2015)

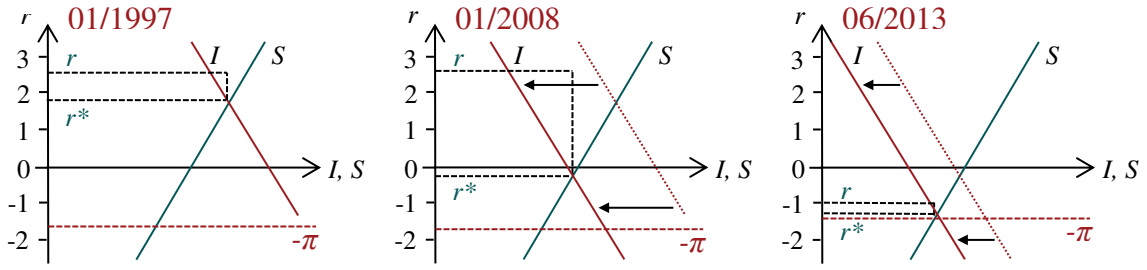
The differences are particularly distinctive following the year 2009: while the author's calculations suggest that r_t^* was permanently larger than r_t, Bouis et al. (2013) report that the natural real rate was almost exclusively located *below* the actual real rate. This may have important implications for the debate on secular stagnation, which – as has been laid out in Section 2.2 – critically depends on the real rate gap:



Source: Bouis et al. (2013), Rawdanowicz et al. (2014) and author's calculations following Basdevant et al. (2004); based on data provided by Eurostat (2015) and the OECD (2015)

In contrast to the author's estimates, the results offered by Bouis et al. (2013) indeed suggest a positive real rate gap since the year 2005, interrupted only from a slight drop into the negative territory in 2012/13. These estimates lead to very different implications compared to those of the author, which have dismissed the threat of secular stagnation under current circumstances (see Section 3.1.3). Rawdanowicz et al. (2014) argue that the results reported by Bouis et al. (2013) may indeed imply that "the decline in interest rates to close to zero may not be giving sufficient stimulus", leading to "a risk that a secular stagnation scenario may become entrenched in the euro area." An illustration of this risk is provided by Figure 30:

Figure 30: The Threat of Secular Stagnation in the Eurozone (Bouis et al.)



Source: Author's illustration following Krugman (2000) and Summers (2014a); based on data provided by Bouis et al. (2013) and Rawdanowicz et al. (2014)

As of mid-2013 (the last observation point in the updated estimates of Rawdanowicz et al. 2014), the Eurozone's natural real rate had become significantly negative. However, even with a nominal interest rate close to the zero lower bound, this did not fulfill the conditions of secular stagnation as the natural real rate was still narrowly located above the inverted inflation rate. But taking into account that the core inflation rate has fallen to 1.0 as of 09/2015, the Eurozone may indeed have entered what Summers (2014a) has defined as secular stagnation, provided that the estimates of Bouis et al. (2013) were correct and that the natural real rate has not increased since then. Any further discussion of these findings would hence require a contemporary update of these author's findings.

This discrepancy between the author's findings and those of Bouis et al. (2013) can largely be attributed to differences in the estimation methods.[30] The sharp drop in the natural real rate of Bouis et al. (2013) is mainly related to a decline in the growth rate of potential GDP (Rawdanowicz et al. 2014), which is not reflected in the author's estimates. In addition, the results of Bouis et al. (2013) are subject to at least three sources of uncertainty: to the statistical properties of their Kalman filter calculations, to the OECD's estimates of potential output, and to the assumptions taken on the risk aversion coefficient. Provided that the author's estimates are also sensitive to the assumptions taken (as will be discussed in Section 3.2.3), it is difficult to determine which of these estimates of r_t^* are rather correct. Hence, in order to further assess the robustness of the author's results, a correlation analysis has been conducted.

3.2.2 Correlation Analysis

According to Garnier and Wilhelmsen (2005), the Eurozone's real rate gap should be significantly correlated to both the output gap and the inflation rate. As several scholars have reported similar findings, a correlation analysis was conducted on the previously estimated

[30] As has been the case with previous estimates of the Eurozone's natural real rate (see Figure 20).

real rate gap. If the respective correlations would fail to materialize, this could indicate shortcomings of the estimation method chosen in Section 3.1. The first variable to be included in this analysis was the output gap, defined as

$$\tilde{y}_t = (y_t - y_t^*) * 100, \tag{13}$$

where y_t is the logarithm of GDP and y_t^* corresponds to the logarithm of potential GDP. Monthly data on seasonally adjusted GDP was taken from the OECD (2015), based on which equation (13) was estimated using a HP filter with $\lambda = 129{,}000$.[31] The second variable to be included was the inflation gap, which corresponds to the deviation of actual inflation from the inflation target:

$$\tilde{\pi}_t = \pi_t - \pi_t^T. \tag{14}$$

Information on core inflation was taken from Eurostat (2015), and the inflation target was set equal to two, as has been communicated by the ECB.[32] Finally, as has been recommended by scholars such as Larsen and McKeown (2004), the unemployment gap was included as a second measure of economic slack. It was defined as

$$\tilde{u}_t = u_t - u_t^*, \tag{15}$$

where u_t is the unemployment rate and u_t^* represents the non-accelerating inflation rate of unemployment (NAIRU). As in the case of the output gap, monthly data on the Eurozone's' unemployment rate has been taken from the OECD (2015), based on which $\tilde{u}_t$ was derived from a HP filter with $\lambda = 129{,}000$.[33] Figure 31 displays the variables used in the analysis. As can be seen, the permanent drop of the real rate gap in 2008 coincided with a decrease of the inflation gap and output gap and an increase of the unemployment gap. This indicates that the variables were subject to different dynamics after the financial crisis and the beginning of the Great Recession (albeit to a varying degree).

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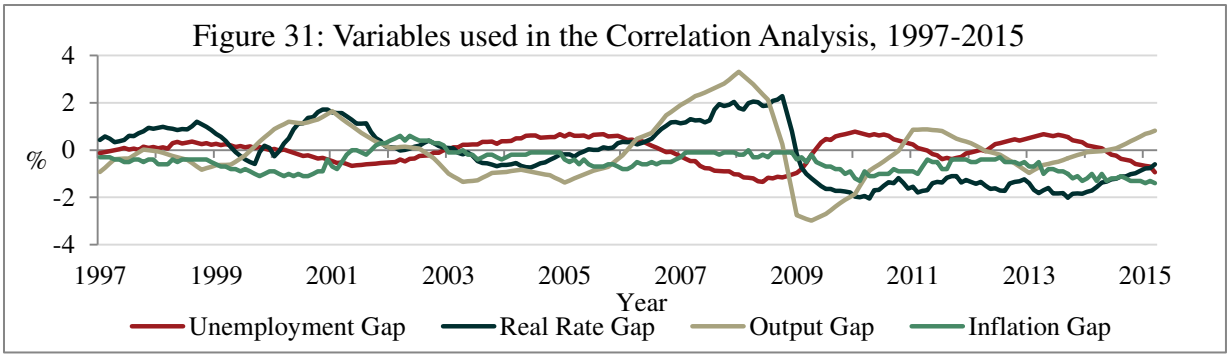
[31] As has been pointed out by Krugman (2012) and Williamson (2012), it is important to concede that the HP filter is nothing more than a trend line fit to the underlying data. Although it is widely used for calculating an economy's potential, its results are based on a purely statistical measure irrespective of any economic assumptions. However, as no alternative measure for the Eurozone's output gap was available on a monthly basis, the HP filter was implemented despite this shortcoming. In order to check for the suitability of this approach, a quarterly measure for the Eurozone's output gap was derived using a HP filter with λ=1,600 and compared to the OECD's (2015) estimate of the output gap (which is also available on a quarterly basis). The resulting Pearson correlation coefficient was 0.54 ($p<0.001$), indicating a moderate positive correlation according to the rule of thumb provided by Hinkle, Wiersma and Jurs (2003). Therefore, the use of the HP filter was deemed to produce an appropriate proxy for the Eurozone's output gap.

[32] As the inflation target was constant over the entire observation period, the resulting Pearson correlations had been identical if core inflation had been included instead of the inflation gap measure.

[33] Comparably to the output gap (see Footnote 31), the OECD (2015) only offered quarterly data on the NAIRU, which were compared to quarterly estimates extracted from a HP filter with λ=1,600. Both measures were found to be moderately correlated with a Pearson coefficient of 0.53 ($p<0.001$). Based on this, the measure derived from the HP filter was considered as a reasonable approximation for the Eurozone's unemployment gap.



Source: Author's calculations; based on data provided by Eurostat (2015) and the OECD (2015)

This is further confirmed by Table 2, which provides mean values and standard deviations (SD) for the variables included in the analysis. It was found that all four variables displayed a lower mean for the time period from 2008 to 2015. In addition to that, all variables except the inflation gap were also found to be more volatile (as indicated by a higher standard deviation) for this period:[34]

Table 2: Statistical Properties of the Variables used in the Correlation Analysis

	1997-2015		1997-2007		2008-2015	
	Mean	SD	Mean	SD	Mean	SD
$\tilde{r}_t^*$	-0.125	1.171	0.452	0.700	-1.001	1.201
$\tilde{y}_t$	0.000	1.234	0.115	1.116	-0.174	1.384
$\tilde{\pi}_t$	-0.512	0.429	-0.367	0.398	-0.731	0.382
$\tilde{u}_t$	0.000	0.512	0.025	0.425	-0.038	0.622
T	219	219	132	132	87	87

Source: Author's calculations; based on data provided by Eurostat (2015) and the ECB (2015)

Consequently, the correlation analysis was conducted for the entire observation period as well as for the two sub periods. Doing so allowed to control for possible changes in the relationships among the variables following the financial crisis and the onset of the Great Recession. Table 3 provides Pearson correlations between real rate gap, output gap, unemployment gap and inflation gap. As the real rate gap has also been shown to be a useful indicator for *future* inflation (Neiss and Nelson 2003), the 12-month ahead inflation gap was included in the analysis as well. The Pearson correlation coefficients were evaluated using the rules of thumb suggested by Hinkle, Wiersma and Jurs (2003).

Table 3: Main Results of the Correlation Analysis

		$\tilde{r}_t^*$	$\tilde{y}_t$	$\tilde{\pi}_t$	$\tilde{\pi}_{t+12}$	$\tilde{u}_t$
1997-2015 (T=219)	$\tilde{r}_t^*$	1.000				
	$\tilde{y}_t$	0.566 ***	1.000			
	$\tilde{\pi}_t$	0.429 ***	0.069	1.000		
	$\tilde{\pi}_{t+12}$	0.527 ***	0.495 ***	0.400 ***	1.000	
	$\tilde{u}_t$	-0.588 ***	-0.636 ***	-0.316 ***	-0.402 ***	1.000

[34] For the observation period as a whole, both the output and the unemployment gap were centered around 0 as they had been derived from a HP filter.

Table 3 (continued)										
1997-2007 (T=132)		$\tilde{r}_t^*$		$\tilde{y}_t$		$\tilde{\pi}_t$		$\tilde{\pi}_{t+12}$		$\tilde{u}_t$
	$\tilde{r}_t^*$	1.000								
	$\tilde{y}_t$	0.766	***	1.000						
	$\tilde{\pi}_t$	-0.094		-0.077		1.000				
	$\tilde{\pi}_{t+12}$	0.391	***	0.479	***	0.290	***	1.000		
	$\tilde{u}_t$	-0.681	***	-0.788	***	-0.323	***	-0.601	***	1.000
2008-2015 (T=87)		$\tilde{r}_t^*$		$\tilde{y}_t$		$\tilde{\pi}_t$		$\tilde{\pi}_{t+12}$		$\tilde{u}_t$
	$\tilde{r}_t^*$	1.000								
	$\tilde{y}_t$	0.544	***	1.000						
	$\tilde{\pi}_t$	0.579	***	0.153		1.000				
	$\tilde{\pi}_{t+12}$	0.294	*	0.564	***	0.255	*	1.000		
	$\tilde{u}_t$	-0.859	***	-0.536	***	-0.449	***	-0.334	**	1.000

Source: Author's calculations; based on data provided by Eurostat (2015) and the ECB (2015);
**** p<.001, ** p<.01, * p<.05, $^{+}$p<.1*

Initially, correlations among unemployment gap, output gap, and inflation gap were examined in order to further evaluate the appropriateness of the HP filter in constructing the measures of economic slack. The correlation between output and unemployment gap ranged from moderately to highly negative. This reflects the well documented tradeoff between unemployment and losses in a country's GDP (Okun 1962). At the same time, both the present and the future inflation gap were positively related to the output gap and negatively correlated with the unemployment gap, as suggested by the Phillips curve.[35] These results were taken as further indication for the appropriateness of the measures derived from a HP filter.

The real rate gap was found to be significantly correlated with all other variables for the observation period as a whole. It showed a moderate and positive correlation with the output gap and both the present and the future inflation gap, as well as a moderate and negative correlation with the unemployment gap. In the case of the two sub periods, the correlation with both the present inflation gap and the unemployment gap was stronger for the years 2008-2015. The correlation with the output gap and future inflation was more pronounced for the years 1997-2007. Hence, as suggested by Garnier and Wilhelmsen (2003), Table 3 confirms that the previously estimated real rate gap was significantly related to the measures of economic slack and to both previous and future inflation.

[35] Lately, a significant number of scholars have expressed doubts about the usefulness of the Phillips curve in forecasting inflation. For example, Atkeson and Ohanian (2001) ascribe an "inability to accurately forecast inflation" to the Phillips curve for the business cycle on which they base their research. Stock and Watson (1999) and Orphanides and Van Norden (2005) point to the unreliability of estimates of both the output gap and the NAIRU, and Stock and Watson (2009) demonstrate how inflation forecasts are much more precise for periods during which economic slack is substantial, as compared to 'normal' periods. However, as the present analysis did not attempt to construct a precise measure for inflation forecasting, but was only concerned with investigating the sign, significance and approximate size of the coefficients, it was argued that these concerns should not significantly alter the results of this section.

As the real rate gap was found to be significantly correlated with the future inflation gap, it was decided to further explore this relationship. Following Neiss and Nelson (2003), correlations were extracted for a variety of lags in order to determine the informative value of the real rate gap in forecasting inflation. Table 4 provides Pearson correlations between $\tilde{r}_t^*$ and $\tilde{\pi}_{t+k}$ at different values of *k*:

Table 4: Correlation between $\tilde{r}_t^*$ and $\tilde{\pi}_{t+k}$ at Different Values of *k*					
	$\tilde{r}_t^*$		$\tilde{r}_t^*$		$\tilde{r}_t^*$
$\tilde{\pi}_{t+1}$	0.427 ***	$\tilde{\pi}_{t+10}$	0.549 ***	$\tilde{\pi}_{t+20}$	0.305 ***
$\tilde{\pi}_{t+1}$	0.457 ***	$\tilde{\pi}_{t+11}$	0.539 ***	$\tilde{\pi}_{t+21}$	0.272 ***
$\tilde{\pi}_{t+2}$	0.479 ***	$\tilde{\pi}_{t+12}$	0.527 ***	$\tilde{\pi}_{t+22}$	0.241 ***
$\tilde{\pi}_{t+3}$	0.499 ***	$\tilde{\pi}_{t+13}$	0.507 ***	$\tilde{\pi}_{t+23}$	0.214 **
$\tilde{\pi}_{t+4}$	0.518 ***	$\tilde{\pi}_{t+14}$	0.482 ***	$\tilde{\pi}_{t+24}$	0.187 **
$\tilde{\pi}_{t+5}$	0.532 ***	$\tilde{\pi}_{t+15}$	0.454 ***	$\tilde{\pi}_{t+25}$	0.158 *
$\tilde{\pi}_{t+6}$	0.548 ***	$\tilde{\pi}_{t+16}$	0.427 ***	$\tilde{\pi}_{t+26}$	0.132 †
$\tilde{\pi}_{t+7}$	0.553 ***	$\tilde{\pi}_{t+17}$	0.401 ***	$\tilde{\pi}_{t+27}$	0.114
$\tilde{\pi}_{t+8}$	0.555 ***	$\tilde{\pi}_{t+18}$	0.371 ***	$\tilde{\pi}_{t+28}$	0.104
$\tilde{\pi}_{t+9}$	0.554 ***	$\tilde{\pi}_{t+19}$	0.339 ***	$\tilde{\pi}_{t+29}$	0.100

Source: Author's calculations; based on data provided by Eurostat (2015) and the ECB (2015);
**** p<.001, ** p<.01, * p<.05, † p<.1*

It was found that the real rate gap was positively correlated with the inflation gap at the 1% level for lags of up to 2 years. The strength of the correlation increased until *k*=8, after which it continuously dropped in size and significance with each additional lag. For k>25, the correlation became insignificant at the 5% level. Comparably to Garnier and Wilhelmsen (2005), the following relationship was subsequently investigated:

$$\tilde{\pi}_t = \beta_0 + \beta_1 \tilde{\pi}_{t-1} + \beta_2 \tilde{r}_{t-k}^* + \varepsilon_t. \tag{16}$$

Using Ordinary Least Squares (OLS) regression, equation (16) was estimated for different values of *k*. The results are displayed in Table 5:

Table 5: The Real Rate Gap as a Predictor of Future Inflation						
	k=1	*k*=2	*k*=3	*k*=4	*k*=5	*k*=6
β_0	-0.038 *	-0.039 *	-0.039 *	-0.040 *	-0.040 *	-0.041 **
β_1	0.929 ***	0.929 ***	0.927 ***	0.926 ***	0.925 ***	0.923 ***
β_2	0.022 *	0.022 *	0.022 *	0.022 *	0.022 *	0.023 *
R^2	0.899	0.899	0.898	0.898	0.898	0.899
	k=6	*k*=8	*k*=9	*k*=10	*k*=11	*k*=12
β_0	-0.039 *	-0.039 *	-0.038 *	-0.036 *	-0.035 *	-0.034 *
β_1	0.928 ***	0.930 ***	0.932 ***	0.935 ***	0.938 ***	0.942 ***
β_2	0.019 †	0.017 †	0.016 †	0.014	0.012	0.010
R^2	0.898	0.898	0.898	0.897	0.897	0.897

Source: Author's calculations; based on data provided by Eurostat (2015) and the ECB (2015);
**** p<.001, ** p<.01, * p<.05, † p<.1*

Similarly to Garnier and Wilhelmsen (2003), it was found that the lagged real rate gap had indeed some predictive power for the future inflation gap. Thus, the analysis confirmed the informative value of the real rate gap in forecasting inflation, which has been suggested by Neiss and Nelson (2003). However, it has to be acknowledged that, after controlling for the influence of the past inflation gap, the coefficients of the real rate gap were small and became less significant for larger values of *k*.

So far, this subsection has demonstrated that the previously estimated real rate gap was significantly related to the output gap, the unemployment gap, and the present and future inflation gap. However, the results also exhibited a certain complicacy: while Garnier and Wilhelmsen (2005), Neiss and Nelson (2003) and Larsen and McKeown (2004) report a negative relationship between the real rate gap and inflation, the author's results suggest the opposite. Likewise, these authors show how their estimates of the real rate gap are negatively related to the output gap and positively related to the unemployment gap – again, this is contrary to what the author's results indicate (see Table 3).

There are several conceivable explanations for this discrepancy. To begin with, it is possible that the present analysis was conducted using improper measures for inflation, output gap, and unemployment gap. In order to test for this, the correlation analysis was repeated using headline inflation rather than core inflation, which did not significantly alter the results. Also, while the author's measures for the output gap and the unemployment gap have to be taken with caution (see Footnote 31 and 33), using more precise measures would surely not lead to a reversion of the signs.

As a second possible explanation, the variation among the different findings could be attributed to differences in the methodology used for estimating the natural real rate. Hence, as a comparative measure, the correlation analysis was repeated based on the natural real rate provided by Bouis et al. (2013) and Rawdanowicz et al. (2014):[36]

Table 6: Repeating the Correlation Analysis on the Estimates of Bouis et al.

		$\tilde{r}_t^*$	$\tilde{y}_t$	$\tilde{\pi}_t$	$\tilde{\pi}_{t+12}$	$\tilde{u}_t$
1997-2013 (T=189)	$\tilde{r}_t^*$	1.000				
	$\tilde{y}_t$	0.672 ***	1.000			
	$\tilde{\pi}_t$	-0.094	0.069	1.000		
	$\tilde{\pi}_{t+12}$	0.248 ***	0.495 ***	0.400 ***	1.000	
	$\tilde{u}_t$	-0.693 ***	-0.636 ***	-0.316 ***	-0.402 ***	1.000

[36] See Footnote 29.

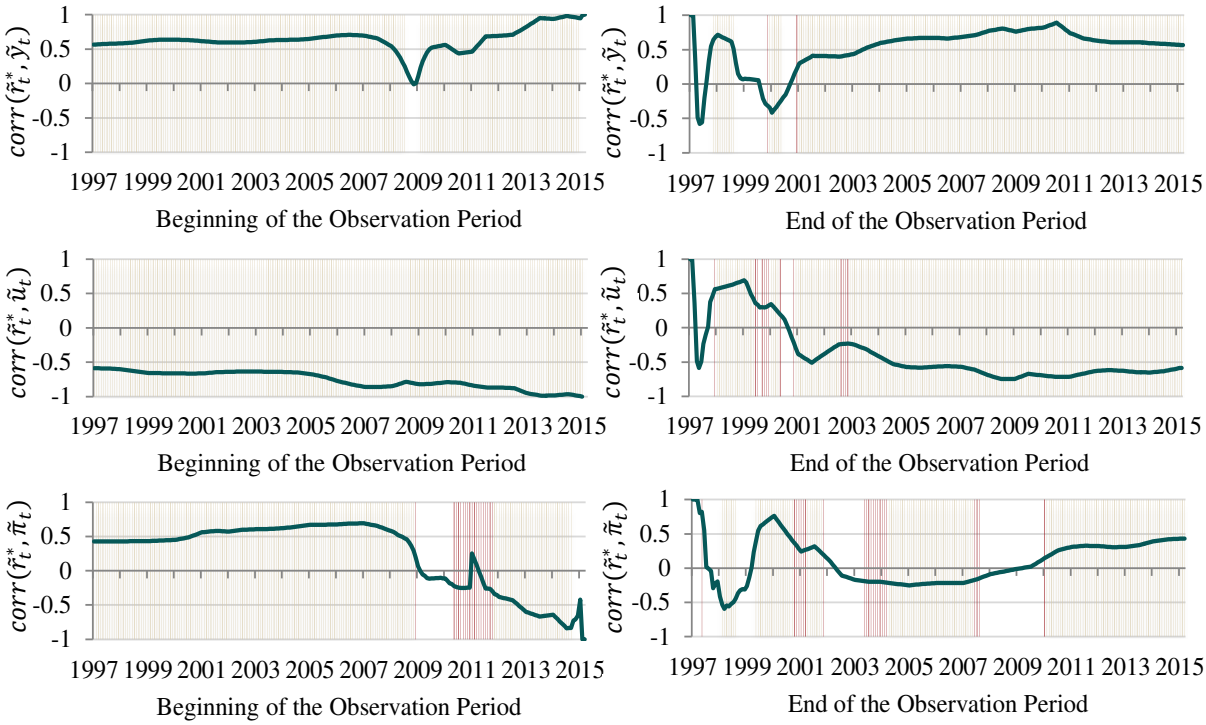
Table 6 (continued)										
1997-2007 (T=132)		$\tilde{r}_t^*$		$\tilde{y}_t$		$\tilde{\pi}_t$		$\tilde{\pi}_{t+12}$		$\tilde{u}_t$
	$\tilde{r}_t^*$	1.000								
	$\tilde{y}_t$	0.866	***	1.000						
	$\tilde{\pi}_t$	-0.265	**	-0.077		1.000				
	$\tilde{\pi}_{t+12}$	0.435	***	0.479	***	0.290	***	1.000		
	$\tilde{u}_t$	-0.590	***	-0.787	***	-0.323	***	-0.601	***	1.000
2008-2013 (T=66)		$\tilde{r}_t^*$		$\tilde{y}_t$		$\tilde{\pi}_t$		$\tilde{\pi}_{t+12}$		$\tilde{u}_t$
	$\tilde{r}_t^*$	1.000								
	$\tilde{y}_t$	0.577	***	1.000						
	$\tilde{\pi}_t$	0.503	***	0.153		1.000				
	$\tilde{\pi}_{t+12}$	0.411	***	0.564	***	0.255	*	1.000		
	$\tilde{u}_t$	-0.856	***	-0.536	***	-0.449	***	-0.334	**	1.000

*Source: Author's calculations; based on data provided by Bouis et al. (2013), Rawdanowicz et al. (2014), Eurostat (2015) and the ECB (2015); *** p<.001, ** p<.01, * p<.05, †p<.1*

As can be seen, the results delivered in Table 6 are very similar to those reported in Table 3. If the Eurozone's natural real rate was calculated using the methodology of Bouis et al. (2013), the resulting real rate gap was positively correlated with the output gap and the future inflation gap and negatively correlated with the unemployment gap. Hence, these findings did not only stem from the estimation method chosen in the author's analysis.

Lastly, the difference in the findings of this paper compared to those of previous authors could result from variations in the underlying data. According to this logic, the results offered in the present study – a positive correlation with the output and the inflation gap and a negative correlation with the unemployment gap – do not indicate that the author's estimates of the real rate gap are wrong. Rather, they could differ simply because previous authors based their calculations on data for different countries (Neiss and Nelson 2003, Larsen and McKeown 2004) or observation periods (Garnier and Wilhelmsen 2005). A similar argument is brought forward by Amato (2005), who finds a positive relationship between the real rate gap and inflation as well and hypotheses that these correlations may strongly be affected by shocks related to externalities or to situations of inefficient supply. He argues that, in such a case, "the correlation between real rate gaps and inflation will be weakened and the sign could even be reversed." In order to demonstrate the sensitivity of the correlation analysis to changes in the observation period, the calculations have been repeated for varying start and end points. The results are displayed in Figure 32:

Figure 32: Pearson Correlations at Different Start and End Points of the Sample



Light brown areas: p<.05, red areas: p<.1, white areas: p>.1; Source: Author's calculations; based on data provided by Eurostat (2015) and the ECB (2015)

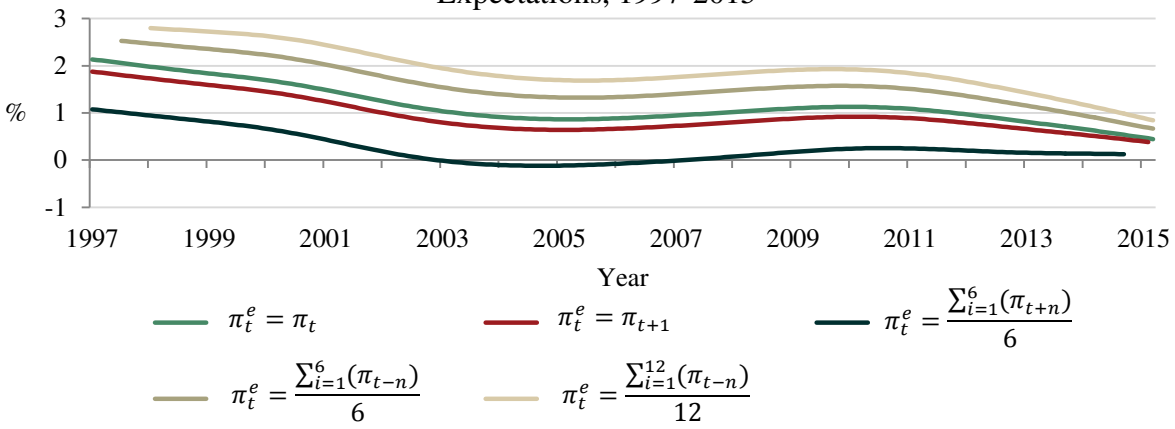
As can be seen, the choice of a different observation period led to changes in the size, the significance, and even the sign of the correlations related to the real rate gap. For instance, if the analysis had been conducted with the final observation point lying between 05/2002 and 02/2009, the results would have suggested a negative correlation between the real rate gap and the inflation gap. This may explain why the implications of the present study differ from those of Garnier and Wilhelmsen (2005), Neiss and Nelson (2003) and Larsen and McKeown (2004). Therefore, the results of the present study were maintained and it was argued that these deviations do not alter the implications for the debate on secular stagnation in the Eurozone.

3.2.3 Sensitivity to the Assumption made on Inflation Expectations

A final robustness check investigated the sensitivity of the chosen method for estimating the natural real rate to the assumption made in equation (3). While r_t and R_t were taken from observed market data, 12-month ahead inflation expectations were assumed to equal core inflation rates in each time period. As this may be considered to be an overly strong assumption, the estimations were repeated using different proxies for inflation expectations. For the first proxy, it was assumed that consumers were rationally expecting the core inflation rate of the next time period. For the second proxy, it was assumed that inflation expectations

were equal to the average core inflation rate of the next 6 months. In the third and fourth proxy, the consumers formed their expectations based on the average core inflation rates of the last 6 and 12 months, respectively. The results are displayed in Figure 33:

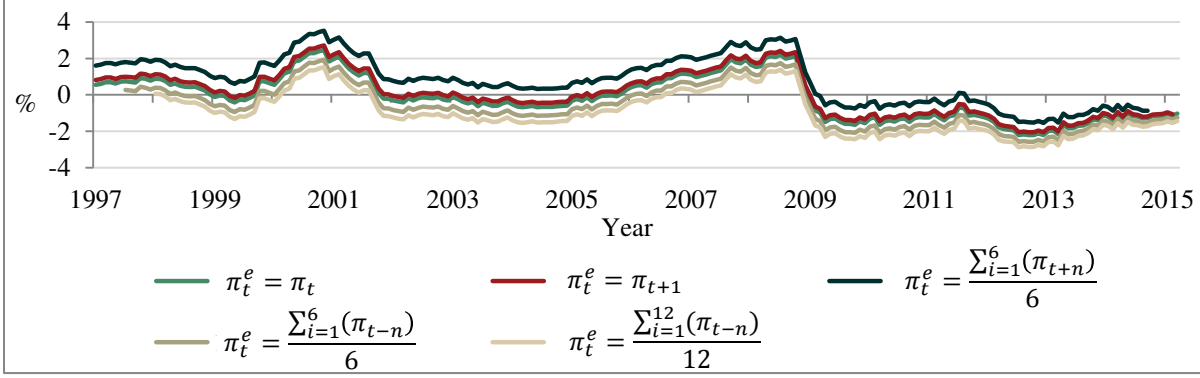
Figure 33: Estimates of the Natural Rate for Different Proxies of Inflation Expectations, 1997-2015



Source: Author's calculations; based on data provided by Eurostat (2015) and the ECB (2015)

It can be seen that the author's estimates of the natural real rate were indeed very sensitive to the assumptions made for expected inflation. If consumers were correctly assuming future core inflation rates, the result was a downward push in the natural real rate. Conversely, if inflation expectations were formed solely on past experience, the resulting estimates were higher. For the entire time period from 1997 to 2015, average values ranged from 0.26% to 1.89%, and for the last common observation period (09/2014), the results ranged from 0.13% to 1.12%. As a consequence, the implementation of different proxies for inflation expectations also led to varying results for the real rate gap:

Figure 34: Estimates of the Real Interest Rate Gap for Different Proxies of Inflation Expectations, 1997-2015



Source: Author's calculations; based on data provided by Eurostat (2015) and the ECB (2015)

If the assumptions made on inflation expectations produced a higher natural real rate, the result was a lower real rate gap (and vice versa). Therefore, these assumptions directly influenced the implications for the debate on secular stagnation in the Eurozone. However, as

can be seen from Figure 34, the results obtained from the different proxies all suggested that the real rate gap had remained negative since the beginning of the Great Recession. Therefore, while acknowledging the sensitivity of the author's estimates, the results of the present section still reject the proposition that the natural real rate has become persistently negative or has even been pushed below the real interest rate since the onset of the crisis.

3.3 Additional Considerations on the Natural Real Rate and Secular Stagnation

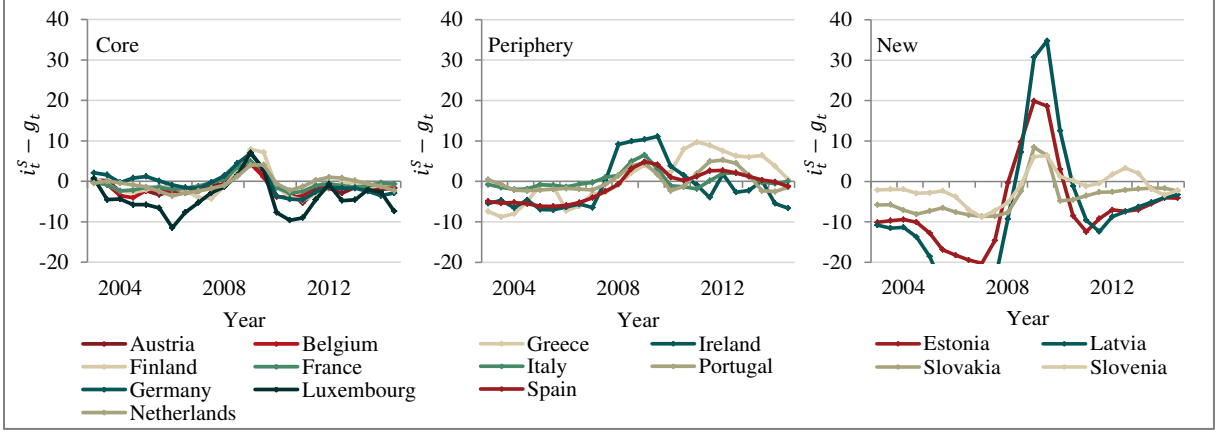
3.3.1 Overaccumulation in the Eurozone

The empirical estimates and robustness checks of Section 3.1 and 3.2 have shown that the Eurozone does not suffer from secular stagnation if the latter is defined as a permanently positive real rate gap coupled with low inflation. However, according to Homburg (2014), the (new) secular stagnation theory proposed by Summers (2014a, 2014b) may also be tested under a slightly altered definition. As has been laid out before (see Figure 4), secular stagnation is characterized by a persistent shortfall of aggregate demand (similar to the 'savings glut' hypothesis, see Bernanke 2015). Homburg (2014) argues that such an overaccumulation of capital can only occur if the interest rate has been pushed below the economy's growth rate. Accordingly, the following condition has to be fulfilled:

$$(i_t^S - g_t) < 0. \tag{17}$$

In order to fully investigate the threat of secular stagnation in the Eurozone, this second definition has been tested as well. The results are displayed in Figure 35:[37]

Figure 35: Nominal Interest Rates (Safe) vs. Growth Rates in the Eurozone, 2003-2014



Source: Authors's calculatons; based on data provided by the OECD (2015)

Beginning with the year 2009, GDP growth rates took a turn for the positive in most Eurozone economies. At the same time, the 3-month interbank offered rates (which were used as a proxy for safe assets following Caballero and Farhi 2014) were continuously reduced. As

[37] No Information was available for Cyprus, Lithuania, and Malta.

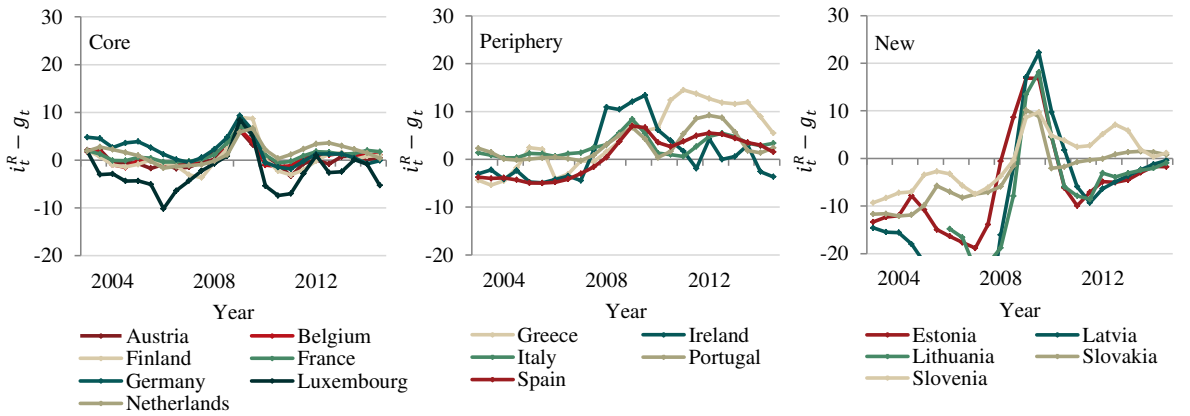
of 2014, the term $(i_t^S - g_t)$ had therefore become negative for every Eurozone member country except Greece. According to this simple indicator, a significant degree of overaccumulation – an essential prerequisite for secular stagnation under the present definition – has indeed taken place in the Eurozone.

However, as shown by Homburg (2014), empirical assessments of overaccumulation may be seriously misleading if they are performed using safe interest rates. Rather, in a world of uncertainty, investment decisions are made based on risky interest rates. Consequently, the overaccumulation condition from equation (17) has been modified to

$$(i_t^R - g_t) < 0. \tag{18}$$

The risky interest rate i_t^R has been proxied using nominal rates on loans to non-financial corporations (ECB 2015).[38] The updated estimates are provided by Figure 36:[39]

Figure 36: Nominal Interest Rates (Risky) vs. Growth Rates in the Eurozone, 2003-2014



Source: Authors's calculations following Homburg (2014); based on data provided by the ECB (2015) and the OECD (2015)

When the calculations were repeated using risky interest rates instead of safe rates, the implications for the Eurozone changed significantly. While Figure 36 generally reports the same cycles compared to Figure 35, the differential between interest and growth rates was found to be negative in only six member countries (Estonia, Germany, Ireland, Latvia, Lithuania, and Luxembourg) as of 2014. In addition, during the preceding years, the differentials were continuously increasing for Germany and the three Baltic states. Hence, it can be concluded that the Eurozone as a whole does not face an acute level of overaccumulation.

[38] Annualised agreed rate (AAR) / Narrowly defined effective rate (NDER).
Series code: MIR.M.[2-Digit Country Code].B.A20.A.R.A.2240.EUR.O

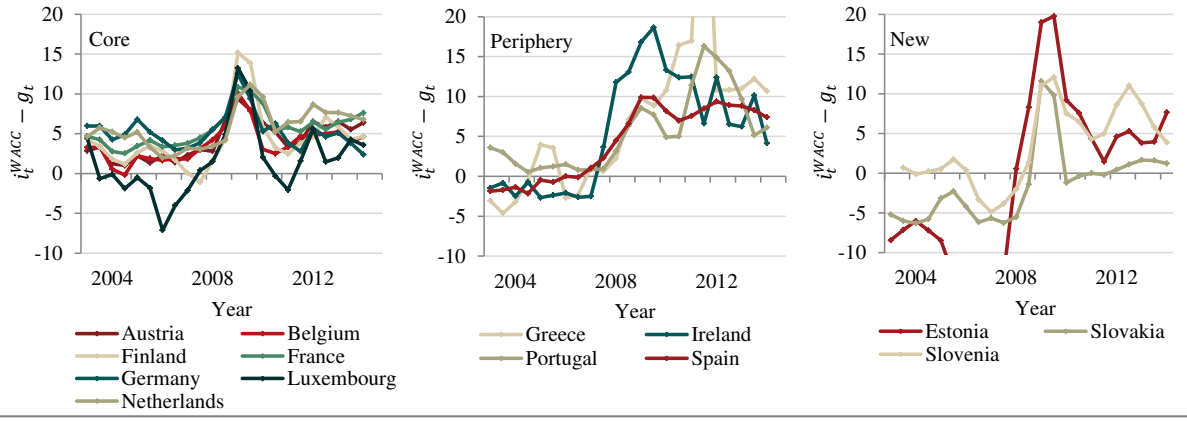
[39] No Information was available for Cyprus and Malta.

At the same time, overaccumulation might still pose a significant challenge for some individual member countries (particularly Luxembourg and Ireland). According to Homburg (2014) and Knolle (2014), further clarification may be delivered by incorporating the weighted average cost of capital (WACC) measure into the analysis. According to this logic, the corporate bond rates used in Figure 36 might not be 'risky enough' in order to fully control for dynamic efficiency. The WACC, on the other hand, would more accurately capture the actual cost associated with an investment. Therefore, the analysis was repeated one final time on the following condition:

$$(i_t^{WACC} - g_t) < 0. \tag{19}$$

Information on i_t^{WACC} has been taken from Knolle (2014), who calculated the degree of dynamic (in)efficiency for the OECD countries plus China.[40] The results are displayed in Figure 37:

Figure 37: Weighted Average Cost of Capital vs. Growth Rates in the Eurozone, 2003-2014



Source: Authors's calculatons; based on data provided by Knolle (2014) and the OECD (2015)

After repeating the analysis using information on i_t^{WACC} instead of i_t^R, not a single Eurozone country displayed signs of overaccumulation as of 2014. The differential between i_t^{WACC} and g_t was located well in the positive area, even for the six countries which had been found to suffer from overaccumulation in Figure 36.

These findings complement the conclusions drawn earlier in this analysis. While Section 3.1 and 3.2 have shown that the Eurozone is not subject to a permanently positive real rate gap coupled with low inflation, the present section has demonstrated that it also does not suffer from overaccumulation. Hence, the present section still concludes that the Eurozone does not suffer from secular stagnation as defined by Summers (2014a, 2014b).

[40] As interest rates on corporate bonds represent a lower level of the return on investment (Homburg 2014), i_t^{WACC} will not report dynamic inefficiency when this has been ruled out by i_t^R. However, it is possible for i_t^{WACC} to point out dynamic efficiency when i_t^R has reported inefficiency. For this reason, Knolle (2014) does not deliver i_t^{WACC} in the case of Italy.

3.3.2 Secular Stagnation and the Importance of Land

By pointing at significant decreases in the Eurozone's potential output, Summers (2014b) has made a compelling argument for the threat of secular stagnation (see Figure 12). In addition to that, Section 2.3 has shown that the Eurozone has recently been subject to (1) a deleveraging shock, (2) a slowdown in population growth, (3) an increase in income inequality, and (4) a fall in the relative price of investment. According to Eggertsson and Mehrotra (2014), these four factors can primarily be held accountable for a decrease in the natural real rate. Faced with this evidence, it has to be asked how an empirical assessment of the Eurozone's natural real rate (see Section 3.1) may possibly dismiss the threat of secular stagnation.

There are a number of reasons which might explain this apparent discrepancy. First of all, the empirical results of Section 3.1 could be inaccurate. However, Section 3.2 has provided some tests for the adequacy of these results. In addition to that, it has been shown that secular stagnation may still be ruled out if the gloomier outlook provided by Bouis et al (2013) is taken into account.[41] As a second reason, it might be possible that Eggertsson and Mehrotra (2014) overstate the significance of at least one of their four factors in shifting the natural real rate. Thirdly, it could be argued that the propositions of Eggertsson and Mehrotra (2014) are correct, but that the effect of the four factors was simply not strong enough (or not lasting long enough, as of 2015) in order to create a permanently positive real rate gap in the Eurozone. This is supported by the finding that the natural real rate did indeed decrease in recent years (see Figure 24), albeit not enough to support the claim of secular stagnation. And finally, it might be possible that the propositions of Summers (2014a, 2014b) as well as the formal model of Eggertsson and Mehrotra (2014) are overlooking one or more variables which may be crucial for the possible emergence of secular stagnation. The present section argues in favor of this final reason, and shows how the discussion on secular stagnation changes if *land* is introduced.

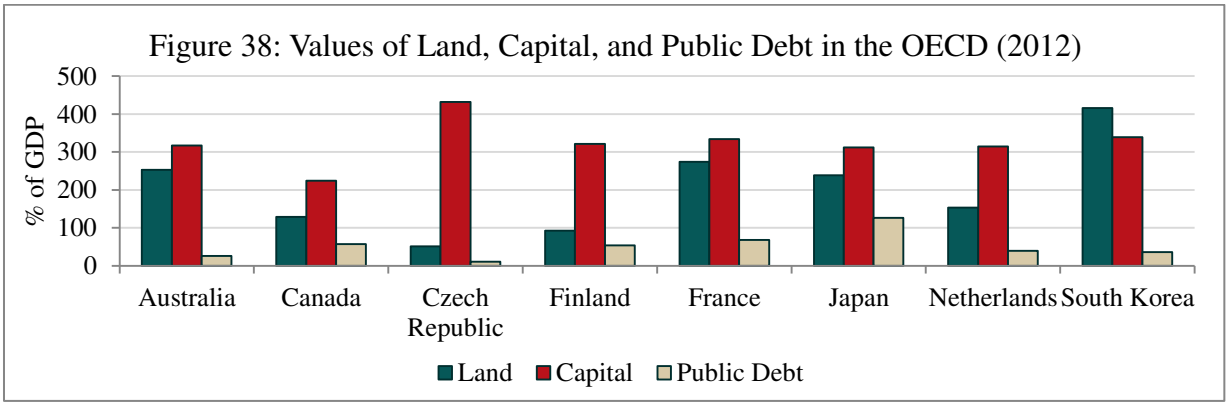
As has been laid out in Section 3.3.1, secular stagnation – under the definition of Summers (2014a, 2014b) – can be seen as a result of overaccumulation. However, Homburg (1991) has shown that overaccumulation cannot occur in the presence of a "non-producible productive asset", such as *land*.[42] Even if it is only marginally productive, the rent on *land* will always be strictly positive. If the economy's interest rate is pushed below its growth rate, the value of *land* – which is defined as the discounted present value of its future

[41] Further clarification on that matter could surely be provided if the results of Bouis et al. (2013) were updated using data of 2014 and 2015.

[42] *Land* only refers to the productive ground. It does not refer to unproductive ground (such as a desert), nor to any improvements or structures situated on it (houses, streets, bridges and the like would be regarded as reproducible assets, see Homburg 1991, 2014).

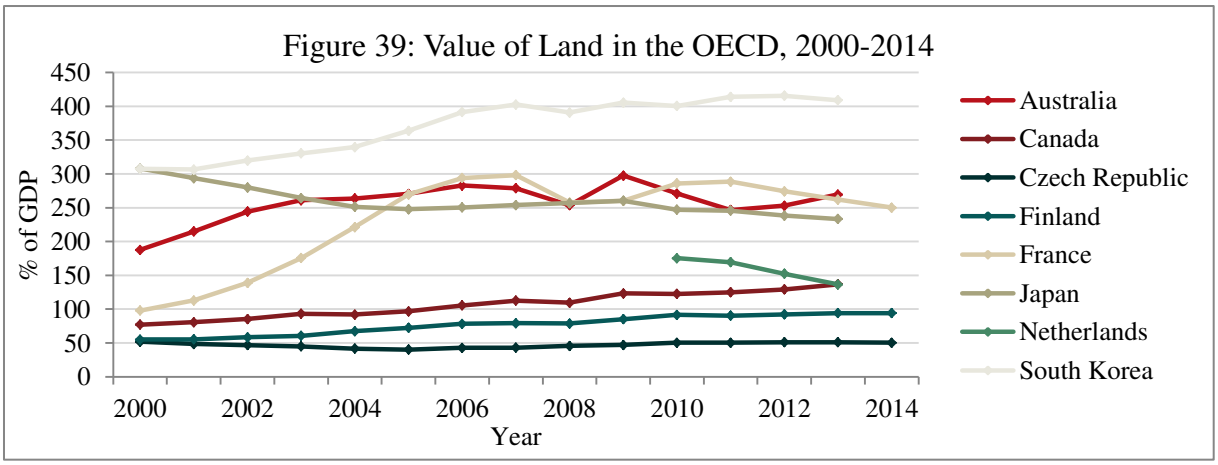
returns – increases. As a result, economic agents will increasingly demand *land* instead of capital, hence preventing any overaccumulation of capital. The price of *land* – which is in finite supply – will then increase as long as the growth rate exceeds the interest rate.

Consequently, even if the natural real rate is subject to persistent downward pressure from a range of other factors – such as adverse demographic developments or increasing inequality – it may not become negative if the economy is endowed with *land*. To put it simple, the possession of *land* prevents the emergence of secular stagnation. Following Homburg (2014), Figure 38 highlights the importance of *land* for a number of OECD economies:[43]



Source: Illustration taken from Homburg (2014); based on data provided by the OECD (2015)

As of 2012, *land* featured prominently in the national accounts of each of the countries highlighted in Figure 38. *Land*/output-ratios ranged from 51.1% (Czech Republic) to 415.8% (South Korea), and the value of *land* therefore grandly exceeded the value of public debt in every single country. Furthermore, for most of these countries, the importance of *land* has increased in recent years, as shown by Figure 39:



Source: Author's illustration following Bova et al. (2013) and Homburg (2014); based on data provided by the OECD (2015)

[43] The data given by the OECD (2015) is based on the System of National Accounts (SNA). Additional information on the theoretical background, the data requirements and the empirical methodology of estimating the value of *land* is provided by Kim (2008).

Unfortunately, the OECD (2015) only provides information on *land* values for those countries included in Figure 38 and 39.[44] As this group only includes three out of the 19 Eurozone countries, it is difficult to draw a final conclusion concerning the importance of land for the Eurozone. However, there is little reason to believe that information on the remaining 16 countries would deliver a very different picture. If *land* is of utmost importance in France and the Netherlands, why should it be of much lesser significance in Belgium, Germany, Spain, and other countries? Hence, it was taken that *land* is an important endowment for the Eurozone as a whole.

This evidence, of course, raises the question why *land* is mostly ignored in the prevalent literature on secular stagnation. Summers (2014a, 2014b) does not mention *land* at all. Eggertsson and Mehrotra (2014) do not include *land* in their formal model, but argue that it would be "straightforward to introduce […] land used for production, and maintain a secular stagnation equilibrium". With regards to the findings of Homburg (1991, 2014), this seems questionable. In addition, it has to be asked why a significant share of the related literature focuses on the role of public debt (see, for instance, Gordon 2012, von Weizsäcker 2013, and Lo and Rogoff 2015), when *land* was found to be of much higher relative importance for each country included in Figure 38.

A possible explanation might be that, as Homburg (1991) acknowledges, the introduction of *land* into growth models "considerably complicates the analysis of steady states". This could explain the absence of *land* in formal models such as the one provided by Eggertsson and Mehrotra (2014). A less theoretical reason could be that the importance of land is not widely acknowledged due to the lack of data – after all, comparable *land* values are only known for a very small number of countries (see Figure 38). Nevertheless, a number of economists have supported the propositions made by Homburg (2014), according to which *land* precludes overaccumulation and, hence, secular stagnation (see, for instance, Mayer 2014, Rowe 2014, and Sinn 2014). The proposition of a permanently negative natural real rate, which is discussed by Summers (2014a, 2014b), Eggertsson and Mehrotra (2014), and others, only holds when *land* is exempted from the discussion.

Hence, in addition to the empirical findings of Section 3.1 and 3.2, the considerations of Section 3.3 have delivered further evidence against the case of secular stagnation in the Eurozone. Neither has the real rate gap become permanently positive, nor does the Eurozone

[44] The Government Finance Statistics (GFS) database provides information for a small number of additional countries, such as Barbados, Bolivia, Colombia, Costa Rica, Colombia, Slovakia, and Switzerland (see Bova et al. 2013). However, as this data is based on a different reporting scheme, it was not included in Figure 38 and 39.

suffer from overaccumulation. Additional considerations on the importance of *land* indicate that the natural real rate will also not become permanently negative in the future. Therefore, it is ruled out that the Eurozone it threatened by secular stagnation as defined by Summers (2014a, 2014b).

4. Secular Stagnation in the Long-Term Perspective

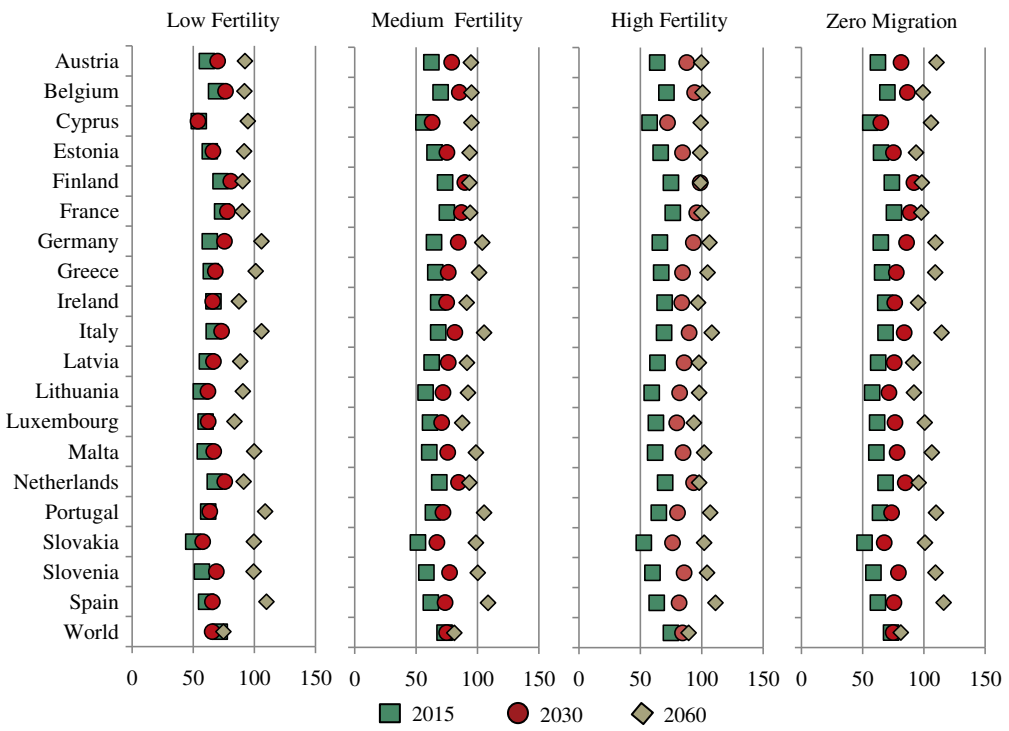
4.1 The Long-Term Challenge from Gordon's Headwinds

4.1.1 Demographics

In Section 3, a contemporary estimate of the natural real rate has shown that the Eurozone does not face an imminent threat of secular stagnation as defined by Summers (2014a). Irrespective of the bleaker outlook delivered by Bouis et al. (2013), additional considerations – such as the incorporation of *land* – indicate that fears of a permanently positive real rate gap are exaggerated. However, as has already been referred to in Section 2.2, there exists an alternative theory which does not rely on shifts in the natural real rate, but rather argues that secular stagnation can be thought of as a long-term decrease in potential output growth. This theory is brought forward by Gordon (2012, 2014), who proposes that four distinct 'headwinds' – demographics, education, inequality, and government debt – are primarily accountable for such a decrease in the case of the US economy. The present section investigates these headwinds in the context of the Eurozone in order to determine whether the threat of secular stagnation – albeit under a different definition – might materialize after all.

Concerning demographics, Section 2.3 has already pointed out that most Eurozone countries currently suffer from a decrease in their working age population. According to estimates of the United Nations (2013), this trend in unlikely to be reversed in the near future:

Figure 40: Dependency Ratios in the Eurozone in 2015, 2030, and 2060

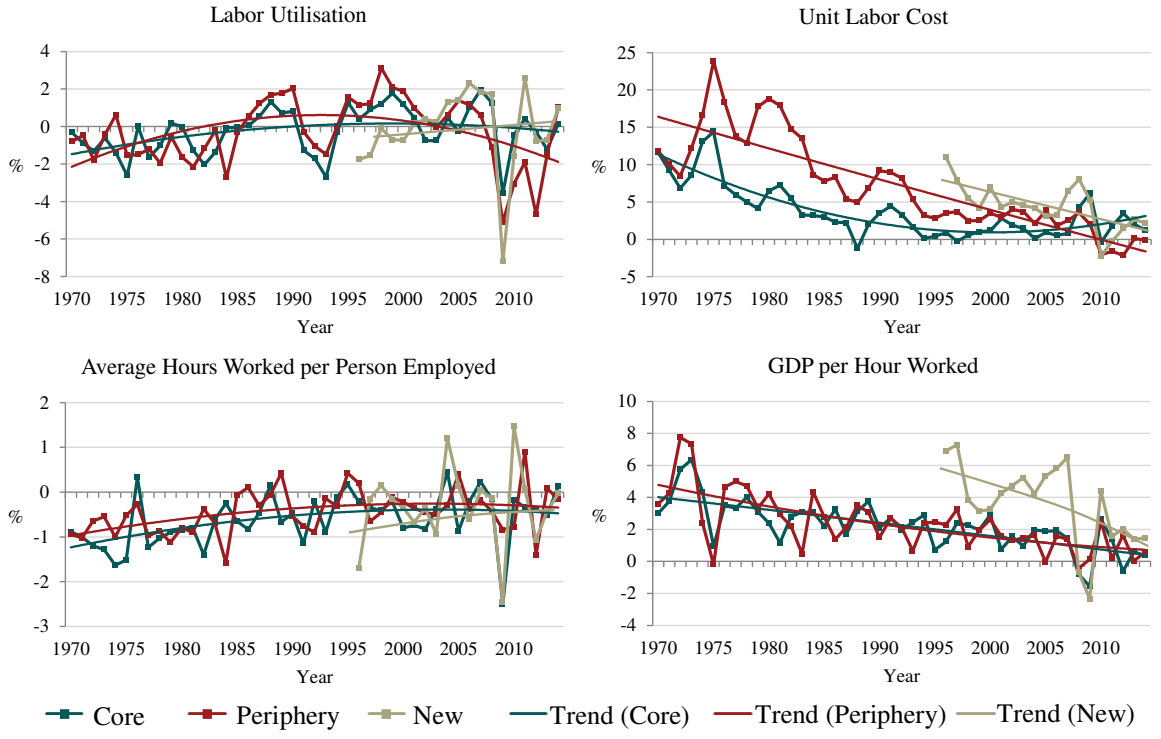


Source: Author's illustration; based on data provided by the UN (2013)

As can be seen, the dependency ratio will increase until 2030 – and even more so until 2060 – for every Eurozone member country.[45] Different assumptions on fertility and migration do not alter the general picture: over the next decades, dependency ratios will grow much faster in the Eurozone compared to the global average. Some member countries will even see their ratios increase to values beyond 100, which indicates that the dependent population will surpass the working-age population in absolute numbers.

These developments will not only constitute a major socioeconomic challenge for the Eurozone, but may also have a profound impact on its long-term economic performance. As potential output per capita growth is defined as growth in labor productivity times growth in hours per capita, a declining working age population could only be offset by an increase in labor productivity or participation (Gordon 2014). However, as shown in Figure 41, recent developments indicate the opposite:[46]

Figure 41: Annual Growth Rates of Productivity Indicators in the Eurozone, 1970-2014



Source: Author's illustration; based on data provided by the OECD (2015)

For all three country groups, the annual growth rate of GDP per hour worked has steadily declined between 1970 and 2014. The average number of hours worked per person employed experienced mostly low or negative growth rates, as did labor utilization. The annual growth

[45] The dependency ratio is defined as the ratio of the dependent population (0-19 and above 65 years of age) per 100 population in the working age (20-64 years of age). In the case of the Eurozone, this definition is considered to be more realistic compared to the common practice of defining the working age population as from 15 to 64 years of age. The zero migration scenario is based on the assumption of a medium fertility rate.

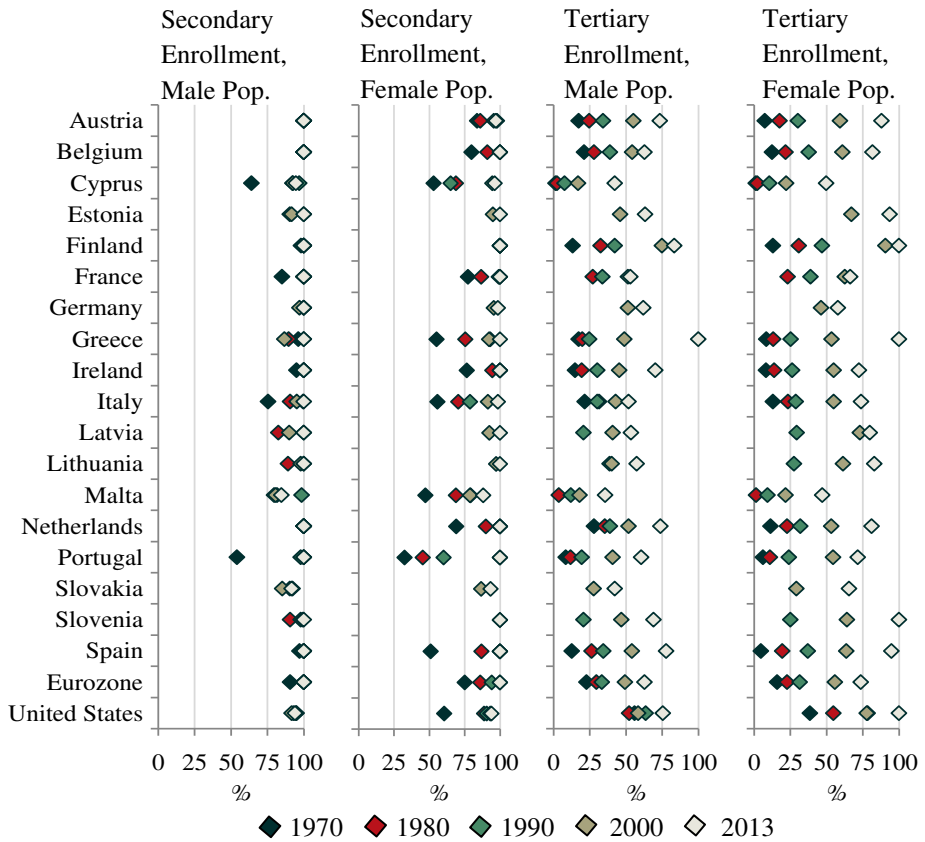
[46] Labor utilization is defined as the number of hours worked per head of the population. No data was available for Cyprus, Latvia, Lithuania, and Malta.

rate of unit labor cost sharply decreased, but still remained positive for the Core and New countries in the year 2014. Hence, all four variables indicate that the Eurozone's productivity growth has slowed down in recent decades. If this development prevails in the future, it is unlikely that the significant decrease in the relative size of the working age population will be offset by an increase in labor productivity or labor force participation. Hence, it can be concluded that demographic factors may indeed have a significantly negative effect on future potential output growth in the Eurozone.

4.1.2 Education

Education represents the second headwind identified by Gordon (2012, 2014). He argues that the impact of education on US-American productivity growth has decreased after a comparably high level of education became the norm. Figure 42 compares the development of US-American secondary and tertiary enrollment ratios to those of the Eurozone:[47]

Figure 42: Secondary and Tertiary Enrollment Ratios in the Eurozone and the USA, 1970-2013



Source: Author's illustration; based on data provided by the World Bank (2015)

[47] Secondary enrollment is expressed as a percentage of the population of official secondary education age. Tertiary enrollment is expressed as a percentage of the population of the five-year age group following on from secondary school leave. Initially, some countries displayed enrollment ratios above 100% (for instance, due to the inclusion of under- and over-aged students, early or late school entrance, or grade repetitions). In these cases, the values were set to 100% instead.

In the earlier decades of the 20th century, US-American educational institutions gradually opened up to previously unprivileged groups of the population (such as minorities, females, and lower income groups). This led to a significant increase in the average workers' productivity, which in turn proved to be an important growth factor in the economy's potential output per capita. However, as can be seen from Figure 42, the process of increasing educational participation was largely concluded as of 2013. Consequently, Gordon (2014) argues that education will be much less substantial in driving future US-American potential output per capita, as compared to earlier decades.

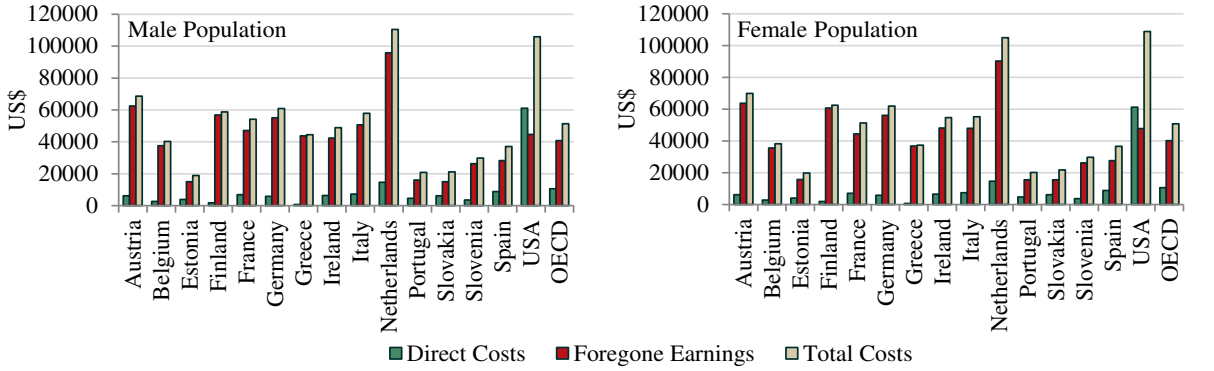
For the Eurozone, the same appears to be true in terms of secondary enrollment. As of 2013, all member countries except Malta had reached secondary enrollment ratios close to 100% for both their male and their female populations. In many countries, this adjustment took somewhat longer compared to the USA (especially in the case of the female population), which may indicate that the Eurozone's potential output per capita still experienced a positive impact between 1970 and 2013. But as the process of increasing secondary enrollment is almost concluded by now, it can be expected that the effect of higher participation on future potential output per capita growth will be negligible.

The case of tertiary, on the other hand, is a bit different. As of 2013, many Eurozone countries displayed enrollment ratios which were much lower than the US-American ones. If these ratios continue to rise in the future, this could have a significant impact on productivity and, hence, potential output per capita. The threat of 'educational stagnation', which Gordon (2014) suspects to be a significant headwind to US-American economic growth, might therefore be smaller in the case of the Eurozone. However, it has to be taken into account that many Eurozone economies rely on their apprenticeship systems to a much larger extent than the USA (particularly Germany with its "dual system", see Lazaryan, Neelakantan and Price 2014). Given that these apprenticeship systems often lead to the education of highly skilled workers (Clark 2001), an increase in tertiary enrollments at the expense of the number of apprentices would not necessarily be productivity-enhancing.

Gordon (2012) further argues that the education-related headwind in the USA is aggravated by the significant "cost inflation in higher education". As college tuition fees continue to grow rapidly compared to the price of other goods, tertiary education becomes increasingly inaccessible for the lower income population. In the long run, this may lead to a substantial loss in the US-American economic potential. In this regard, the Eurozone has one significant advantage: the private costs of education are much lower compared to the USA.

This is displayed in Figure 43, which compares the Eurozone's private costs of tertiary education (which are composed of direct costs and foregone earnings) to those of the USA:[48]

Figure 43: Private Costs of Attaining Tertiary Education in the OECD (2010)



Source: Author's illustration; based on data provided by the OECD (2014)

As of 2010, only the Netherlands displayed total costs of tertiary education that rivaled those of the USA (which were more than twice as high as the OECD average). In addition, the direct costs of education (such as tuition fees) amounted to only a small fraction of the total costs for the Eurozone, while the larger share was represented by foregone earnings. Only in the USA did the direct costs of education surpass the amount of foregone earnings. Of course it has to be taken into account that the private benefits of attaining tertiary education were also larger in the USA than in most other countries (OECD 2014), but the high amount of direct costs represents a much bigger challenge for US-American college students:[49]

Table 7: Tuition Fees & Financial Aid to Students in 2010, Eurozone vs. USA

	Annual Tuition Fees in US$			Percentage of Students who received Financial Aid			
	Public Institutions	Government Dependent Private Institutions	Independent Private Institutions	Public Loans	Scholarships /Grants	Public Loans and Scholarships /Grants	No Public Loans and/or Scholarships /Grants
Austria	860	860	Up to 11,735	n.a.	15	n.a.	85
Belgium (Fl.)	576-653	576-653	n.a.	n.a.	19	n.a.	81
Belgium (Fr.)	653	754	n.a.	n.a.	n.a.	16	84
Estonia	n.a.	3,527	5,322	n.a.	n.a.	n.a.	n.a.
Finland	0	0	n.a.	n.a.	54	n.a.	46
France	200-1,402	1,138-8,290	n.a.	n.a.	31	n.a.	69
Ireland	6,450	n.a.	n.a.	n.a.	37	n.a.	n.a.
Italy	1,407	n.a.	4,406	n.a.	19	n.a.	81
Netherlands	1,966	n.a.	n.a.	n.a.	n.a.	85	15
Slovakia	Up to 2,916	n.a.	n.a.	n.a.	26	n.a.	n.a.
Spain	1,129	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United States	5,402	n.a.	17,163	13	26	37	24

Source: Author's illustration; based on data provided by the OECD (2014)

[48] The private costs of attaining tertiary education were evaluated by comparing workers attaining tertiary education to those attaining upper secondary or post-secondary non-tertiary education. Costs were expressed in equivalent US$ after adjusting them using data on PPP. No information was available for Cyprus, Latvia, Lithuania, Luxembourg, and Malta.

[49] Only national full-time students are included. Costs were expressed in equivalent US$ after adjusting them using data on PPP. No information was available for Luxembourg, Malta, Cyprus, Latvia, and Lithuania.

While comparative information on tuition fees and financial aid to students is incomplete, Table 7 still delivers two important points. Firstly, as of 2010, tuition fees were in fact much higher for the USA than for most Eurozone countries, especially with regard to public institutions. And secondly, about 50% of all US-American students received a public loan bound to compulsory repayment, much higher than in any Eurozone country except the Netherlands.[50] And since Table 7 does not deliver information on private loans, the actual debt burden might be even higher.

Based on the information delivered by Figure 43 and Table 7, it cannot be ruled out that increasing costs of tertiary education may also lead to lower college enrollment and higher student debt in the Eurozone. But even in this case, the effect would surely be much less adverse compared to the USA which, in the words of Gordon (2014), faces the threat of creating "a new generation of indebted baristas and taxi drivers". The present section therefore concludes that the Eurozone is not facing the acute threat of seeing its potential output per capita growth lowered due to "educational stagnation". While further quantitative research would be needed in order to assess whether the Eurozone's economy is adversely affected by a slower growth in enrollment ratios or an increase in the private costs of tertiary education, this headwind would be less profound than in the case of the USA.

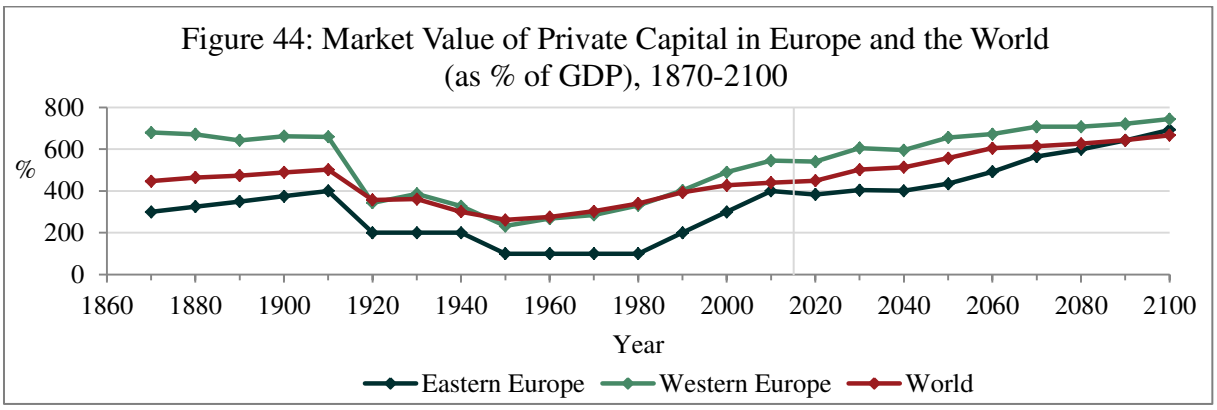
4.1.3 Inequality

Rising inequality represents the third headwind which, according to Gordon (2012, 2014), may reduce future growth in potential output per capita. He points out that, in recent years, the average per capita income was growing much faster than the median real income. The larger share of income gains was captured by the richest one percent of the population. Gordon (2014) concludes that, if GDP is defined as consumer welfare and if consumers are defined as the bottom 99% of the income distribution, real GDP per capita was growing at a slower pace than indicated by the official numbers. Consequently, every further increase in income inequality would lead to a decrease in potential GDP per capita growth.

Concerning the Eurozone, Section 2.3 has already shown that income inequality has recently increased in most member countries. However, as detailed data on income distribution was only available for the year 2000 onwards, it is difficult to draw conclusions on future developments solely on this information. But according to Piketty (2014),

[50] And in the case of the Netherlands, the available information did not reveal whether those "public loans and scholarships/grants", which were received by 85% of the students, did effectively pledge them to repay these loans.

capital/income ratios – which have steadily increased in most European countries since the 1950s – will continue to grow substantially in the next decades:[51]



Source: Author's illustration; based on data provided by Piketty (2014)

According to Piketty (2014), capital amounted to no less than 544% of Western Europe's GDP (Germany: 412%, France: 575%) and 400% of Eastern Europe's GDP in 2010. Until 2100, he expects these ratios to increase to 744% and 693%, respectively. He argues that this trend, which he attributes to higher relative returns on capital, will lead to an increasing concentration of wealth, probably even to "levels of inequality never before seen". If these predictions are correct, this would indicate that the richest one percent of the Eurozone's population will continue to capture ever larger shares of the available income gains. In the context of Gordon's (2012, 2014) findings, this development would constitute a significant headwind for the Eurozone's growth in potential output per capita.

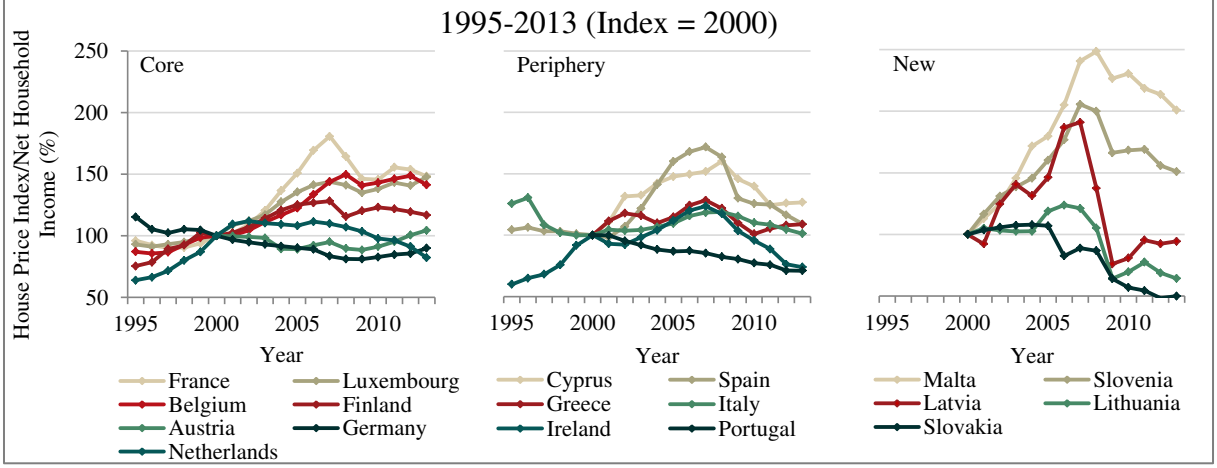
However, the bleak outlook given by Piketty (2014) has not remained unchallenged. Analyzing Piketty's original data, Rognlie (2014) finds that recent increases in capital wealth and income inequality are by no means self-enforcing, but are rather driven by rising housing prices.[52] He explains the importance of housing – which "accounts for nearly 100% of the long-term increase in the capital/income ratio" – by the artificial scarcity of land: as governments implement land use regulations, land becomes scarce relative to output, which in turn leads to a higher relative price of land and housing. This implication is particularly important for the present analysis: if inequality is indeed significantly driven by housing prices, the current development of these prices might allow for conclusions on future inequality in the Eurozone.

[51] Private capital is defined as the "total value of private wealth in real estate, financial assets, and professional capital, net of debt".

[52] These findings are similar to those of Homburg (2015a), who analyzes Piketty's original data as well and shows that recent increases in wealth-income ratios can largely be attributed to rising land prices (compare to Figure 38 and 39). While not specifically focusing on housing prices (in contrast to Rognlie 2014), he arrives at the similar conclusion that increases in wealth are not bound to a rising capital-income share. In other words, increasing wealth does not necessarily imply higher inequality. It follows that Piketty's (2014) predictions of ever-increasing levels of inequality have to be taken with caution.

In order to test for this, the development of housing prices in the Eurozone was investigated, with the results being displayed in Figure 45. In most member countries, housing prices increased much faster than disposable household income until the financial crisis (the only exceptions being Germany, Austria, Portugal, and Slovakia). After the onset of the Great Recession, housing prices dropped significantly relative to disposable household income:[53]

Figure 45: Home Price Indices vs. Disposable Household Income in the Eurozone, 1995-2013 (Index = 2000)



Source: Author's calculations following Friggit (2012); based on data provided by Mack and Martínez-García (2011), Eurostat (2015), and the IMF (2015)

As of 2013, the results were mixed: in seven out of 18 Eurozone countries, housing prices had experienced a much higher growth relative to disposable household income since the year 2000. The discrepancy was particularly large in France, Belgium, and Luxembourg (the even higher increases in Malta and Slovenia have to be taken with caution, see Footnote 53). On the other hand, the opposite was true in four countries, where housing prices had experienced a much lesser growth compared to disposable household income. In the remaining seven countries, both indicators had grown more or less comparably from 2000 to 2013.

Hence, the development of housing prices only allows for a miscellaneous outlook on inequality in the Eurozone. Provided that Rognlie (2014) is correct in assuming that capital/income-ratios (one of the driving forces of inequality according to Piketty 2014) are primarily driven by housing prices, the recurring of higher growth rates in housing prices may lead to a substantial increase in inequality. However, as of 2015, it is difficult to predict this behaviour. If the fast growth of housing prices relative to disposable household income would

[53] No information was available for Estonia. In the case of the five remaining countries in the New country group, information on disposable household income was only available for the years 2005-2013. Based on this, the values for the years 2000-2004 were worked backwards using the growth rates of the respective countries' GDP per capita for the same time period (IMF 2015). As the growth rates of GDP per capita and disposable household income may differ substantially, these results have to be taken with caution.

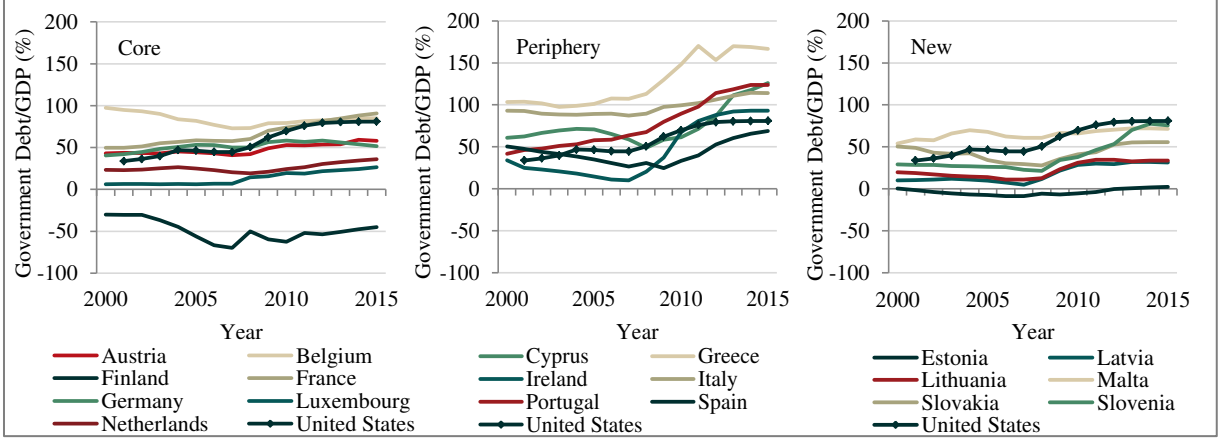
have continued in the absence of the Great Recession, it might be assumed that these high growth rates will arise again once the Eurozone has overcome its economic hardships. On the other hand, unpredictable developments – such as the availability of more land due to higher governmental supply or the possible burst of a future housing bubble – might keep average growth rates at lower levels. In any case, policy makers should keep a close look on housing prices in the different Eurozone member countries, and possibly intervene if they threaten to create an inequality-related headwind to future economic growth.

4.1.4 Government Debt

The final headwind identified by Gordon (2012, 2014) for the US economy is represented by government debt. The logic of this is straightforward: as the growth rate of potential GDP per capita decreases (particularly due to the remaining headwinds), tax revenues will grow slower than expected as well. As a consequence, the US government will have to face an uneasy choice: If it wants to avoid any further increase in its debt-to-GDP ratio (which has risen from 33.8% in 2001 to 80.9% in 2015, see IMF 2015), it has to reduce expenses and/or raise taxes. However, both higher taxes and lower transfers would lead to a decrease in disposable household income, dampening economic activity and, as a consequence, growth in potential output per capita. As a result, Gordon (2014) predicts that the US-American debt-to-GDP ratio might increase to 150% in the late 2030s, and to much more in the longer run due to "apparently intractable pension burdens".

As Gordon warns about unsustainable levels of government debt in the USA, this threat may be even more acute in the case of the Eurozone, which is still struggling to overcome the combined effects of the Great Recession and the sovereign debt crisis. Figure 46 compares the debt-to-GDP ratio of the United States to those of the Eurozone:

Figure 46: Debt-to-GDP Ratios in the Eurozone and the United States, 2000-2015

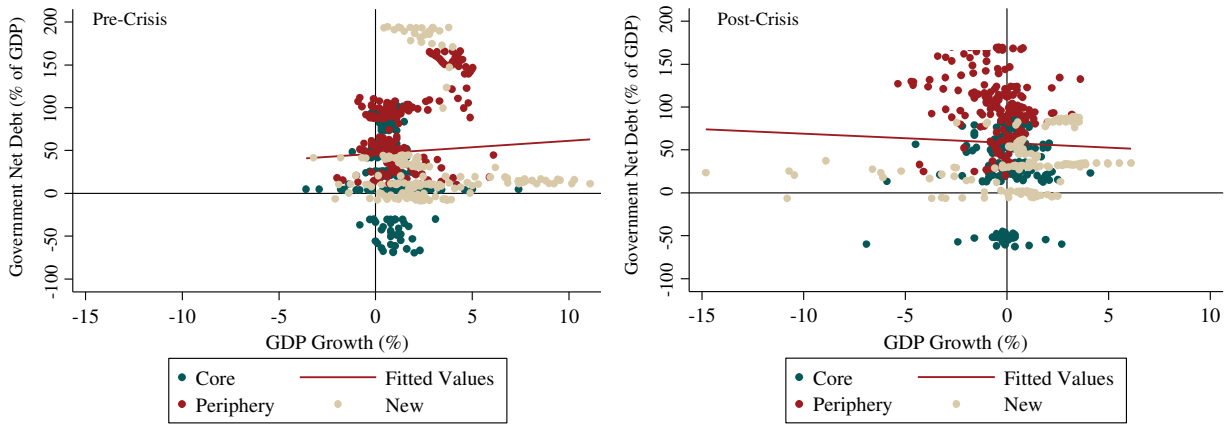


Source: Author's illustration; based on data provided by the IMF (2015)

Between 2007 and 2015, debt-to-GDP ratios increased in every single Eurozone country, with the increase ranging from only 1.6% (Germany) to 82.9% (Ireland).[54] As of 2015, average levels of debt amounted to 43.2% (Core), 115.3% (Periphery), and 44.9% (New). However, intragroup variation was substantial, and some countries displayed debt-to-GDP ratios far above the average of their respective group. For example, the Core group displayed ratios from -45.1% (Finland) to 90.6% (France). Hence, if Gordon (2014) is correct in assuming that the US-American debt-to-GDP ratio of 80.9% is seriously threatening fiscal stability and future economic growth, then the same may be true in the case of the Eurozone.

In order to draw conclusions on this, it has to be taken into account that higher levels of government debt are not necessarily associated with slower economic growth. As has been laid out before, a government may choose to increase its debt burden in order to finance expenses for which it otherwise would have to raise taxes or decrease transfers. In this regard, an increase in the debt-to-GDP ratio may be stimulating economic growth. In the case of the Eurozone, the empirical research by Checherita and Rother (2010) suggests that, on average, the negative growth effect of high debt sets in at debt-to-GDP ratios of 70-100%. Figure 47 depicts this relationship using quarterly data for the Eurozone:[55]

Figure 47: Government Debt and GDP Growth in the Eurozone, Pre-Crisis vs. Post-Crisis



Left Chart: 1999-2007 (n=640), right chart: 2008-2015 (n=522). Source: Author's illustration; based on data provided by the IMF (2015) and the World Bank (2015)

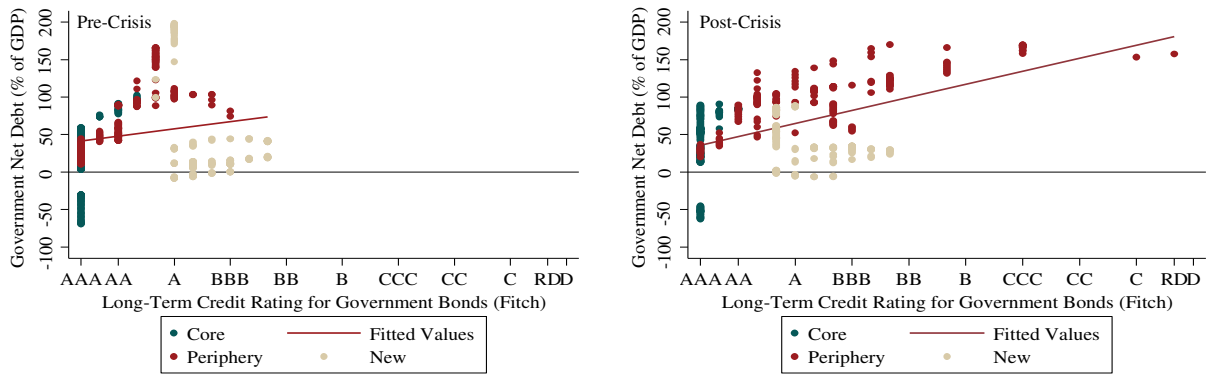
[54] Debt-to-GDP ratios were expressed as government net debt divided by GDP. While gross debt is often used as a benchmark for evaluating government indebtedness (as an example, see Lo and Rogoff 2015), this may overstate the actual debt burden for some countries. For example, Finland's gross government debt amounted to 59.3% of its GDP in 2015, while its net debt amounted to -45.1% (IMF 2015). As information on net government debt was not available for Cyprus, Luxembourg, Malta, Slovakia, and Slovenia, Figure 46 displays the gross debt-to-GDP ratio for these countries instead.

[55] For Cyprus, Lithuania, and Malta, information on GDP growth was not provided by the World Bank (2015) and has therefore been taken from the IMF (2015). No data was available for Slovenia. In the case of Malta, no data was available for the years 1999 and 2000. The IMF (2015) did not provide information on net public debt for Cyprus, Luxembourg, Malta, Slovakia, and Slovenia. Complementary data was therefore taken from the World Bank (2015). As a result, the information in Figure 47 slightly differs compared to Figure 46.

Before the financial crisis, larger debt-to-GDP ratios were, on average, associated with higher levels of GDP growth. After the onset of the Great Recession, however, the opposite was true: higher debt burdens were now associated with lower growth rates (particularly in the Periphery and the New group).[56] As post-crisis growth experienced a lower reduction in the less indebted Core countries, the simple correlation analysis in Figure 47 delivers some support for the findings of Checherita and Rother (2010).

In addition to having an adverse effect on economic growth, very high levels of public debt may raise the question of fiscal stability. The following chart compares the Eurozone's governmental debt burden to Fitch's long-term credit rating for government bonds, which can be taken as an (imperfect) indicator of fiscal stability:[57]

Figure 48: Government Debt and Credit Rating in the Eurozone, Pre-Crisis vs. Post-Crisis



Left Chart: 1999-2007 (n=648), right chart: 2008-2015 (n=522). Source: Author's illustrations, based on data provided by Fitch Ratings (2012, 2015), the IMF (2015) and the World Bank (2015)

Due to increasing levels of government debt, the fitted line displays a much steeper curve for the years 2008-2015, and a significant degree of downgrading took place in the highly indebted Periphery group. As long-term credit ratings for government bonds reflect the creditworthiness of sovereign states and determine their borrowing costs, this development might be indicative for a decreasing fiscal stability in the Eurozone.[58]

So far, the present section has shown that high levels of public debt are surely a matter of concern for the Eurozone. Solely based on these findings, however, it is difficult to conclude whether public debt will materialize as a profound headwind for the Eurozone, and a number

[56] This also indicates that, contrary to popular belief, the slow recovery in the periphery countries was not initiated by imposed austerity policies. For a more detailed assessment of this, see Homburg (2013a, 2015b).

[57] As in Figure 47, quarterly information on government net debt in the Eurozone was provided by the IMF (2015) for all countries except Cyprus, Luxembourg, Malta, and Slovakia. For these countries, data was been taken from the World Bank (2015). No data was available for Slovenia.

[58] In recent years (and especially since the global financial crisis), credit rating agencies have been subject to an increasing degree of criticism. In particular, critics have debated the accuracy of credit ratings and possible adverse effects on a country's financial stability. However, taking these effects into account would be beyond the scope of the present analysis, and long-term credit ratings for government bonds have therefore been taken as a simple proxy for fiscal stability. Further information on the importance of rating agencies on the Eurozone's economy is provided by Paudyn (2013).

of additional factors would have to be taken into account. For instance, Reinhart, Reinhart and Rogoff (2012) and Bornhorst and Arranz (2014) show that conclusions on the impact of public debt on potential economic growth cannot be drawn without taking the size and structure of private and external debt into account as well. Similarly, the importance of public and private deleveraging would have to be analyzed: Authors such as Koo (2014) and Lo and Rogoff (2015) argue that it is not the actual size of the debt burden, but rather the prolonged process of deleveraging which hinders potential output growth. In contrast to Gordon (2012, 2014), who considers high levels of debt to be a long-term headwind, they argue that a balance sheet recession may be overcome by appropriate policy measures.

However, taking these (and other) considerations into account would be beyond the scope of the present analysis. This section therefore simply concludes that high levels of public debt will remain a considerable challenge for the Eurozone in the foreseeable future. Luckily, European policymakers are fully aware of this threat (see, for instance, Draghi 2015), and it remains yet to see whether they can avoid the emergence of a debt-related headwind.

Summing up, Section 4.1 has investigated whether the Eurozone faces the threat of secular stagnation as defined by Gordon (2012, 2014), who proposes that four distinct headwinds may substantially decrease future growth in potential output per capita in the case of the USA. It was found that demographic factors, combined with a decrease in labor productivity growth, will most likely turn into a headwind for the Eurozone's economy. The same might be true for income inequality and government debt, although future trends in these indicators are difficult to predict. The last possible headwind, education, will probably have a much less adverse effect compared to the USA. Hence, while acknowledging that at least three out of these four factors will challenge the Eurozone's future economic growth, current evidence is not sufficient enough to assert that they will constitute a prolonged period of secular stagnation.

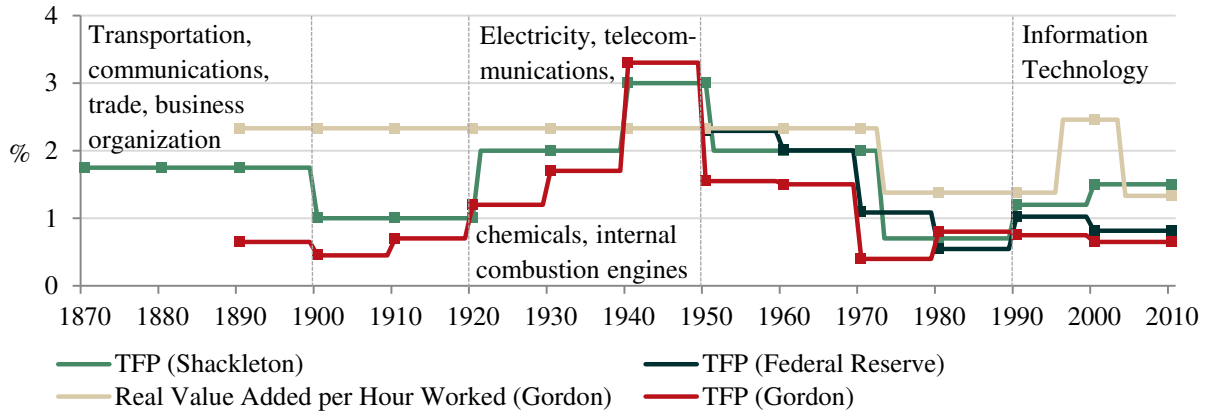
4.2 A Possible Demise of Technological Growth

After having dismissed both the (new) secular stagnation theory proposed by Summers (2014a, 2014b) as well as Gordon's (2012, 2014) 'headwinds' in the context of the Eurozone, the present section investigates one final definition of secular stagnation: the possible demise of technological growth. According to a number of scholars, the largest impediment to long-run economic growth might be a slowdown of innovation. It is argued that current technological advances have a much smaller impact on productivity growth – and, ultimately, on per capita output growth – than those of earlier periods (such as electricity or the steam engine). This 'innovation stagnation' hypothesis is therefore closely related to the

'headwinds' of Gordon (2012), although he stresses that technology was not his primary concern (see Gordon 2014).[59] Nevertheless, the innovation stagnation hypothesis has recently been advanced by scholars such as Kasparov and Thiel (2012) and Fernald (2014) and features prominently in many subsequent works on secular stagnation (see, for instance, Teulings and Baldwin 2014). As many of the Eurozone's member countries may be characterized as innovation economies, possible innovation stagnation could have a profound impact on future economic growth. Hence, this final – and, admittedly, rather broad – definition of secular stagnation has been investigated as well.

Technological progress is essentially unobservable, but it may be defined as the increase in output growth which cannot be explained by changes in production inputs (Solow 1957). In order to draw conclusions on technological progress, it has been approximated by total factor productivity (TFP) growth in the present analysis. If we are in fact experiencing an era of innovation stagnation, TFP growth rates should have declined substantially compared to periods of significant technological progress. It follows that long-term historical data on TFP is needed in order to test for innovation stagnation. Unfortunately, in the case of the Eurozone countries, detailed data on that matter is scarce. However, estimations for the last 125-145 years have been given by Gordon (2012, 2014) and Shackleton (2013) for the US economy:

Figure 49: Average Growth in TFP and Real Value Added per Hour Worked in the USA, 1870-2010



Source: Author's illustration; based on the data provided by Gordon (2012, 2014), Shackleton (2013), and the FRBSF (2015). Vertical lines depict the growth cycles identified by Shackleton (2013)

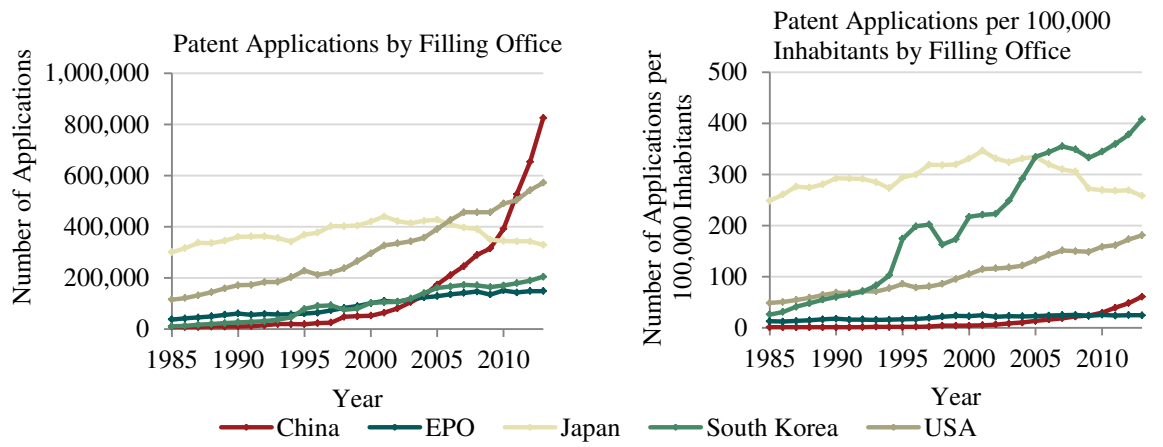
[59] While Kasparov & Thiel (2012) expect a significant slowdown in the pace of technological progress, Gordon (2014) makes it clear that he does not. Rather, he argues that constant technological change will translate into lower rates of productivity growth compared to previous decades. Hence, it was taken that Gordon's headwinds and the innovation stagnation theory follow two different economic rationales, which is why they have been investigated separately.
In fact, technology could also be investigated within the context of Summers' (2014a, 2014b) definition of secular stagnation. Similarly to a negative aggregate demand shock, a positive technology shock may potentially drive down the natural real rate (see Arestis and Chortareas 2008 and Andréz, López-Salido and Nelson 2009). However, as Section 3 has already ruled out the threat of secular stagnation as defined by Summers, technology was only analyzed in the broader sense provided by the present section.

Figure 49 delivers two important implications for the discussion on innovation stagnation. Firstly, as proposed by Shackleton (2013), US-American technological progress can roughly be divided into growth cycles. Secondly, the US-American TFP is currently growing much slower compared to earlier cycles. Owed to advances in information technology, TFP growth has accelerated between 1990 and 2010 compared to 1970-1990, but still remained much lower compared to the period of 1920-1970. While such detailed information is only available for the USA, it can be argued that the developments should have been similar in the (Core) Eurozone and other innovation economies (such as Great Britain or Japan). Hence, Figure 49 seems to support the "Gordon-Kasparov-Theil" argument, according to which our technological frontier is expanding more slowly than it once did. This slowdown in technological progress would then translate into lower productivity growth and, consequently, lower per capita output growth (Lo & Rogoff 2015).

However, while Figure 49 has indicated that technological progress is currently slower than it used to be, any reflection on the threat of innovation stagnation has to go beyond that – more precisely, it requires estimating the likely evolution of future technological growth. Hence, two main questions were examined: firstly, is it probable that TFP will continue to grow at low levels, or will future technological advances prove the pessimists wrong? And secondly, what will be the role of the Eurozone in shaping future technological progress?

While current technological progress is not directly observable, this is all the more true for future technological progress. However, as has been shown by Jalles (2010), there exist at least two suitable proxies: patents and intellectual property rights indices. Figure 50 displays the development of patent applications at the world's leading offices:

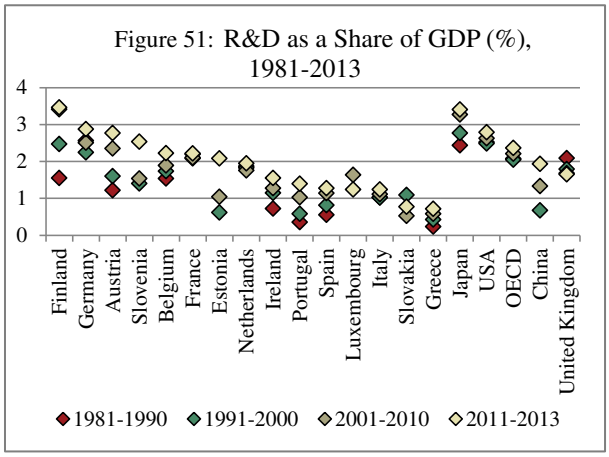
Figure 50: Number of Applications at the Largest Patent Offices, 1985-2013



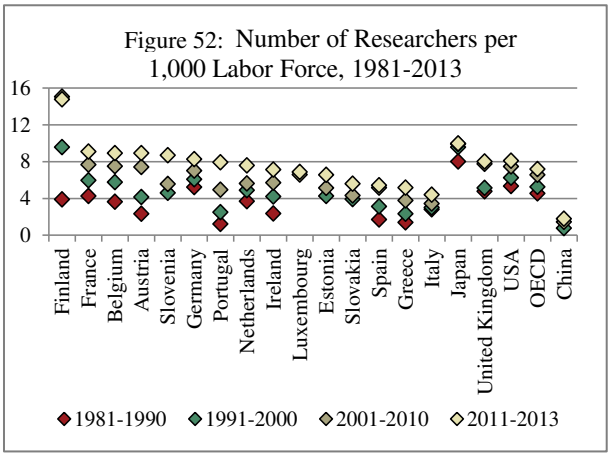
Source: Author's illustration; based on data provided by the IMF (2015) and the WIPO (2015)

Between 1985 and 2013, the total number of worldwide patent applications grew from 920,000 to 2,570,000, mainly due to large increases in China and the USA. The number of applications grew more slowly for the European Patent Office (EPO) and South Korea, although the increases were still substantial. Only in Japan did the number of applications decrease in recent years, but the country still held the third place as of 2013. A different picture is delivered by the number of patent applications per 100,000 inhabitants. When the size of the population is accounted for, the Japanese and South Korean offices displayed much more applications, although the USA was catching up to a decreasing Japan. For both China and the EPO, the growth in the total number of applications was largely offset by rapid increases in their population.[60]

Hence, Figure 50 does not seem to support the gloomy outlook of the innovation stagnation hypothesis. Between 1985 and 2013, the total number of patent applications has almost tripled, and the number of applications per capita has increased for all offices except Japan.[61] At the same time, the global investment in research and development (R&D) has increased significantly, as shown by Figure 51 and 52:



Source: Author's illustration; based on data provided by the OECD (2015)



Source: Author's illustration; based on data provided by the OECD (2015)

In most of today's innovation economies, the share of resources allocated to the development of technological progress is growing. From 1981 to 2013, the OECD countries (with the exception of Luxembourg, Slovakia, and the United Kingdom) and China continuously raised their relative expenses for R&D. Simultaneously, the number of researchers per capita significantly increased in every single OECD country plus China. As

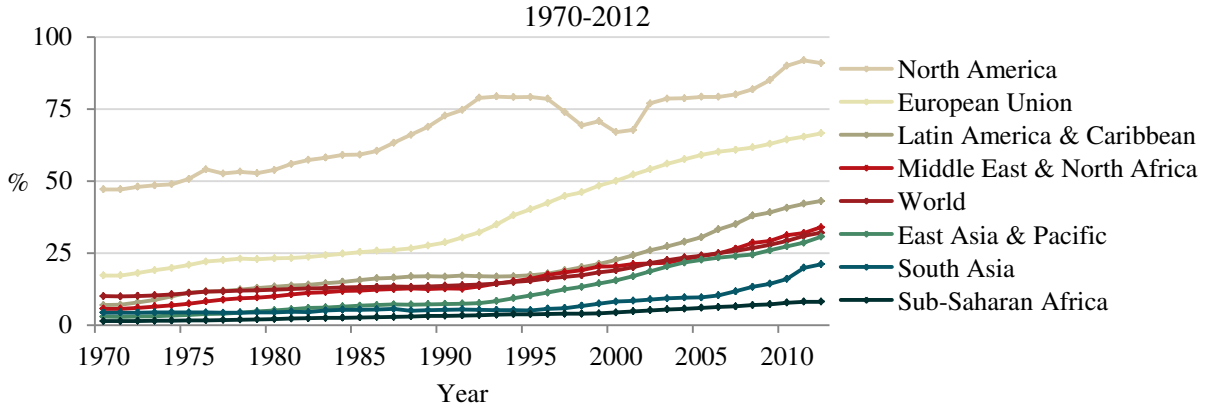
[60] The EPO's "population" grew much faster than the actual European population due to the continuous admission of new member states. While only 11 countries were EPO members in 1985 (inhabitants: 291 million), this number had increased to 28 in 2013 (inhabitants: 605 million).

[61] According to Glaeser (2014), the large increase in the number of patents could also indicate that modern patents have become less important, or that patent offices have lowered the requirements for applications. However, he argues that these factors are not likely to be significant.

future technological progress can be expected to be more knowledge-intensive compared to earlier cycles (Mokyr 2014a, 2014b), this is only consequential and casts further doubt on the notion of innovation stagnation.

Until now, the present section has only focused on those countries which have primarily driven technological growth during recent decades. If the focus is instead turned towards a worldwide perspective, it can easily be seen that our global population still holds large amounts of untapped potential:[62]

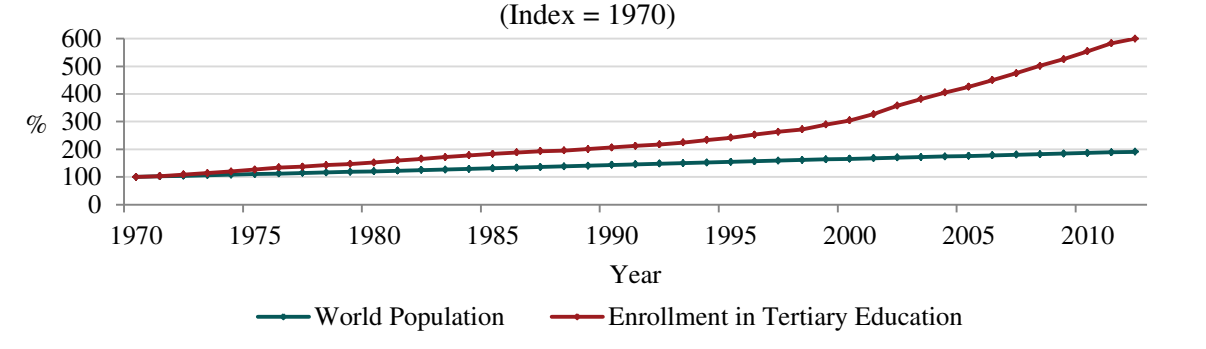
Figure 53: Tertiary Enrollment Ratios for the Different World Regions, 1970-2012



Source: Author's illustration; based on data provided by the World Bank (2015)

As of 2012, tertiary enrollment ratios amounted to more than 90% in the case of North America, and to almost 70% in the case of the European Union. For all other world regions, the ratios were significantly lower than 50%. However, the latter regions – with the exception of Sub-Saharan Africa – all displayed high growth rates since the mid-1990s. In most cases, this was coupled with high population growth (especially in East and South Asia), leading to a rapid increase in the global (tertiary) student population:[63]

Figure 54: World Population vs. Student Population, 1970-2012 (Index = 1970)



Source: Author's illustration, based on data provided by the World Bank (2015)

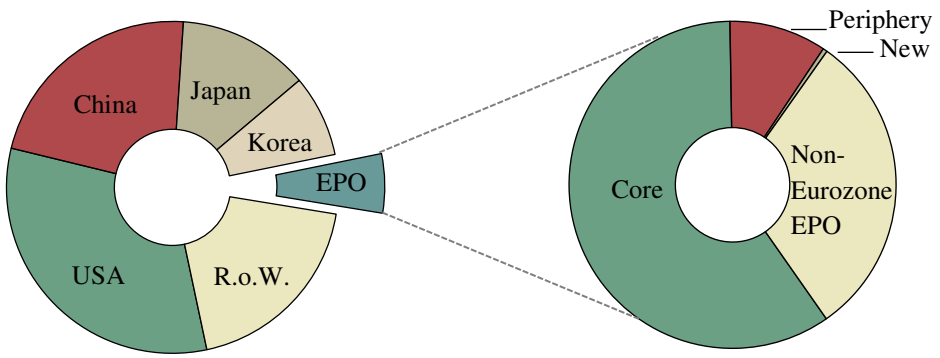
[62] Tertiary Enrollment is defined as "the total enrollment in tertiary education […], regardless of age, expressed as a percentage of the total population of the five-year age group following in from secondary school leaving". No distinction is made between sexes. As the European Union and the Eurozone displayed almost the same enrollment ratios, the Eurozone has not been highlighted separately.

[63] No distinction was made between sexes, public and private institutions, or full- and part-time students.

Between 1970 and 2012, the global population roughly doubled, while the global student population increased by the factor of six. As the global population will still grow in the coming decades, and as tertiary enrollment ratios can be considered to increase further as well (especially in East and South Asia, see Figure 53), the number of students will continue to grow faster than the number of humans. This delivers an important implication for the discussion on innovation stagnation: even if the student population in North America and Europe does not increase further (due to low population growth and high enrollment ratios), the vastly growing number of students on a global scale may help to maintain (and potentially even increase) the speed of innovation. It is therefore argued that a global demise of technological growth seems quite unlikely.

But which role will the Eurozone play in shaping future technological progress? As has been shown in Figure 50, the EPO is still one of the world's leading patent offices. But compared to the other large offices, applications are relatively low in absolute numbers, and even more so when adjusted for population size. Furthermore, as with most other economic indicators, large intergroup differences persist within the Eurozone. In 2013, 59.5% of all EPO applications were filed by the Core countries (particularly Germany and France), 9.6% were filed by the Periphery countries (mainly Italy and Spain), and only 0.4% were filed by members of the New country group:[64]

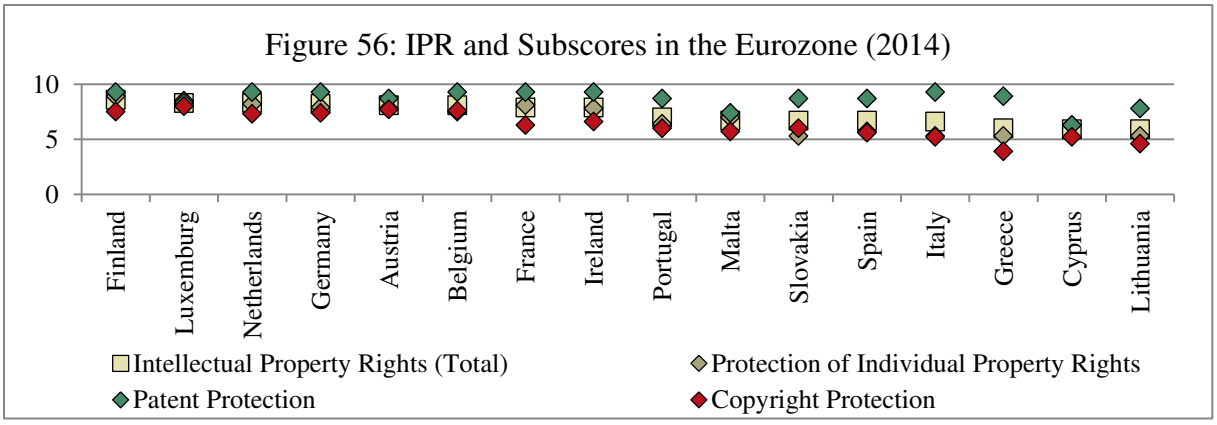
Figure 55: The Eurozone's Share in Global Patent Applications (2013)



Source: Author's calculations; based on data provided by the WIPO (2013)

The large degree of intergroup differences is partly related to differences in intellectual property rights (IPR), which Jalles (2010) has defined as a second possible proxy for technological progress. As of 2014, the IPR index and most of its subscores were usually much smaller in the Periphery and New countries (Ireland being the only notable exception):

[64] The remaining 30.5% were largely attributable to Denmark, Norway, Sweden, Switzerland, and the United Kingdom. Significantly smaller numbers were filed by residents of Albania, Bulgaria, the Czech Republic, Croatia, Hungary, Iceland, Liechtenstein, Monaco, Macedonia, Poland, Romania, Serbia, San Marino, and Turkey. Applications filed by residents of non-EPO countries were not included.



Source: Author's illustration; based on data provided by the PRA (2015)

In particular, copyright protection and the protection of individual property rights were much lower in those countries.[65] As these indices are significantly linked to the evolvement of innovation, further improvements could ensure that these countries play a larger role as drivers of technological process.

But what if the Eurozone's innovation environment cannot be significantly increased? What if the Eurozone's student population will not grow further due to adverse demographics, what if budget constraints prohibit the allocation of additional resources for R&D, and what if the number of patents filed at the EPO remains low? Or, to put it bluntly, what if the Eurozone will be playing an ever smaller role in driving global technological growth? Even in this case, the Eurozone would not face any type of secular stagnation in the shape of slow technological growth. In our globalized world, innovation spillovers will also be felt in slower-growing areas – if a Chinese firm achieves a breakthrough in biotechnology or artificial intelligence, this knowledge will sooner or later become accessible to Western researchers and firms as well.

As a conclusion, the present section has shown that the global economy – and, hence, the Eurozone – will not suffer from innovation stagnation in the near future. Rather, it is argued that technological growth will be sustained or even accelerated, as has been proposed by authors such as Brynjolfsson and McAfee (2014) and Mokyr (2014a, 2014b). But while the predictions of these authors have often been considered as too optimistic and scientifically unfounded,[66] the present section bases its conclusion solely on factor endowments. The global population of college students – and, consequently, the number of researchers – is rapidly

[65] For most of the countries included in Figure 56, information on the IPR and its subscores was given for the years 2007-2014. However, most of these scores did not experience substantial changes during said time period. Because of this, the development over time has not been displayed. No data was available for Estonia, Latvia, and Slovenia.

[66] For instance, Gordon (2014) regards them as "techno-optimists [who] focus entirely on their hopes and dreams of unprecedented future breakthroughs in technology" and who predict "hypothetical future breakthroughs without any contact with the historical data".

growing. In almost all advanced economies, the amount of resources allocated to R&D is much larger compared to previous decades – and it is still increasing. Faced with this empirical evidence, it is difficult to believe that the technological frontier will expand significantly more slowly in the future. Hence, in addition to the propositions of Summers (2014a, 2014b) and Gordon (2012, 2014), this third definition of secular stagnation is rejected as well in the case of the Eurozone.

5 Monetary Policy and the Decline of the Natural Rate of Interest

5.1 Identifying the 'Correct' Target Rate for the Eurozone

Section 3 has proposed a contemporary estimation of the Eurozone's natural real rate of interest. It was found that, while the natural real rate was exposed to a considerable downward trend in recent years, it had not become negative. With core inflation rates close to 1%, the real interest rate r_t was still located considerably below r_t^*. Therefore, it was concluded that the Eurozone did not enter an era of secular stagnation as defined by Summers (2014a, 2014b). However, a decline in the natural real rate still has important implications for the Eurozone's monetary policy, as r_t^* is a key variable in the monetary-policy rule defined by Taylor (1993). The present section aims at investigating how the decline in r_t^* has affected the target rate recommended by the Taylor rule and whether or not the ECB's monetary policy has been appropriate against this background. In its general form, the Taylor rule can be written as

$$i_t^T = \pi_t + r_t^* + a_\pi \tilde{\pi}_t + a_y \tilde{y}_t, \tag{20}$$

where i_t^T is the target rate, r_t^* is the natural real rate of interest, $\tilde{\pi}_t$ is the inflation gap (as defined by equation (14)) and $\tilde{y}_t$ is the output gap (as defined by equation (13)). In his initial paper, Taylor (1993) made the additional assumption that

$$a_\pi = a_y = 0.5. \tag{21}$$

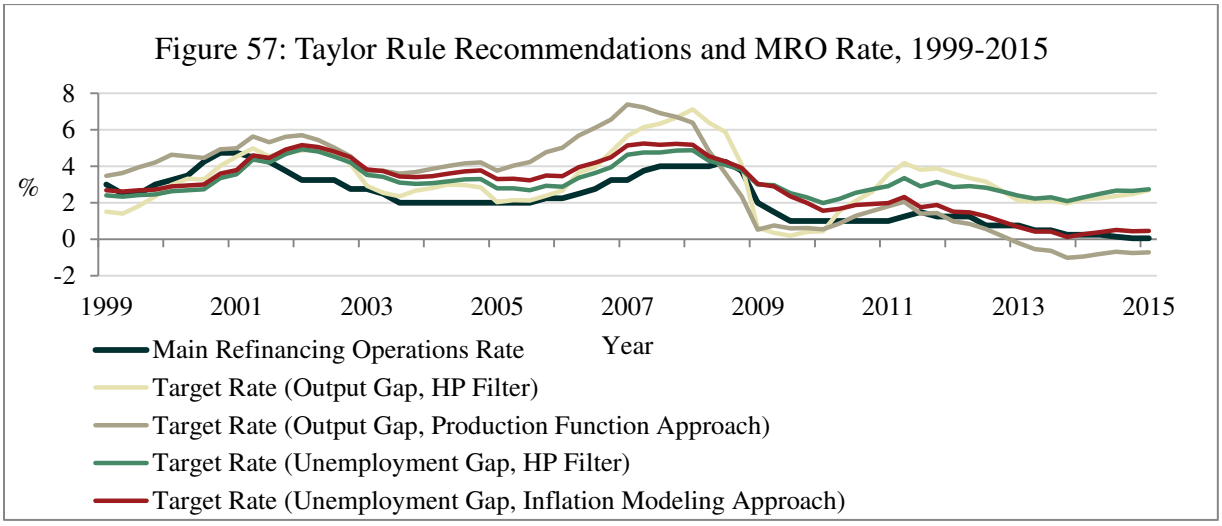
However, following this proposition resulted in target rates which were remarkably lower than the actual interest rate for most of the observation period. Hence, as recommended by Nechio (2011), it was assumed that the ECB places more emphasis on the output gap than on the inflation gap, resulting in $a_\pi = 0.5$ and $a_y = 1$. Furthermore, the ECB has declared an inflation target of 2%. Under these assumptions, equation (20) can be rewritten as

$$i_t^T = r_t^* + 1.5\pi_t - 1 + \tilde{y}_t. \tag{22}$$

In his original proposition, Taylor (1993) specified r_t^* to be 2%. Since then, it has become the prevalent approach among economists to assume a constant natural real rate when calculating the Taylor rule (see, for example, Moons and Van Poeck 2008, Nechio 2011, Bouis et al. 2013[67] and Afflatet 2014 for the Eurozone). In the present analysis, it was initially assumed as well that the natural rate of interest equaled 2% over the entire observation period. This restriction was then relaxed later on. Quarterly data on (core) inflation and seasonally

[67] Bouis et al. (2013) estimate the Eurozone's natural real rate for the years 1980-2012 and acknowledge that it has declined substantially, but use a constant rate of 1.9% for their calculations of the Taylor rule.

adjusted GDP was taken from Eurostat (2015) and the OECD (2015). Some scholars, such as Rudebusch (2010) and Nechio (2011), have argued that the output gap may be replaced by the unemployment gap in order to obtain a better estimate of the target rate. In a comparative approach, $\tilde{y}_t$ was therefore replaced by $(-\tilde{u}_t)$ as defined by equation (15). The OECD (2015) estimates $\tilde{y}_t$ using a production function approach and u_t^* using an inflation modeling approach. For comparison, the output gap and the unemployment gap were approximated using a HP filter with λ=1,600, as recommended for quarterly data (Ravn and Uhlig 2002).[68] Figure 57 compares the target rates calculated from this framework to the ECB's main refinancing operations (MRO) rate:



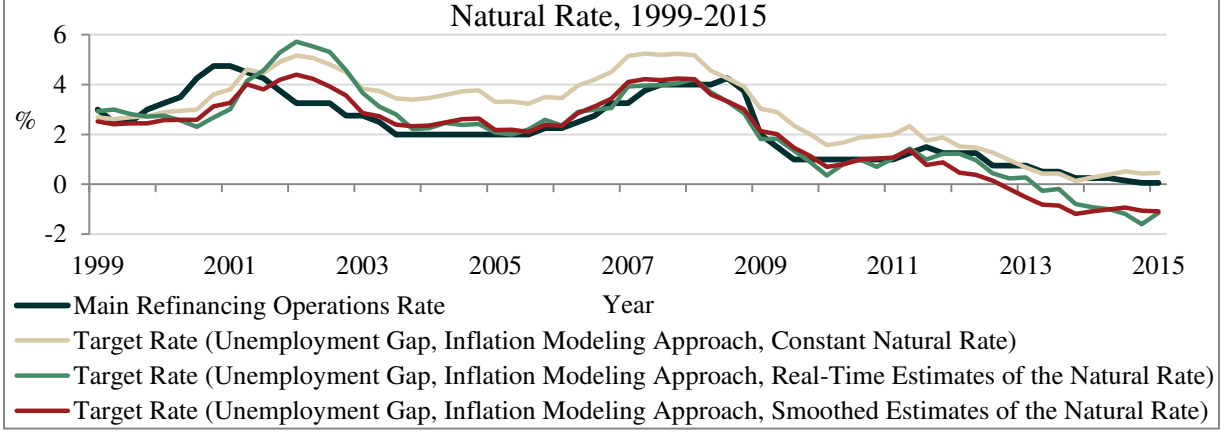
Source: Author's calculations following Taylor (1993) and Nechio (2011); based on data provided by the ECB (2015), Eurostat (2015) and the OECD (2015)

It was found that the different setups produced strongly varying results. For instance, from 2009 to mid-2010, both measures based on the output gap reported a target rate below the actual MRO rate, while the calculations based on the unemployment gap suggested the opposite. For the last observation period, the deviation of the different estimates amounted to up to 3.46%. Overall, it seemed that the estimates were somewhat more volatile when they were based on the output gap. At the same time, the target rate tended to be overestimated for the most recent years when the output or unemployment gap was extracted from a HP filter – as of 03/2015, increasing the MRO to 2.7% could be considered unrealistic at best. On the other hand, the target rate seemed to provide a reasonable fit and was more in line with other recent literature when based on the unemployment gap calculated by the OECD's inflation modeling approach. Hence, subsequent calculations were based on this measure.

[68] As has been mentioned in Footnote 31 and 33, output and unemployment gaps calculated from a HP filter have to be taken with caution. However, since it is often found that HP filtered results closely match those derived from more theoretically founded calculations, the HP filter was applied as a comparative measure nevertheless.

After having determined the most convenient slack variable, the assumption of a constant natural real rate was relaxed. To this effect, the previously obtained monthly estimates of r_t^* (both real-time and smoothed) were converted into quarterly data and entered into Equation 22. Figure 58 compares the target rate provided by a constant r_t^* of 2% to those resulting from a time-varying r_t^*:

Figure 58: Taylor Rule Recommendations at Different Levels of the Natural Rate, 1999-2015



Source: Author's calculations following Taylor (1993) and Nechio (2011); based on the author's estimates of the natural real rate and on data provided by the ECB (2015), Eurostat (2015) and the OECD (2015)

From 1999 to 2015, the average target rates derived from a time-varying r_t^* were 2.17% (real-time estimates) and 2.01% (smoothed estimates), fairly close to the actual MRO rate, which had an average of 2.23%. The average target rate derived from a constant r_t^* of 2% was much higher, at 2.95%. It is difficult to believe that for the years 2009 to 2012 (right after the onset of the Great Recession) the MRO rate should have been considerably higher than it actually was. Hence, it was concluded that assuming a constant natural real rate (especially a relatively high rate, such as 2%) may seriously overestimate the target rate and result in misleading policy recommendations.[69]

In the following, the target rate derived from the author's (real-time) estimates of r_t^* was therefore used as a benchmark for evaluating the ECB's monetary policy. From Q3/2003 to Q1/2008, the MRO rate closely followed this target rate. Following Q1/2008, the target rate sharply dropped until Q1/2010, while the actual MRO rate was held constant and even increased in July 2008, before it was finally reduced in November 2008. Between Q2/2011 and Q3/2011, the target rate fell by 0.43%, while the MRO rate was increased twice by a total of 0.5% before being reduced again. In all of these cases, the ECB prematurely increased the MRO rate, leading to the creation of contractionary forces in the Eurozone. Similarly, the

[69] For example, Darvas (2014) calculates a target rate for the Eurozone using a constant natural real rate of 2% and finds that the MRO rate was continuously below the target rate for the entire period from 2001 to 2014. This proposition would surely have turned out more cautiously if a time-varying (or at least a smaller constant) natural real rate had been chosen in the calculations.

target rate dropped sharply following Q1/2012 and became negative in Q2/2013, while the actual MRO rate was reduced more slowly and was not brought to the ZLB before September 2014.

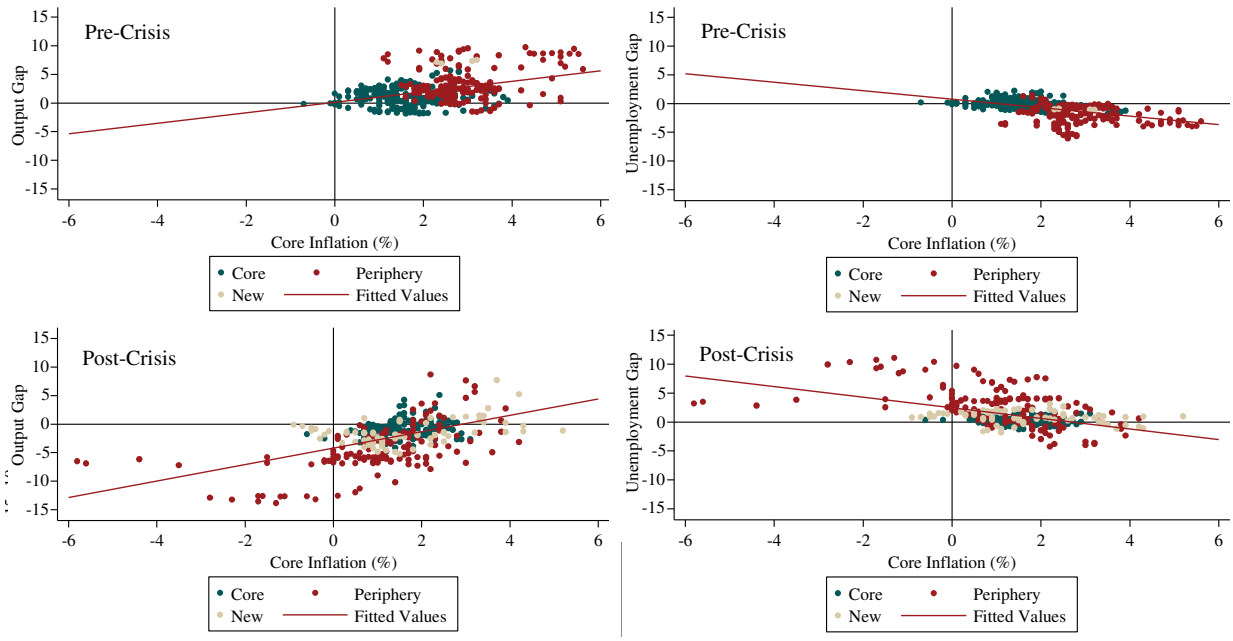
The results of this section have demonstrated that from 2002 to 2007, the MRO rate closely followed the target rate if the latter was based on the unemployment gap (calculated from the OECD's NAIRU measure) and the previously estimated natural real rate. After the onset of the Great Recession, the ECB has raised the MRO prematurely on three occasions and reduced it to the ZLB later than suggested by the target rate. Still, for the Eurozone as a whole, the ECB's monetary policy seems to have generally been appropriate in the face of a declining natural real rate.

5.2 When One Size does not fit All: The Role of Diversity within the Eurozone

5.2.1 Target Rates, Policy Stress and Convergence at the Aggregated Group Level

However, a different question would be whether the ECB's monetary policy could also be considered appropriate from the individual member countries' point of view. In order to answer this question, regional differences in the determinants of the Taylor rule (see Equation 22) were investigated. Figure 59 depicts output gaps, unemployment gaps, and core inflation for the different Eurozone groups:

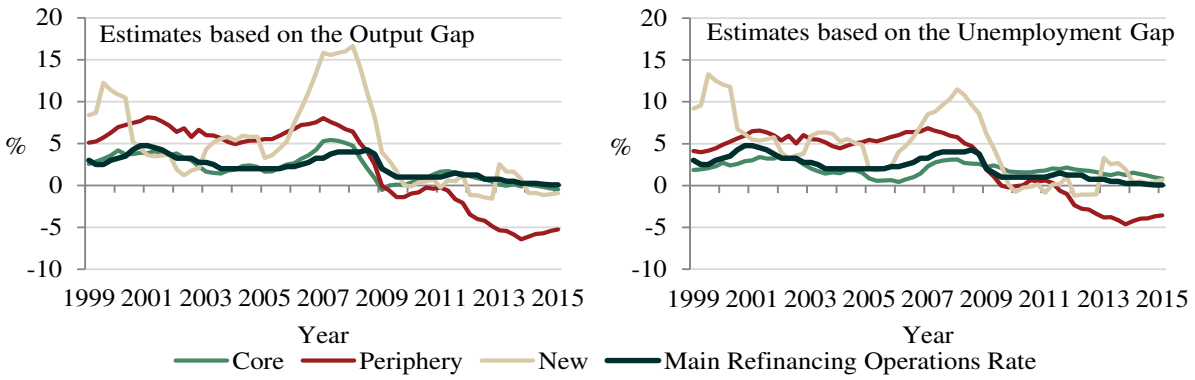
Figure 59: Core Inflation, Output Gaps, and Unemployment Gaps in the Eurozone, Pre-Crisis vs. Post-Crisis



Upper charts: 1999-2007 (n=428), lower charts: 2008-2015 (n=406); source: Authors's illustration following Rawdanowicz et al. (2014); based on data provided by Eurostat (2015) and the OECD (2015)

As can be seen from the different scatter plots, large intergroup differences existed even before the Great Recession began.[70] In particular, from 1999 to 2007, the Periphery countries displayed lower unemployment gaps and much larger output gaps and inflation rates than the Core countries. This condition was reversed from 2008 to 2015, with the Periphery countries now showing larger unemployment gaps and lower output gaps and levels of inflation compared to the Core countries. Furthermore, all variables displayed a much larger standard deviation for the Periphery countries (especially for the years following 2008), indicating a higher degree of dispersion within this group. In the case of the New countries, means and standard deviations were always smaller compared to the Periphery countries, but lay considerably above the respective values for the Core countries. Based on this information and on the author's estimates of r_t^*, quarterly target rates were calculated for each group of countries using Equation 22.[71, 72] The results are displayed in Figure 60:

Figure 60: Taylor Rule Recommendations at the Aggregated Group Level, 1999-2015



Source: Author's calculations following Taylor (1993) and Nechio (2011); based on the author's estimates of the natural real rate and on data provided by Eurostat (2015) and the OECD (2015)

Whether the target rates were calculated using the output gap or the unemployment gap, the results indeed suggested the existence of large intergroup differences within the Eurozone. Focusing on the right hand graph (as the unemployment gap had been determined as a more

[70] In order to deliver an accurate representation of the diversity within the Eurozone, the Periphery and New countries were only included for those years during which they were members of the monetary union. No information was avaible for Cyprus, Lithuania and Malta.

[71] It is surely a strong assumption to consider the author's estimate of the natural real rate (which has been calculated for the Eurozone as a whole) as an appropriate variable in calculating target rates for the different country groups. After all, these groups were subject to very different economic dynamics (see Figure 59). However, the previous section has shown that assuming a constant rate (e.g., 2%), which has established itself as a common practice, would constitute an even stronger and less reliable assumption. As has been demonstrated in Section 2.3, it is reasonable to assume that the natural real rate has been subject to significant downward pressure in each of the Eurozone countries. Therefore, quarterly aggregates of the author's smoothed estimates – which suggest that the natural real rate has declined from 2.14% to 0.45% between 01/1997 and 03/2015 – have been used in all subsequent calculations.

[72] For each group, countries were weighed according to the size of their respective GDP in each observation period. The results considerably deviated from those of Nechio (2011), which may be explained by differences in the underlying assumptions. For instance, Nechio assigns Italy to the Core rather than the Periphery group and assumes a constant natural real rate of 2%.

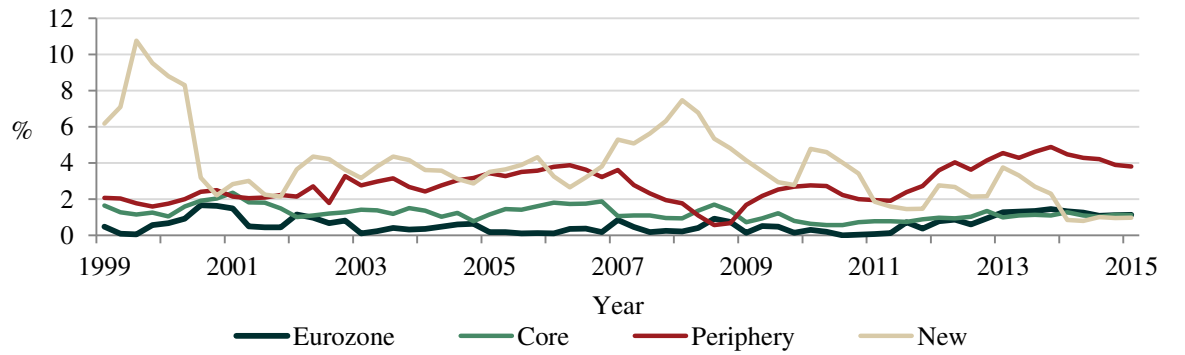
suitable basis in the previous section), the target rate for the Core group was below the actual MRO rate until the beginning of the Great Recession and above the MRO rate afterwards. Using the words of Wren-Lewis (2014), this means that the ECB's monetary policy has been "too tight" for the Core group until about 2009, and "too easy" since then. For the Periphery countries, the opposite was true: the results suggested that the rate should have been much higher until 2008 and should have been reduced to the ZLB much earlier after that. The absolute degree of deviation was also much larger for the Periphery group than for the Core group in almost all observation periods. The countries within the New group consecutively entered the Eurozone between 2007 and 2015, and it seems that their target rate converged closer to the actual MRO rate as time progressed.

In order to gain more precise insights on the economic pressure created by the ECB's common monetary policy, a measure of policy 'stress' was created following the example of Clarida, Galí and Gertler (1998). According to these authors, the policy 'stress' for a given group of countries can be defined as the differential between the actual and the optimal policy, i.e.:[73]

$$s_{j,t} = \left| i_{j,t}^{T} - i_{t}^{MRO} \right|, \tag{23}$$

where $s_{j,t}$ is the economic 'stress' for a given country group j in period t and i_t^{MRO} is the ECB's MRO rate. Figure 61 presents the results for the different country groups as well as for the Eurozone as a whole:[74]

Figure 61: Monetary Policy 'Stress' at the Aggregated Group Level, 1999-2015



Source: Author's calculations following Clarida et al. (1998) and Sturm and Wollmershäuser (2008); based on the author's estimates of the natural real rate and on data provided by Eurostat (2015) and the OECD (2015)

[73] While the theoretical justification has been given by Clarida et al. (1998), equation (23) was inspired by Sturm and Wollmershäuser (2008).

[74] For each group, countries were weighed according to the size of their respective GDP in each observation period. As has been pointed out by Quint (2014), these results strongly differ if a lower limit of 0 is defined for every target rate calculated by the Taylor rule. In that case, 'stress' levels tend towards 0 following 2008, as the ECB gradually reduced the MRO rate to the ZLB. However, doing so would produce some deceptive results, such as specifying the same level of 'stress' for France and Finland as for Greece in Q1/2015. Therefore, it was decided not to define a lower limit for the Taylor rate and to display the deviation between actual and optimal policy rate in its entire magnitude instead.

For the years 1999 to 2015, the average 'stress' level was 0.59% for the Eurozone as a whole, 1.23% for the Core group and 2.81% for the Periphery group. The average pre-crisis 'stress' level (1999-2007) was lower than the post-crisis level (2008-2015) for the Eurozone (0.53% vs. 0.69%) and the Periphery group (2.68% vs. 2.97%). For the Core group, pre-crisis levels were much higher than post-crisis ones (1.44% vs. 0.99%). From the year 2007 (the year of Slovenia's accession to the Eurozone) to 2015, average 'stress' amounted to 3.33% for the New group, albeit displaying a noticeable downward tendency.

Hence, Figure 61 delivers three important insights. Firstly, with the exception of a small interlude in 2008, the degree of economic 'stress' was much larger for the Periphery than for the Core group. Secondly, since the beginning of the Great Recession, economic 'stress' has declined for the Core and the New group, but massively increased for the Periphery group. And finally (and most importantly), the ECB's monetary policy has been much more appropriate for the Eurozone as a whole than from the point of view of the individual country groups. Hence, the findings of this section are in line with those of a range of earlier studies (see, for instance, Sturm and Wollmershäuser 2008 and Lee and Crowley 2009), even after accounting for a decline in the natural real rate. Confronted with this degree of diversity, it appears plausible to ask whether a single monetary policy can actually be appropriate for such heterogeneous groups of countries.

Thus, the results of this section are closely related to the debate on the optimum size of currency areas. The modern debate on this topic goes back at least until Mundell (1961) who, as part of his 'stabilization argument', considered currency domain as invaluable in dealing with asymmetric shocks and advocated to keep the size of currency areas small.[75, 76] Figures 59 to 61 have clearly demonstrated that the Great Recession constituted such an asymmetric shock which adversely affected the different Eurozone members.[77] Many of those members – particularly the Periphery countries – would probably have dissented from the monetary policy determined by the ECB and pursued measures more suitable for their own needs, if they only could. However, this is not open for debate since, as Eichengreen (1998) put it, "EU member states with very different preferences [are] shackled to one another by a

[75] In a later paper, however, Mundell reversed his conclusion after implementing a new economic model and began advocating larger currency areas instead of smaller ones. McKinnon (2000) demonstrates how Mundell – the "intellectual father of the euro" – subsequently arrived at being cited both by proponents and opponents of European monetary integration.

[76] A more detailed comparison between the optimum currency area (OCA) theory and the realities of the European Economic and Monetary Union (EMU) is provided by Mongelli (2008).

[77] This is not to say that the ECB's monetary policy would generally have been appropriate for all member countries if the Great Recession had not occurred. As shown by Deroose, Langedijk and Roeger (2004), the Eurozone countries are particularly susceptible to "overheating and overcooling" due to the single monetary policy even in 'normal' times.

single monetary policy". Consequently, many scholars have defined the task of determining such a single monetary policy where "one size fits all" as a substantial challenge since the Eurozone was proposed for the first time. Björksten and Syrjänen (2000), Eichengreen (1998, 2002), Feldstein (1997, 2000), Friedman (1997), Krugman and Obstfeldt (2003), Ohr (1999), and Vaubel (1998, 1999) were among those who warned that the large differences between the currency union's member states – both in terms of economic indicators and political incentives – might pose a serious impediment to its long-term success.[78]

The findings of the present section seem to reassure the propositions of these sceptics. One and a half decades after the introduction of a common currency, the Taylor rule recommendations have not converged for the different country groups. Rather, the 'stress' from the common monetary policy is currently much higher for the Eurozone as a whole (and even more so for the Periphery group) than it was when the euro was introduced. As long as these significant differences persist, the Eurozone will remain far from unfolding its full economic potential. This section therefore concludes that, while the Eurozone is unlikely to enter an era of secular stagnation in the near future, the threat of a prolonged 'diversity stagnation' is rather acute and much more substantial.

5.2.2 Target Rates, Policy Stress and Convergence at the Individual Country Level

As suggested by the scatter plots displayed in Figure 59, the determinants of the Taylor rule not only strongly varied among, but also within the respective country groups. For the first quarter of 2015, for example, the unemployment gap was 8.46% in Greece compared to -0.83% in Ireland and 1.41% in Finland compared to -0.80% in Germany. Core inflation amounted to 1.8% in Austria, but only to 0.7% in France. Hence, while analyzing target rates and 'stress' levels on an aggregate level (see Figures 60 and 61) delivered an important insight on the existing intergroup difference within the Eurozone, it did not offer much information on the suitability of the ECB's monetary policy for the individual member countries. Hence, in order to gain more insights on the threat represented by Eurozone diversity, the analysis was repeated on the individual level. As such, the Taylor rule was used as a benchmark of how monetary policy "might have been in each individual Eurozone

[78] Academic criticism of the extent, effective date, and admission criteria of the European monetary union was particularly vocal in Germany. A first manifest arguing for a revision of the proposal ("The Monetary Resolutions of Maastricht: A Danger for Europe") was signed by 62 German economics professors (Ohr and Schäfer 1992). It was argued that, while European monetary integration was generally considered desirable, the Maastricht criteria were too soft and the remaining time frame too short for achieving an adequate degree of convergence among the future members of the currency union. A second manifest ("The Euro starts too early"), stated that convergence had not been achieved and that, in contrast, many structural problems had actually worsened during the previous years (Kösters et al. 1998). It was supported by no fewer than 155 German economics professors.

economy, if they had retained their own currency and had floated" (Wren-Lewis 2014). Figure 62 presents the results for every single Eurozone country. As has been supposed, the intragroup differences were found to be substantial:[79]

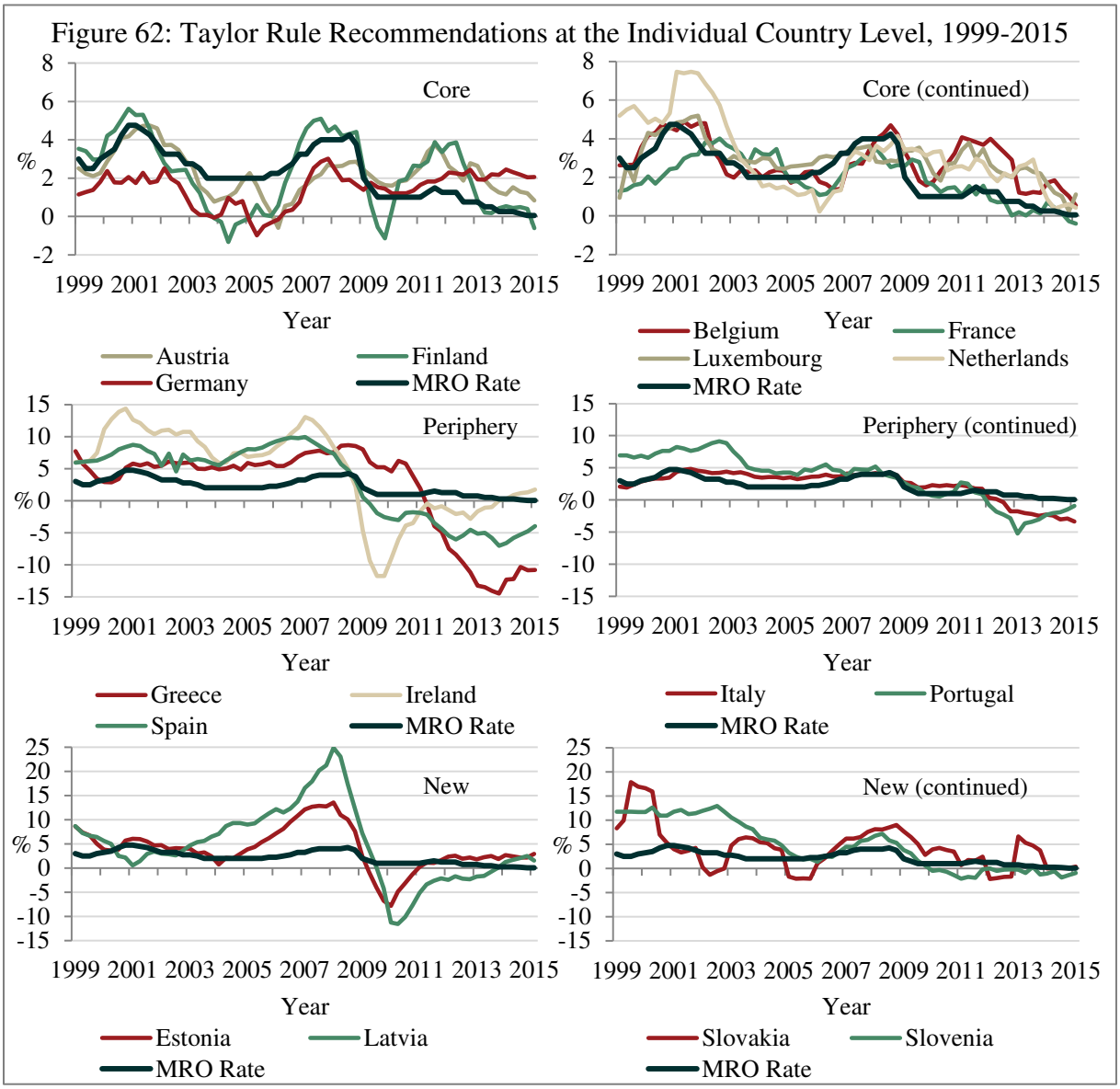


Figure 62: Taylor Rule Recommendations at the Individual Country Level, 1999-2015

Source: Author's calculations following Taylor (1993) and Nechio (2011); based on the author's estimates of the natural real rate and on data provided by Eurostat (2015) and the OECD (2015)

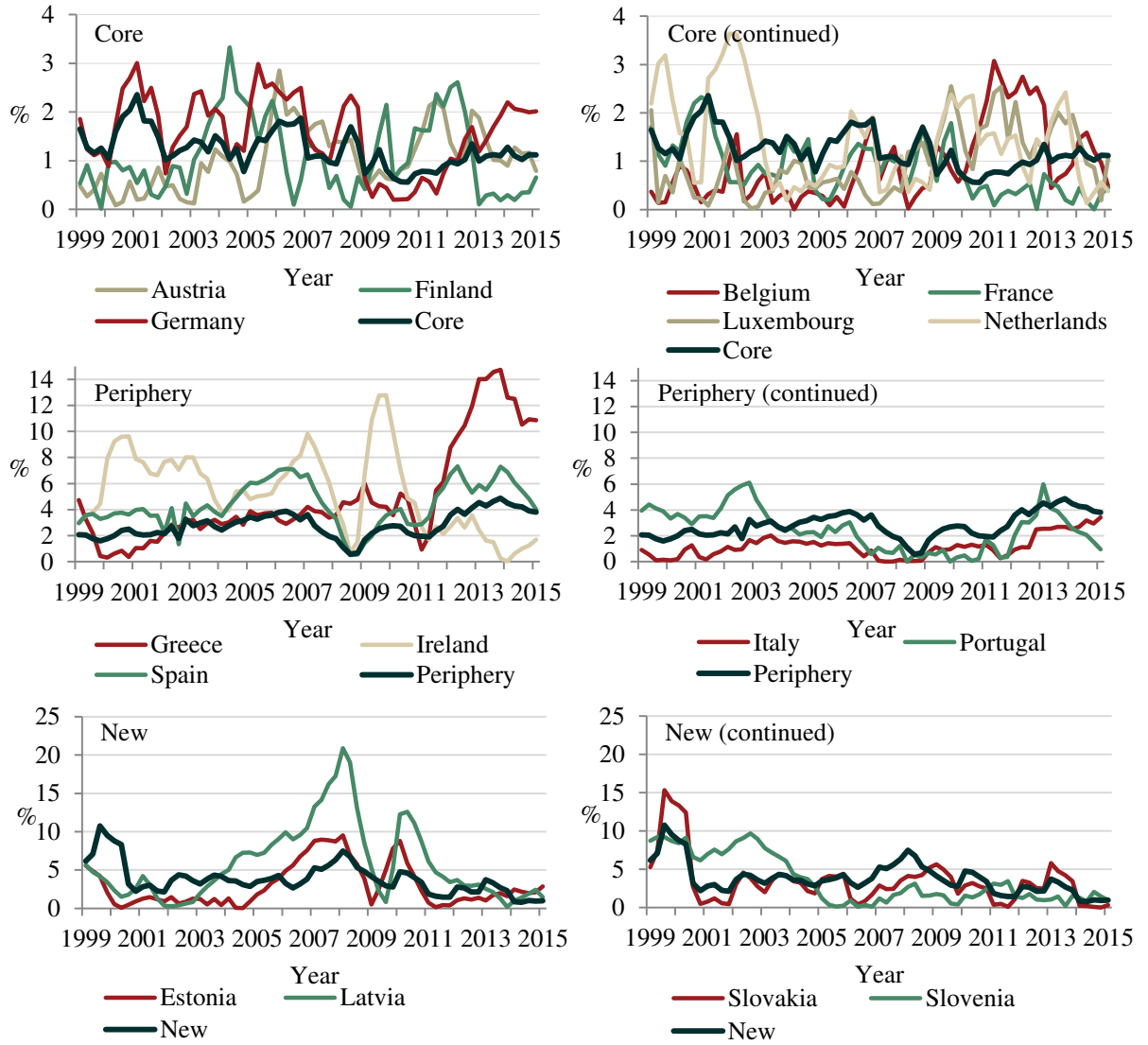
As of Q1/2015, the MRO rate had been reduced to the ZLB. Concerning the Core countries, the Taylor rule implies that doing so was appropriate in the case of Finland and France. For the remaining five countries, this policy is considered as too loose (particularly in Germany, where a target rate of 2.1% is recommended). For most of the depressed Periphery countries, the Taylor rule recommends a negative MRO rate, ranging from -0.9% in Portugal to -10.8% in Greece (which is, of course, ruled out by the ZLB). Ireland, on the other hand,

[79] Calculations were based on the unemployment gap instead of the output gap, as this procedure had been found to deliver the most convenient results in Section 5.1. No data was available for Cyprus, Lithuania, and Malta.

would benefit from raising the rate to 1.7%. Finally, in the case of the New country group, the Eurozone's monetary policy is found to be too loose for Estonia, Latvia, and Slovakia. For Slovenia, keeping the MRO rate at the ZLB can currently be considered as appropriate.

These findings cast further doubt on the adequacy of the common monetary policy rate. Not only was the ECB's monetary policy too loose for the Core group and too tight for the Periphery group following the financial crisis, the discrepancies were even larger from the individual countries' point of view. Following Sturm and Wollmershäuser (2008), the degree of convergence among member countries (as defined as a reduction in monetary policy 'stress') was investigated more closely:[80]

Figure 63: Monetary Policy 'Stress' at the Individual Country Level, 1999-2015



Source: Author's calculations following Clarida et al. (1998) and Sturm and Wollmershäuser (2008); based on the author's estimates of the natural real rate and on data provided by Eurostat (2015) and the OECD (2015)

[80] See Footnote 79.

While Figure 61 has already shown that the monetary policy 'stress' was lower for the Eurozone as a whole than for any of the three country groups, Figure 63 allows for a more detailed assessment of this pattern. Two points have to be noted. Firstly, As of Q1/2015, not a single Eurozone member country exhibited a true pattern of convergence (which would be defined as a sustained reduction of its 'stress' indicator towards 0).[81] And secondly, for each country, the 'stress' indicator was subject to a large degree of volatility. Annual averages were subsequently calculated in order to control for the quarterly fluctuations. The results are displayed in Table 8:[82]

Table 8: Monetary Policy 'Stress' at the Individual Country Level, 2001-2015

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	ø
Austria	0.4	0.3	0.8	0.7	1.0	2.2	1.6	1.3	0.6	0.9	2.0	1.4	1.3	1.1	0.8	1.1
Belgium	0.5	0.7	0.4	0.2	0.2	1.1	0.9	0.3	1.0	1.5	2.6	2.5	0.7	1.3	0.5	1.0
Finland	0.5	0.6	1.5	2.6	1.9	0.8	1.0	0.4	1.2	1.0	1.9	2.1	0.2	0.3	0.7	1.1
France	1.4	0.7	0.9	1.1	0.4	1.3	0.9	1.1	1.1	0.4	0.3	0.4	0.3	0.2	0.5	0.7
Germany	2.4	1.3	2.2	1.4	2.6	2.4	1.2	2.0	0.5	0.2	0.6	1.3	1.6	2.1	2.0	1.6
Luxembourg	0.7	0.3	0.6	0.7	0.6	0.4	0.3	1.2	1.9	1.4	2.2	1.3	1.9	0.9	1.1	1.0
Netherlands	3.1	2.8	0.5	0.5	0.8	1.8	0.7	0.5	2.0	1.9	1.4	1.0	2.0	0.4	0.4	1.3
ø	1.3	1.0	1.0	1.0	1.1	1.4	1.0	1.0	1.2	1.1	1.6	1.4	1.1	0.9	0.8	1.1
Core	1.9	1.1	1.4	1.1	1.4	1.8	1.1	1.3	0.9	0.6	0.8	1.1	1.1	1.1	1.1	1.2
Greece	1.3	2.7	3.0	3.0	3.7	3.2	3.8	4.3	4.8	4.1	3.6	10.2	14.3	11.6	10.8	5.6
Ireland	7.2	7.6	6.5	4.7	5.0	7.2	8.1	2.3	10.8	6.6	2.3	3.1	1.4	0.7	1.7	5.0
Italy	0.5	1.2	1.7	1.5	1.4	1.0	0.2	0.1	0.9	1.2	0.7	1.4	2.6	2.8	3.4	1.4
Portugal	3.6	5.7	3.6	2.4	2.3	2.3	0.8	0.5	0.5	0.3	0.9	2.9	4.3	2.1	1.0	2.2
Spain	3.8	3.0	3.9	4.6	6.2	6.9	5.1	1.5	2.5	3.4	4.2	6.4	6.3	5.8	4.0	4.5
ø	3.3	4.0	3.7	3.2	3.7	4.1	3.6	1.8	3.9	3.1	2.4	4.8	5.8	4.6	4.2	3.8
Periphery	2.1	2.5	2.9	2.9	3.4	3.6	2.7	1.0	2.3	2.4	2.2	3.8	4.6	4.2	3.8	3.0
Estonia	-	-	-	-	-	-	-	-	-	-	0.4	1.2	1.6	2.2	2.9	1.7
Latvia	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	1.5	1.6
Slovakia	-	-	-	-	-	-	-	-	4.1	2.8	0.5	2.9	4.6	0.1	0.3	2.2
Slovenia	-	-	-	-	-	-	1.4	2.2	1.1	1.8	2.8	1.3	1.1	1.4	1.0	1.5
ø	-	-	-	-	-	-	1.4	2.2	2.6	2.3	1.2	1.8	2.4	1.4	1.4	1.9
New	-	-	-	-	-	-	1.4	2.2	3.3	2.5	1.0	2.3	3.3	0.9	1.0	2.0

Source: Author's calculations following Clarida et al. (1998) and Sturm and Wollmershäuser (2008); based on the author's estimates of the natural real rate and on data provided by Eurostat (2015) and the OECD (2015)

As a proxy for the appropriateness of the ECB's monetary policy during the years 2001-2015, the rightmost column of Table 8 delivers the average 'stress' level for each member country and for the different country groups. Average levels amounted to 1.2 for the Core, 3.0 for the Periphery, and 2.0 for the New country group, as has already been suggested by earlier findings. But Table 8 further indicates that the common monetary policy has not been

[81] The members of the New country group seem to have converged somewhat, but only compared to the large levels of monetary policy 'stress' displayed in earlier years. As of Q1/2015, their respective 'stress' levels (with the exception of Slovakia) were still higher than for most countries in the Core group.

[82] *Ø* depicts simple averages. *Core*, *Periphery* and *New* represent weighted averages, for which each member country was weighed according to the relative size of its GDP in each year. For each respective year, the averages of the New group only include those countries which were Eurozone members.

appropriate for a single member country. Even France, which has been subject to the lowest degree of policy 'stress', still displayed an average level of 0.7. Provided that even small changes in interest rates may have profound economic impacts, it can be expected that an average deviation of 0.7% from the optimum rate over a period of 15 years significantly restrained France's economic potential.[83] But these hardships seem to fade when compared to the average 'stress' levels of countries such as Spain (4.5), Ireland (5.0), or Greece (5.6).

Concerning the development of the monetary policy 'stress' indicator over time, a small number of countries does indeed seem to have experienced some convergence during recent years. These countries are Finland, France, Ireland, the Netherlands, Portugal, and Slovakia. In some of these cases, however, it remains yet to see whether the recent developments indicate a long-term convergence or only a cyclical reduction in policy 'stress'. But even if the reductions have a long-term character, they are more than offset by constant – or even increasing – levels of 'stress' in the remaining countries.

The present section has extended the findings of Section 5.2.1 to the individual country level. For every single Eurozone member country, divergences between the Taylor rule recommendations and the actual MRO rate were found to be sizable. When compared to the aggregated group level, the results highlighted large intragroup differences in addition to the previously discussed intergroup differences. This supports earlier empirical assessments of scholars such as Sturm and Wollmershäuser (2008).[84] The lack of convergence between 2001 and 2015 suggests that the Eurozone's economic potential may continue to be significantly restrained by these differences. The implications are profound: while the euro has been introduced in order to foster European integration, the results of the present section have shown that the single monetary policy might actually solidify – or even increase – structural differences. This is also suggested by Estrada, Galí and López-Salido (2013), who show that the dispersion of unemployment rates following the Great Recession has been much larger for the Eurozone compared to non-Eurozone countries.[85] Consequently, these authors conclude that the "common currency in its initial design and the lack of country-specific monetary

[83] The large impact of even marginal interest rate adjustments can be illustrated by the recent reduction in the ECB's MRO rate: Between July 2011 and September 2014, it experienced seven different adjustments in order to be reduced from 1.5% to 0.05% (ECB 2015).

[84] Some of the findings in Sturm and Wollmershäuser (2008) are also contradicted by the present analysis, which is owed to the different time horizon. For instance, these authors propose that a significant degree of convergence had taken place in Italy. As can be seen from Table 8, the Great Recession has reversed this development.

[85] Estrada, Galí and López-Salido (2013) analyze convergence and divergence of four different variables within the EMU: Unemployment, relative prices, inflation, and current account balances. They show that the operation of the EMU may have led to a convergence of relative prices (particularly among tradable goods) and current account balances. In the case of unemployment, however, the EMU led to a large degree of divergence.

policies or stabilizing risk-sharing devices to accommodate country-specific shocks may have been a factor behind the large differences in unemployment performance." Or, to put it differently, the ECB's challenge to implement a single monetary policy for countries with strongly varying preferences and needs may result in a compromise where "one size fits none" (Enderlein 2015).

However, determining the actual economic burden associated with this 'diversity stagnation' is not an easy task, and the gains from having a common monetary policy – such as the impact on trade and competition – could well outweigh this burden (Sturm and Wollmershäuser 2008). It follows that any conclusive assessment would require quantifying the detriments and benefits, which is beyond the scope of the present analysis – even more so as many effects, such as the impact on political stability within the EU, are difficult to measure. Leaving this assessment up to further research, the present section concludes that the single monetary policy – which was initiated with the aim of accelerating European integration[86] – may actually stimulate divergences within the Eurozone. During the previous 15 years, every single member country has been subject to a significant degree of economic pressure, a condition which is unlikely to be reversed in the near future.

5.3 Lessons from the USA

The different Taylor rates estimated in Section 5.2 have pointed to large divergences within the Eurozone. While the ECB's single monetary policy was found to be appropriate for the Eurozone as a whole, it was far from ideal from the perspective of most individual countries. Based on these results, it was argued that any possible policy rate would constitute a compromise which would inevitably restrain the Eurozone's economic potential and possibly impair European integration. But while these findings seem to reassure the many critics of the euro (see Section 5.2.1), it has to be asked whether this headwind does in fact rule out the possibility of future convergence. To this end, the chances of a successful European monetary integration have often been assessed at the example of the USA (see, for instance, Eichengreen, Obstfeldt, and Spaventa 1992 and Bayoumi and Eichengreen 1993). The present section highlights the most important differences between both monetary unions in order to evaluate whether or not the Eurozone could emulate the US-American success. Thus, the main question

[86] Three decades before its introduction, Mundell (1969) already defined European integration as the primary goal of any future European currency. He argued that "even if there were no economic case for a European Money there is a political case for one", adding that "the case for a European money must be made primarily on political grounds, just because politics in the widest sense of the word has to override economics."

of the present section is straightforward: If the USA managed to create an optimum currency area out of 50 diverse states, why should the same be out of reach for the European Union?[87]

Against this case, it is often argued that the Eurozone is simply much more heterogeneous. To many observers it seems self-evident that, while the USA are a rather homogenous nation, countries such as Germany and Slovenia, Greece and Portugal are just too different in economic and cultural terms to form a monetary union. However, if cultural factors (such as a common language) are left out, the interstate economic differences in the USA seem to be quite comparable to those of the Eurozone. As of 2014, levels of per capita GDP ranged from 31,551$ in Mississippi to 66,160$ in Alaska (USA: 49,469$). Alaska' economy contracted by 1.3%, while North Dakota displayed a growth rate of 6.3%. In 2015, unemployment rates amounted to 2.7% in Nebraska and to 7.5% in West Virginia (USA: 5.3%).[88] On top of that, the USA are subject to large regional differences in a number of additional indicators which may influence economic performance, such as population density, geography, climate, and ethnics.

These indicators show that the economic performance among some US states differs to a similar degree than between the Eurozone's Core and Periphery states. As a result, the USA have been subject to a number of asymmetric regional shocks during the preceding decades (Mundell 1998). And yet, despite these apparent interstate differences, the Federal Reserve Bank issues a single policy rate for each of its 12 districts. This indicates that a comparison between the ECB's and the Fed's monetary policy could deliver important implications for the Eurozone. More specifically, it could explain why a single monetary policy is rather appropriate in the case of the USA, and whether or not the Eurozone could be adjusted accordingly.

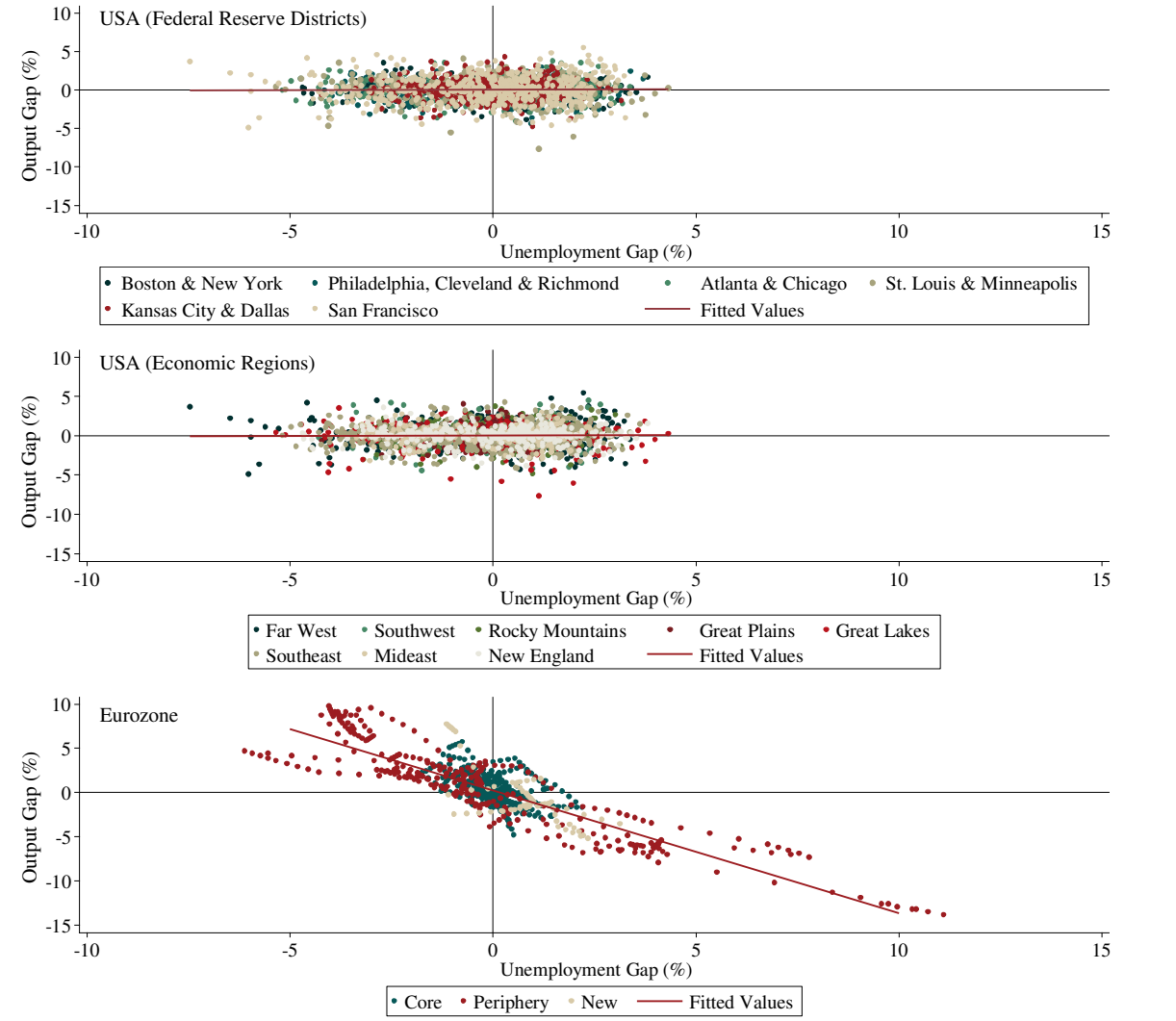
Initially, the Eurozone's output gap and unemployment gap (two of the main determinants of monetary policy, see equation (20)) were compared to those of the USA in order to get an overview on existing intergroup differences. For each US state, annual data on GDP and unemployment for the time period from 1999 to 2014 was provided by the Bureau of Economic Analysis (BEA) and the Bureau of Labor Statistics (BLS). This information was converted into quarterly data, based on which the output gap and the unemployment gap were

[87] It has to be noted that there is no academic consensus on whether or not the USA represent an ideal OCA. Also, monetary integration took a long time in the case of the USA – Rockoff (2013) considers a period of 150 years as "a reasonable minimum". As a starting point for the present analysis, however, it is taken that the USA resemble an OCA.

[88] See BEA 2015 and BLS 2015.

calculated for each of the 50 states using a HP filter with λ=1,600.[89] The resulting estimates were grouped according to the states' affiliation with the 12 US Federal Reserve Districts. For the sake of clarity, the 12 Federal Reserve Districts have been merged into six groups, each containing approximately the same number of observations. In a comparative approach, the observations were grouped according to the eight different economic regions as defined by the BEA (2015). Figure 64 compares the spreading of output gap and unemployment gap in the USA and the Eurozone:

Figure 64: Output Gaps and Unemployment Gaps in the USA and the Eurozone, 1999-2014



Source: Author's calculations; based on data provided by, the OECD (2015), the BEA (2015), and the BLS (2015); n=3111/782 (USA/Eurozone)

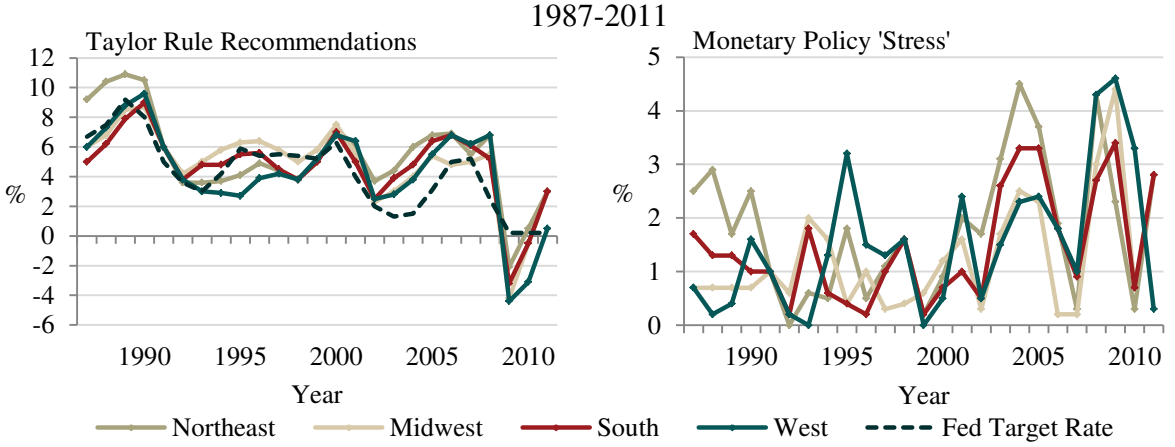
The 12 different US Federal Reserve Districts displayed a very similar kind of pattern. Mean values were all close to zero due to the use of a HP filter. The standard deviations displayed a range from 0.79 (Richmond) to 1.71 (San Francisco) in the case of the output gap

[89] As has been laid out earlier (see Footnotes 31 and 33), these results have to be taken with caution. However, as information on output gap and NAIRU were not available for the different US states, the HP filter was implemented nevertheless.

and from 1.12 (Dallas) to 2.16 (Atlanta) for the unemployment gap. This did not change much if the 50 US states were grouped according to the eight different economic regions instead. In that case, the standard deviations of the output gap ranged from 0.97 (Mideast) to 1.67 (Far West). For the unemployment gap, they ranged from 0.95 (Far West) to 2.03 (Great Plains). For the Eurozone, on the other hand, the scatter plot presented a distinctively different pattern for the three country groups. Standard deviations were 1.78 (Core), 2.91 (New) and 5.27 (Periphery) for the output gap and 0.68 (Core), 1.10 (New) and 3.44 (Periphery) for the unemployment gap. The intergroup variation was therefore much larger for the Eurozone than for the USA. Of course it has to be acknowledged that this can partially be explained by the different estimation methods, as the US data had only been derived from a simple HP filter which constrained the mean values close to zero. However, if the calculations for the Eurozone were repeated using HP filtered data as well, the resulting scatter plot still displayed the distinct skewness pattern and intergroup variation shown in Figure 64.

These findings suggest that a single monetary policy may indeed be more appropriate for the USA than for the Eurozone. Comparably to Section 5.2.1 and 5.2.2, this could be confirmed by the calculation of Taylor rates for the different US states and regions. Unfortunately, information on inflation rates was available neither for the 50 different US states, nor for the 12 Federal Reserve Districts or the eight different economic regions. Hence, the present section relied on the estimations of Malkin and Nechio (2012), who calculated Taylor rates for the four major geographical regions:[90]

Figure 65: Taylor Rule Recommendations and Monetary Policy 'Stress' in the USA, 1987-2011



Source: Malkin and Nechio (2012) and author's calculations based on the data provided by Malkin and Nechio (2012) and the St. Louis Fed (2015)

[90] Malkin and Nechio (2012) base their calculations on a constant natural rate and on national information on headline inflation. Section 5.1 has discussed the drawbacks of this approach, and the results in Figure 65 have therefore to be taken with caution.

Three important observations can be made based on Figure 65. Firstly, the average monetary 'stress' amounted to 1.8 (Northeast), 1.3 (Midwest), 1.4 (South), and 1.5 (West) during the years 1987-2011. While these levels were low compared to those experienced by the Eurozone's Periphery since the introduction of the euro, they were much higher than for each Core country except Germany and the Netherlands. Secondly, the intergroup differences between Northeast, Midwest, South, and West were much smaller than between the Core, Periphery, and New groups. And thirdly, in contrast to the Eurozone, the different US-American Taylor rates always followed the same cycles.

Provided that these findings are representative for the Federal District and state level, they deliver an important implication for the present analysis: A common monetary policy is indeed more suitable in the case of the USA. While the Fed's target rate did not always correspond to the Taylor rule recommendations (either due to a delayed reaction by the Fed, such as from 2002 to 2004, or due to the zero lower bound, as in 2009), the monetary requirements of the four major regions never ruled each other out. In the Eurozone, on the other hand, Figure 60 has shown that the Core would currently benefit from an increase of the MRO rate, but the Periphery would not. The USA has not managed to fully avoid the 'stress' which stems from a single monetary policy, but the degree of 'stress' is more evenly distributed among its regions. Hence, whereas the Fed is able to set a target rate which accommodates the requirements of the different regions to a similar degree, the ECB is not. It follows that, in order to reduce the economic pressure stemming from the Eurozone's common monetary policy, European policymakers have to find ways to improve its efficiency.

Within a monetary union, the efficiency of the common monetary policy can generally be improved via two channels. The first one is the adjustment of the monetary policy towards the needs of its member states. As has been shown, however, this is currently beyond the means of the ECB due to the large degree of inter- and intragroup variations. The second channel is the adjustment of its member states towards the needs of a single monetary policy. This would surely constitute an extensive and tedious challenge, but it might be an unavoidable one. If the Eurozone does indeed not constitute an optimum currency area, the future of the euro will depend on the implementation of changes aimed at reversing this condition. The effort may surely be worthwhile in terms of economic gains and political integration, as suggested by the example of the USA. According to Eichengreen (1991, 1992) and Feldstein (2011), two changes would be particularly rewarding in emulating the US-American success: the creation of an efficient, single labor market, and the implementation of a common fiscal policy.

Concerning the absence of a single European labor market, the large regional differences in unemployment (see Figure 64) may be seen as the result of low intra-Eurozone mobility of labor. While a number of steps have been taken towards the integration of the different national labor markets, they still remain separated by significant cultural and legal barriers. In addition to that, recent evidence points at a significant increase in the emigration of Eurozone workers to non-Eurozone destinations (Dhéret et al. 2013). Hence, further integration of the Eurozone's national labor markets could reduce the threat of asymmetric shocks and support the alignment of the different member states' growth cycles.[91]

Similarly, the potential rewards from the implementation of a common fiscal policy seem evident as well. While monetary policy has been centralized in the Eurozone, fiscal policy has been left to the responsibility of its member states. The Stability and Growth Pact (SGP), aimed at maintaining budgetary discipline within the Eurozone, has not been enforced. The result was a loss of fiscal stability within the Eurozone (Mundell 2011). In addition to that, the USA possesses a system of transfers aimed at equalizing economic growth among its member states. Without the implementation of such a system, it will be difficult to align the growth cycles of the different Eurozone countries.

Hence, both the absence of an efficient, single labor market and the lack of a common fiscal policy point at the need for further European integration.[92] Admittedly, this is more easily said than the Eurozone's realities allow for. Far-reaching reforms would surely be met with tremendous political resistance (particularly if they were aimed towards fiscal integration), and it is difficult to predict whether these hurdles may be overcome. However, as shown by the results of Section 5, there might be no viable alternative. While the ECB's common monetary policy has been appropriate for the Eurozone as a whole, it has not been able to accommodate the specific needs of its three country groups (let alone the needs of its individual member countries). Hence, the significant differences among the Eurozone's member countries will restrain its economic potential in the absence of profound reforms. In contrast to the alleged threat of secular stagnation, the threat of a protracted 'diversity stagnation' is very real and has to be countered.

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[91] For further insights on the development of factor mobility and on current convergence/divergence patterns within the Eurozone's labor market see ECB (2012), Estrada, Galí and López-Salido (2012), and Dhéret et al. (2013).

[92] In fact, Feldstein (2011) delivers three main reasons for the alleged superiority of the US-American system: a single labor market, a centralized fiscal system, and the constitutional obligation of its member states to maintain a balanced budget. In the present analysis, the second and third reason have been merged into a general lack of a common fiscal policy. A number of authors have brought forward additional reasons which they regard as equally important to the lack of a single labor market and a common fiscal policy. For instance, Bordo (2004) considers a lack of political will as a central complication in the case of the Eurozone. This additional consideration will be addressed in Section 6.

6 The Political Economics of a Reform

6.1 The Need for a Reform of the Fiscal and Monetary Framework

The prevalent literature on secular stagnation seems to agree that only the implementation of bold, unconventional policy measures may counter the threat of a Japan-style 'lost decade' in the Eurozone. Accordingly, policy recommendations usually suggest raising demand by means of an extensive monetary and fiscal stimulus, accompagnied by structural reforms aimed at boosting potential growth and the natural real rate (see, for instance, Buiter 2014, Crafts 2015, Rawdanowicz et al. 2014, and Wolff 2015).[93] In this regard, the recent initiation of the ECB's expanded asset purchasing programme (EAPP) and the launch of the European Fund for Strategic Investment (EFSI) are considered by many as a viable response to the threat of secular stagnation.[94, 95]

However, Sections 3 and 4 have shown that the Eurozone does not face a significant threat of secular stagnation, neither in the imminent future, nor in the medium to long run. The Eurozone's monetary policy has not become inefficient due to a decrease in the natural real rate of interest, but – as shown in Section 5 – it has been impaired by the significant degree of differences among its member states. In contrast to the alleged threat of secular stagnation, this 'diversity stagnation' will not be overcome by the implementation of a monetary stimulus or fiscal expansion. Hence, unlike a number of other works on the given topic, the present analysis does not specifically discuss monetary, fiscal, or structural policies aimed at reversing or preventing secular stagnation. Rather, Section 6 delivers an overview on different options for a reformation of the Eurozone's monetary and fiscal system, and debates whether the implementation of any of these measures constitutes a likely outcome.

Section 5.3 has defined the lack of a common fiscal policy as one of the two fundamental restraints of European integration (as compared to the USA). However, asserting that the Eurozone does not display a common fiscal policy *at all* would not be correct, as its member countries are bound by a number of important treaties. First and foremost, with the signing of

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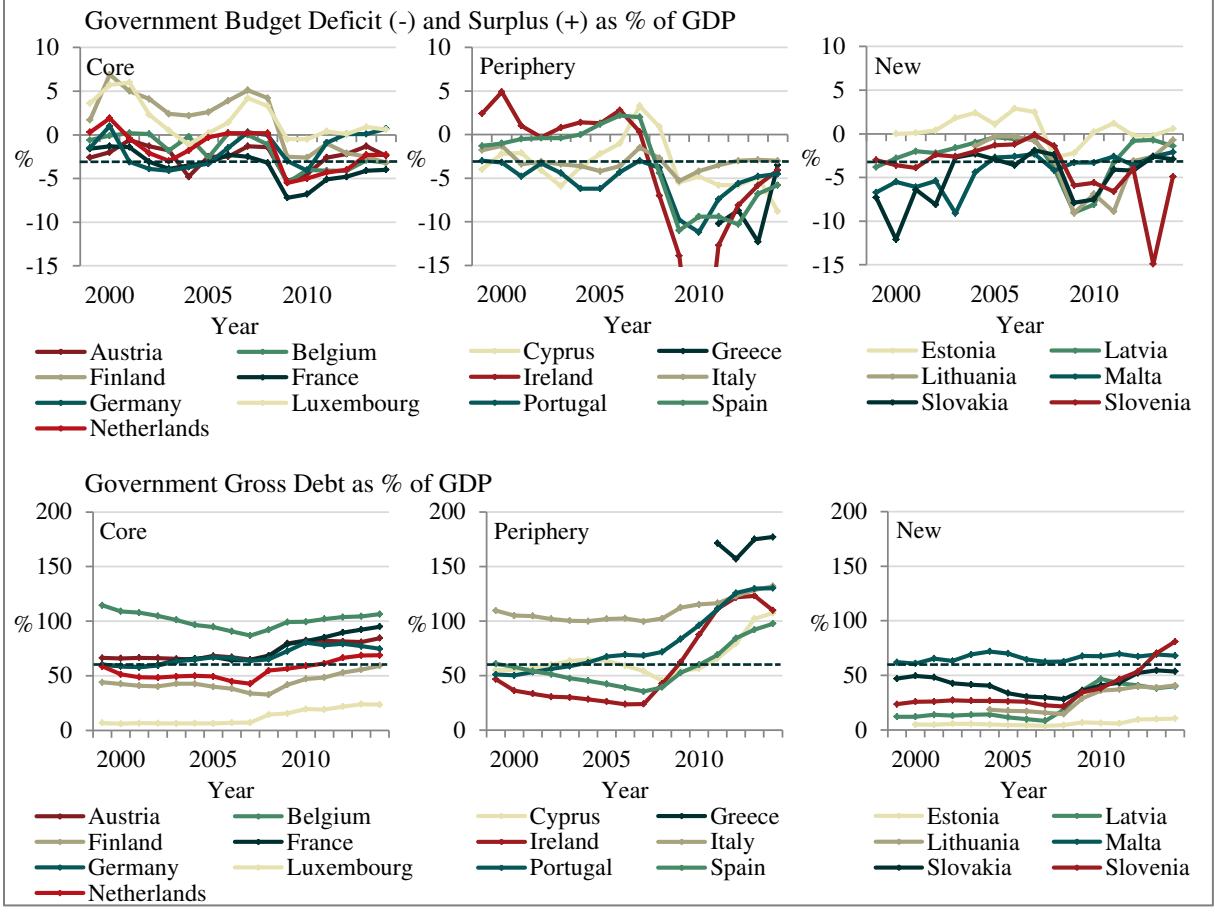
[93] Apart from the implementation of a monetary and/or fiscal stimulus coupled with structural reforms, a large number of additional (and sometimes rather radical) unconventional measures have been proposed as well. Examples are the elimination of the ZLB (Buiter 2009), an elevation of the inflation target (Ball 2014, Eggertsson and Mehrotra 2014), and the abolition of paper currency (Rogoff 2014).

[94] The EAPP aims at raising inflation within the Eurozone by purchasing three different kinds of securities at a volume of €60bn per month: Third covered bonds, asset-backed securities, and public sector securities. It therefore constitutes a type of QE and is intended to be carried out at least until September 2016 (with the option of extending it in case of persistently low inflation).

[95] The EFSI, which has been established within the European Investment Bank (EIB), is the central element of the Investment Plan aimed at boosting investment within the EU. Also known as the 'Juncker Plan', the Investment Plan rests on three pillars: The mobilization of financial resources, the support of investments in the real economy, and the creation of an investment friendly environment (for further information, see EC 2015a and Duprat 2015).

the Maastricht Treaty in 1992, the future Eurozone member states agreed upon four different convergence criteria – the inflation criterion, the fiscal criterion, the exchange rate criterion, and the interest rate criterion.[96] A potential member has to meet all four of these conditions in order to accede to the Eurozone. In addition to that, the fiscal criterion has to be met continuously after joining the monetary union. It is further composed of the deficit criterion and the debt criterion, which were institutionalized with the SGP in 1997 and which define the fiscal constraints that the Eurozone members should comply with. Specifically, these clauses state that a government should not run a budget deficit larger than 3% of the country's GDP and that the government's (gross) debt-to-GDP ratio should not exceed 60%. Figure 66 illustrates the member countries' compliance with these criteria:

Figure 66: Compliance with the Deficit Criterion and the Debt Criterion, 1999-2014



Dotted lines: Thresholds defined by the SGP (budget deficit: -3%; government gross debt: 60%);
Source: Author's calculations; based on data provided by Eurostat (2015)

Figure 66 delivers two important insights. Firstly, the debt criterion was violated by Belgium, Greece and Italy when they adopted the euro, while Greece and Slovakia infringed on the deficit criterion. Strictly spoken, this means that these four countries should not have

[96] Further details on the convergence criteria are provided by article 126 and article 140 of the Treaty on the Functioning of the European Union (TFEU).

been admitted to the Eurozone at the given time.[97] The remaining countries, however, complied with the two clauses (or, such as in the case of Austria, only missed one of the criteria by a narrow degree). And secondly, almost all member countries were running large budgetary deficits and substantially increased their debt-to-GDP ratios following the year 2007. Initially, the European Commission signalized an understanding for short-term violations of the debt and deficit clauses due to the specific circumstances of the financial crisis. However, as can be seen from Figure 66, the violation of the debt criterion has since evolved into a rather long-term trend. This has a profound implication for the Eurozone: As of the year 2014 only Luxembourg, Slovakia and the Baltic states complied with the debt and deficit criteria.

What have been the consequences of this apparent disregard of the common fiscal rules? According to article 126 (11) TFEU, countries which violate the fiscal criterion may face warnings and, ultimately, financial sanctions. If a country repeatedly fails to meet the corrective rules specified in the SGP, these sanctions could amount to 0.5% of its GDP. Theoretically, this should be seen as a substantial threat – in the case of Germany, this would be almost as high as the annual budget of the Ministry of Education and Research (0.59%), and higher than the annual budget of the Ministry of Health (0.47%).[98]

However, the repeated violation of the SGP has not yet resulted in any significant punitive measures. Following the year 2008, the SGP's corrective arm initiated an Excessive Deficit Procedure (EDP) for each of the current Eurozone members except Estonia (EC 2015b). As of 2015, eleven of these EDPs have been closed, even though not all of these countries displayed efforts to reduce their fiscal burden.[99] In the case of Italy, which displayed a debt-to-GDP ratio above 130%, the Commission argued that current conditions would "make the respect of the debt rule particularly demanding". As the Italian government committed to implement growth-enhancing structural reforms in the future, the Commission concluded that "the debt criterion […] should be considered as currently complied with" (EC 2015c). Similar arguments were brought forward for Austria, Belgium and Germany, whose debt levels were

[97] While it was supposed that Greece met the deficit criterion at the time of its accession to the Eurozone, a subsequent investigation documented that the information submitted to the European Commission did not correspond to reality. Hence, Greece was the sole member country which infringed on both criteria when entering the monetary union. In addition to that, it is now presumed that statistical data on Greece's governmental debt and deficit has not only been manipulated before, but also beyond the year 2001. Accordingly, Figure 66 only displays this information for the years 2011-2014. For further information, see EC (2010).

[98] Based on Germany's estimated 2015 GDP (constant prices, base year: 2005) and the official 2015 federal government budget (IMF 2015, BMF 2015).

[99] EPDs have been closed for Austria, Belgium, Finland, Germany, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, and Slovakia.

far above 60% and still rising when the Commission published its verdict (EC 2012, 2014, 2015d). For the remaining seven Eurozone countries, EDPs were still ongoing, with deadlines for correction ranging from 2015 to 2017. However, based on the previous decisions of the corrective arm, it may well be expected that these procedures will be concluded without the implementation of punitive measures as well.

The example of the SGP highlights the central complication of the Eurozone's fiscal framework: not the absence of common rules has led to fiscal imbalances, but rather the member countries' inability and/or unwillingness to comply with the existing regulations. This is further aggravated by the lack of a credible enforcement of the SGP: the failure to impose adequate measures in the face of apparent and repeated violations of the fiscal criterion does surely not result in a favorable signaling effect. Recent reforms of the SGP (such as the implementation of the 'six-pack' in 2011, the addition of the fiscal compact and the 'two-pack' in 2013, and the European Semester in 2014) fell short of adequately addressing this issue (ECB 2014, Mabbett and Schelkle 2014).

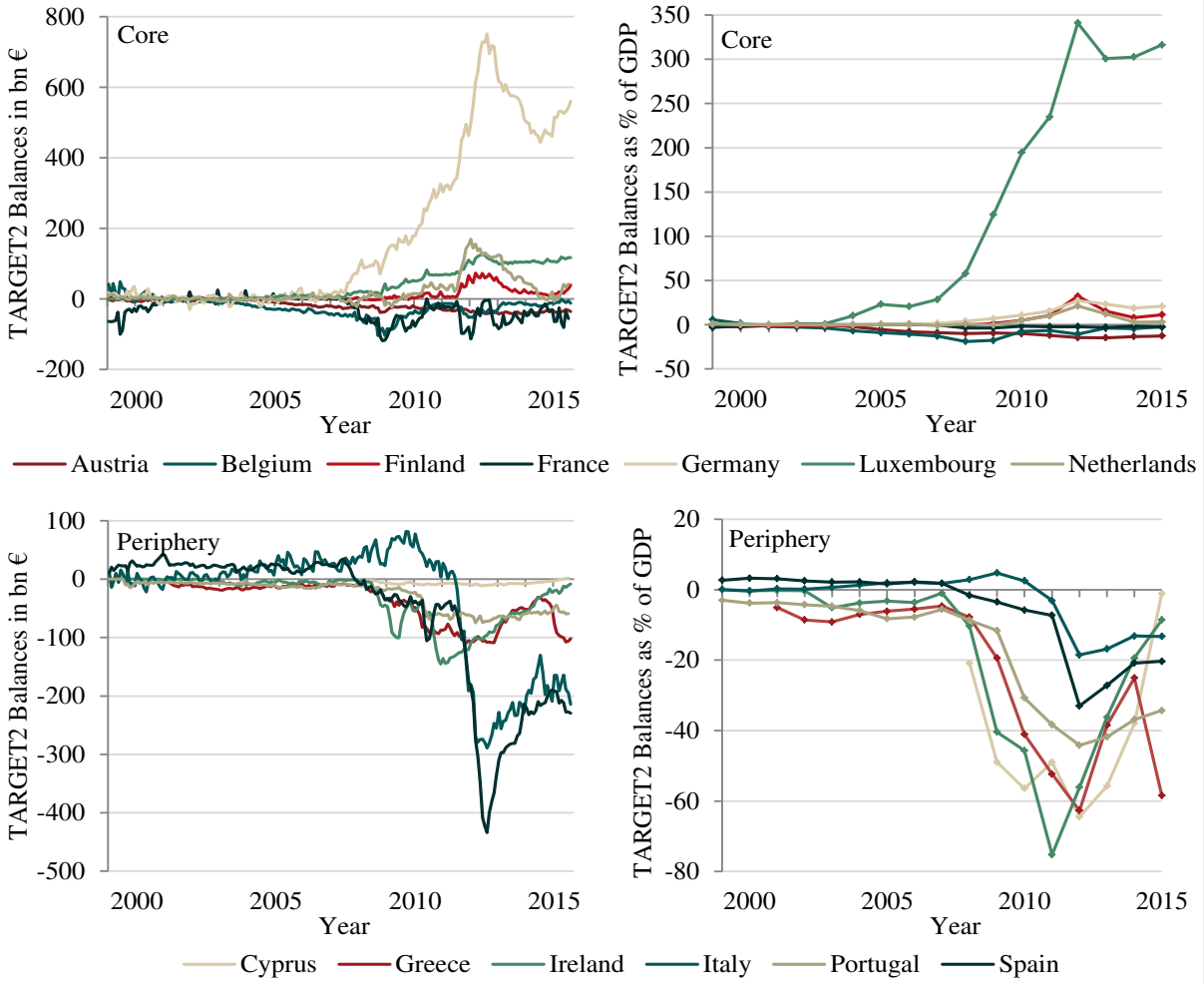
Apparent violations of the common legal framework can also be found elsewhere. Examples are the implementation of the European Financial Stability Facility (EFSF) and the European Stability Mechanism (ESM), which constitute a breach of the 'no bail-out' clause (article 125 TFEU), and the direct purchase of government bonds by the ECB, which sidesteps article 123 TFEU (Homburg 2011a). In each of these cases, existing laws were deliberately violated based on political grounds and against a vocal opposition of rather cautious academics and policymakers.

Possibly the most alarming example of insufficient legal regulation may be found in the recent development of the balances within the Trans-European Automated Real-Time Gross Settlement Express Transfer System (TARGET2).[100] TARGET2 is a settlement system which supports the functioning of the Eurozone's monetary market by processing transactions between its member countries via the national central banks and the ECB. If a French citizen A orders a car from a German exporter B, the payment is channeled from A's bank account to B's bank account via the Banque de France, the ECB, and the Bundesbank. This leaves A's bank with a debit at the Banque de France, which in turn has a debit at the ECB. B's bank, on the other hand, now has a credit with the Bundesbank, which in turn has a credit at the ECB. This results in a French TARGET2 deficit and a German TARGET2 surplus. These balances are interest-bearing, which turns them into a kind of short-term Eurobonds, and technically without an upper limit (Sinn and Wollmershäuser 2011). This was not

[100] In the year 2007, TARGET2 replaced the earlier TARGET settlement system which had served this purpose since 1999.

considered as problematic when TARGET2 was implemented, as it was expected that transactions on the interbank market would largely countervail these balances. In the given example, inflows of public or private capital from Germany (or any other TARGET2 member country) to France would reduce the French TARGET2 deficit.[101] However, when the interbank market broke down during the global financial crisis and the subsequent sovereign debt crisis, this could no longer be ensured. Unintended by the developers of the system, this resulted in a persistent increase of the TARGET2 balances:[102]

Figure 67: TARGET2 Balances for the Core and Periphery Countries, 1999-2015



Source: Steinkamp and Westermann (2014) and author's calculations based on data provided by Steinkamp and Westermann (2014) and the IMF (2015)

[101] As the purpose of the present section is to merely present the imbalances in the Eurozone's fiscal and monetary framework rather than to discuss them in a detailed manner, the given example does not address the topic in its entire complexity. For further detail see Sinn and Wollmershäuser (2011) and Homburg (2011b).

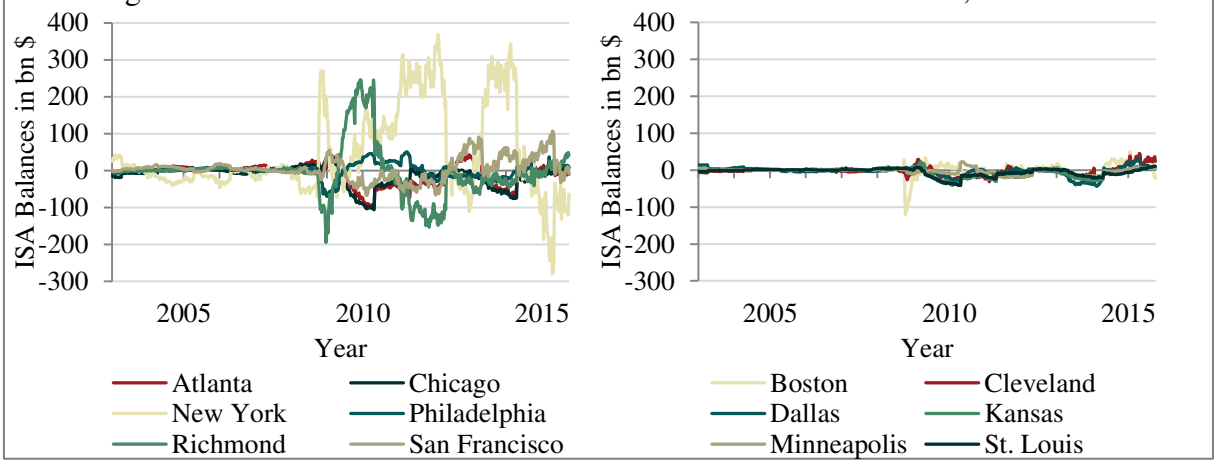
[102] For the charts on the right hand side, monthly TARGET2 balances have been converted into annual averages before dividing them by annual GDP (measured in constant 2005€). For the year 2015, average TARGET2 balances have been calculated based on information for January to August. As their TARGET2 balances were substantially smaller than those of the Core and the Periphery countries (both in nominal terms and as a share of their GDP), the members of the New country group have not been included in Figure 67.

After the onset of the global financial crisis, the Periphery countries soon found it increasingly difficult to obtain sufficient credit from the private capital markets. The ECB swiftly reacted and significantly reduced its collateral standards in order to enable and encourage the peripheral central banks to provide additional capital. However, this resulted in massive capital flows from the Periphery to a number of Core countries – particularly to Germany, which was generally considered as a 'safe haven'. Due to the limited demand for credit in the Core countries, the large inflow of foreign capital displaced the lending of capital by the Core's central banks (Sinn and Wollmershäuser 2011).

As can be seen from Figure 67, this process resulted in the emergence of significant claims and liabilities between the Eurozone's central banks. These balances show a clear North-South divide: the immense liabilities of Greece, Ireland, Italy, Portugal and Spain are almost exactly offset by the claims of Germany, Luxembourg, Finland and the Netherlands (Steinkamp and Westermann 2014). Scholars such as Sinn and Wollmershäuser (2011) and Homburg (2011b) have argued that, while the ECB's swift intervention has initially prevented a financial collapse in the Periphery countries, it did not reduce its assistance after the acute stage of the financial crisis was overcome. Instead, the duration and magnitude of said assistance exceeded by far the scope of a mere crisis management. Hence, these authors argue that the massive increase in TARGET2 balances may have constituted a 'stealth bailout', an immense financial assistance to the crisis states under avoidance of any kind of parliamentary consent.

This has not remained unchallenged. For instance, Whelan (2014) argues that the massive build-up of claims and liabilities has been a by-product of an agreed approach to monetary policy rather than a covered rescue attempt. But even if this were true, it would not lessen the need to find a policy solution in order to address this issue.

Figure 68: ISA Balances for the Different Federal Reserve Districts, 2003-2015



Source: Author's illustration; based on the data provided by the St. Louis Fed (2015)

As a comparison, Figure 68 presents the balances within the Interdistrict Settlement Accounts (ISA) system, which constitutes the US-American equivalent to the European TARGET2. As can be seen, both systems differ in a significant detail: Every year, the 12 Federal Reserve Districts have to settle their liabilities.[103] Hence, while substantial claims and liabilities may emerge within the ISA as well (as can be seen from the example of the Federal Reserve Districts of New York and Richmond), the annual equalization prevents the build-up of ever increasing, long-term imbalances.

The omission of a similar control mechanism from the TARGET2 system has resulted in far-reaching consequences: as of August 2015, the GIIPS (Greece, Ireland, Italy, Portugal and Spain) have amassed cumulated liabilities of €590bn. Germany has been left with €560bn worth of target claims (about 20.8% of its GDP). Luxembourg's claims amount to €117bn, which constitutes a staggering 316.2% of its GDP. As shown by Homburg (2011b), this will have a profound impact in case of a (partial or full) breakup of the monetary union: If one of the debtor states leaves the Eurozone, it is obliged to clear its TARGET2 liabilities. However, this state might be either unable or unwilling to do so – for instance, it may well be doubted that Greece had settled its liabilities of more than €100bn if it had left the Eurozone earlier in 2015. In this case, these liabilities would constitute a loss for the remaining member countries, which had to be divided amongst them according to their respective capital shares at the ECB. If, on the other hand, one of the creditor states would leave the Eurozone, the remaining member countries would have to pay off the outstanding claim. However, it is more than unclear whether the remaining member countries would be able or willing to settle a credit of €560bn if Germany left the Eurozone.

It follows that the persistent TARGET2 balances, which have arisen in the years following the financial crisis, exhibit a significant conflict potential. It is unclear whether these balances will be reduced in the future and what exactly would happen to them in the case of a possible (partial or full) dissolution of the Eurozone. While the emergence of such persistent claims and liabilities may not have been anticipated when TARGET2 was implemented, the ECB could have prevented them from increasing to their present levels. Hence, similar to earlier examples presented in this section (such as the disregard of the SGP and the violations of articles 123 and 125 TFEU), the root of this problem lies within insufficient regulation and the willingness to sidestep important principles of monetary and fiscal policy.

[103] For further detail on the differences between ISA and TARGET2 as well as on the Fed's proceedings of settling the liabilities, see Sinn and Wollmershäuser (2011).

Section 5 has shown that the ECB's common monetary policy fails to adequately address the needs of its individual member countries, and that further fiscal integration (as has been implemented in the USA) may be needed in order to enhance the efficiency of the Eurozone. The present section has delivered additional insights on the shortcomings of the Eurozone's common monetary and fiscal framework, particularly on the lack of credible enforcement of the existing rules. In order to overcome this unsatisfactory status quo, four general scenarios remain: (1) the complete integration of fiscal policy (i.e., the formation of a European state), (2) the credible enhancement of the existing fiscal framework without fully integrating it, (3) the partition of the Eurozone into smaller currency areas, and (4) the dissolution of the Eurozone. The feasibility and the likelihood of these four scenarios are discussed in the following section.

6.2 The Tragedy of the Euro

The need for a reformation of the Eurozone's monetary and fiscal framework is apparent to most observers. The ECB's common monetary policy has proven to be unable to single-handedly accommodate the needs of the individual member countries (see Section 5), and the existing policy rules remain insufficiently enforced (see Section 6.1). The result is an increasing divergence among the individual member countries, both in terms of their needs for monetary policy and in terms of their fiscal stability. These results were not unanticipated: scholars such as Sachs and Sala-i-Martin (1991), Wyplosz (1991), and Eichengreen (1992) have argued at an early stage that any European monetary union would eventually require a larger degree of fiscal integration.[104] This is underlined by historical comparisons: European predecessors, such as the Latin Monetary Union (de facto: 1865-1914; de jure: -1927) and the Scandinavian Monetary Union (de facto: 1872-1914; de jure: -1931), always disintegrated when they were not accompanied by further political integration (Theurl 1996).[105]

[104] Sachs and Sala-i-Martin (1991) show that a 'Federal Fiscal Authority' may help to lessen the impact of regional shocks within a monetary union. While recognizing that efforts made by regional governments could serve this purpose as well, they argue that a federal agreement may be much more effective. Wyplosz (1991) points out that each monetary union will eventually have to choose between fully integrating fiscal policy (such as within a federal budget) or maintaining a system of flexible and uncommitted policy coordination. He considers a middle ground between these two extremes as unlikely, given that extensive fiscal coordination is difficult to implement and to maintain in practice. Because of this, he concludes that some degree of fiscal federalism may be inevitable in the long run. Eichengreen (1992) regards fiscal federalism, which he considers as an important complement to each monetary union, as improperly substituted by the fiscal criteria laid out in the Maastricht Treaty. He also considers the fiscal clauses as unsuitable accession criteria for two reasons: firstly, due to the arbitrary nature of the criteria, they could well be violated by countries possessing the desired discipline; and secondly, fiscally undisciplined countries could 'masquerade' as disciplined ones for a prolonged period.

[105] For a detailed comparison of these monetary unions (also taking into account the "involuntary" unions of the Austro-Hungarian krone and the post-Soviet ruble) with the Eurozone, see Berthold, Braun & Coban (2014).

Based on this evidence, it has to be wondered why European policymakers have not yet properly addressed this issue. The previous section has presented four possible scenarios to overcome the detrimental status quo, all of which would require bolder steps towards further integration or (partial or full) disintegration of the Eurozone. The first proposal demands the full integration of fiscal policy, leading to a type of fiscal federalism comparable to the USA. The second proposal falls short of fiscal federalism, but still requires significantly strengthening the existing framework (for example, by implementing a credible enforcement mechanism). The third scenario calls for a separation of the Eurozone into smaller, rather optimal currency areas (such as dividing it between the Core and Periphery countries or between its geographical north and south). The final proposal demands the dissolution of the Eurozone, based on the consideration that its member countries would be better off if they could conduct individual monetary and fiscal policies according to their own needs.

All of these propositions have long since found their way into the academic and public discussion, with most of the attention being devoted to the two extreme cases – the dissolution of the euro on the one hand, full fiscal integration on the other. The financial crisis, followed by the Great Recession and the sovereign debt crisis, has resulted in a growing public distrust towards the common monetary policy. Moreover, the rejection of the euro has widely led to a general discontent with the growing competences of the 'ever closer' European Union, and Eurosceptic political parties have rapidly gained ground in subsequent national and European elections (Leonard and Torreblanca 2014). In contrast, many individual policymakers have expressed their commitment towards further integration of the Eurozone. Most recently, Sigmar Gabriel (the German Vice Chancellor and Minister of Economic Affairs) and Emmanuel Macron (the French Minister of Economic Affairs) released a joint statement in which they argued for a radical reform of the monetary union:

"The current, rules-based fiscal framework – while flexible and important, to ensure fiscal discipline – doesn't guarantee that the sum of national fiscal policies will lead to an adequate fiscal stance for the Eurozone as a whole, in either good or in bad times. This demands a fiscal capacity over and above national budgets that would improve the ability to provide automatic stabilization and allow the European level to expand or tighten fiscal policy in line with the economic cycle".

– *Gabriel and Macron (2015)*

In addition to the establishment of a supranational budget, these leading politicians of the Eurozone's largest economies also suggest the encouragement of wage harmonization among member countries and the creation of an institution which may raise taxes within the union. In

a subsequent interview, Macron (2015) concretized these plans, arguing for the necessity of a "European economic government" led by a "Euro Commissioner" in Brussels, with sufficient competences to coordinate the individual member countries' social, financial and economic policies. He also confirmed that this would necessitate the transformation of the Eurozone into a transfer union:

"If the member states continue to repudiate any form of financial transfers within the monetary union, we can discard the idea of the euro and the Eurozone."

– *Macron (2015)*

Despite these demonstrations of individual political will, however, it remains uncertain whether the Eurozone will ever see the implementation of such profound changes. Too hardened seem the fronts on this sensitive topic – not only among, but also within member countries. The joint statement of Gabriel and Macron (2015), for instance, sharply contrasts with the official stance of Merkel's government, which firmly opposes permanent fiscal transfers to poorer countries of the monetary union. And while this debate seems to be as acute and important as never before, it actually dates back at least to the signing of the Treaty of Maastricht, and the arguments for and against further fiscal integration have not changed much during the past 23 years. But as most European policymakers seem to be reluctant to implement any kind of fiscal federalism, they also strongly oppose the idea of dissolving or downsizing the Eurozone. Angela Merkel (2012) argued that "the failure of the euro would constitute the failure of Europe", and Mario Draghi (2012) famously stated that the ECB was committed to do "whatever it takes to preserve the euro". The policy measures taken during the Greek debt crisis have shown that doing "whatever it takes" would even go as far as violating the Eurozone's common legal framework.

Hence, the experiences of the recent years have demonstrated the following: the public opinion on the future development of the Eurozone is strongly divided, and while national policymakers have shown a strong reluctance towards ceding fiscal competences to the Eurozone, they have been willing to go to great lengths to preserve the monetary union in its current form. Hence, even though the weaknesses of the current framework are widely acknowledged, it still seems unlikely that any of the four previously presented solutions will be implemented in the near future. While this phenomenon appears irrational at first sight, it has recently been argued that preserving the status quo may actually be in the best interests of most parties concerned. This can be shown by implementing a concept from the public choice theory – namely, the 'tragedy of the commons'.

The tragedy of the commons, as presented by Hardin (1968), defines the overconsumption of a common good due to poorly defined property rights and the destructive rationalism of its consumers. Hardin (1968) illustrated the problem as follows: imagine a *common* (a collectively used pasture) and a number of herdsmen which may drive their cattle onto it. Every time a herdsman drives an additional animal on the common, he will be the sole recipient of the benefits, while the costs – in the shape of overgrazing – are born equally by each of the herdsmen. Hence, the individual benefits associated with adding additional cattle to the common are larger than the individual costs associated with it, creating an incentive to drive ever more cattle on the common. Moreover, every individual is aware that the other herdsmen are facing the same incentives as he does. Hence, even if he might be worried about a possible overuse of the common, every herdsman has to assume that overgrazing – together with the associated collective costs – will occur anyways. This provides further incentives to drive more cattle on the common in order to reap as much of the remaining benefits as possible. Consequently, the only rationale decision for each of the herdsmen is to increase their own use of the collective resource. The common is increasingly overconsumed and finally disappears, depriving every herdsman of its use. This has, of course, not been in the interest of any of the herdsmen. Individual rationalism thus leads to collective irrationalism (and, hence, collective damage) if the use of a common good is not sufficiently regulated.

It follows that four conditions have to be fulfilled for the occurrence of a tragedy of the commons: (1) the presence of a (finite) common good, (2) a number of economic agents who have access to it and draw a benefit from consumption, (3) unrestricted or insufficiently regulated access to the common good, and (4) the presence of negative externalities.

The compliance with the first two criteria is easily answered in the case of the Eurozone. As shown by Bagus (2011), the common good is represented by the single currency issued by the ECB, and the economic agents having access to it are the national governments of the Eurozone member countries. These governments benefit from an increase in the monetary stock for two reasons. The first one is the increase in revenue due to “seigniorage”, which is distributed amongst the 19 national central banks according to their respective shares in the ECB, and which is forwarded to the national governments at the end of the year (Whittaker 2011). As a second reason, the national governments can finance themselves at the ECB by issuing government bonds. This might either happen directly, meaning that the ECB purchases the government bonds, or indirectly, meaning that the ECB accepts government bonds as collateral for loans to the banking sector (Bagus 2011). In fact,

following the year 2007, the ECB has made it much easier for the national governments to access the common resource. Firstly, it has declared all solvent banks eligible for central bank financing, while leaving it within the competences of the national financial regulation authorities to decide whether or not a bank qualifies as being solvent. And secondly, it has consecutievely and significantly reduced its collateral standards (Dinger, Steinkamp and Westermann 2012).

Concerning the third criterion – the presence of poorly defined property rights – the Eurozone's legal framework should actually prevent the emergence of a tragedy of the commons. While the herdsmen in Hardin's (1968) classic example had unrestricted access to the common, the national member states should not have unrestricted access to the funds generated by the ECB for at least three reasons. Firstly, as noted by Collignon (2011), the ECB is an independent institution and could refuse to lend money to its member states. However, as has already been discussed earlier in this analysis, the ECB has recently shown a willingness to sidestep this principle. While the legal framework clearly prohibits the direct purchase of government bonds and the financial bail-out of a member state, the ECB has conducted both. In addition, it has voluntarily suspended its minimum credit requirements for accepting bonds as collateral during the Greek debt crisis. Secondly, since agreements such as the SGP oblige the member states to maintain fiscal discipline, they should not be able to overconsume the common good. But, as has been shown earlier in the analysis, the repeated violation of the fiscal clauses has not resulted in the imposition of penalties. And thirdly, as has been pointed out by Bagus (2011), poorly defined properly rights could be overcome if politically influential countries – such as Germany and France – used their influence to enforce and enhance them, i.e. to discipline the less disciplined members of the monetary union. However, as shown by Figure 66, Germany and France violate the SGP themselves, which should lower their willingness to push for the imposition of sanctions on other member countries. Based on these three points, the access to the Eurozone's common resource may indeed be seen as insufficiently regulated.

Finally, in order to qualify as a tragedy of the commons, the individual consumption of the common resource has to be associated with a negative externality. In the case of a monetary union, a first obvious negative externality is the acceleration of inflation. As the different governments increase their deficits in an attempt to externalize the costs (which, in its most extreme case, might even result in a 'spending race', see Bagus 2011), the loss in purchasing power affects every single member state. Additional external effects may result from increasing interest rates (as the rapid accumulation of public deficit and debt results in an

upward pressure on inflation-adjusted long-term interest rates, see Sanchis i Marco 2014) and from an appreciation of the common currency (leading to a reduction of exports, see Frenkel & Goldstein 1996). In fact, all of these externalities have been anticipated in the case of the Eurozone (or, rather, the EMU), as shown by the early warning issued by Holzmann, Hervé and Demmel (1996):

Negative externalities may be triggered both by excessive deficits, while still respecting the solvency constraint of government, and by unsustainable debt levels. While deficit-related externalities will affect primarily the real economy through interest rate and exchange rate effects, debt-related externalities may pose a threat to price stability in EMU.

[...] [The] EMU is likely to induce fundamental changes in the economic framework of European countries. From this result incentives for unsound national fiscal policies that have the potential to trigger significant negative externalities for the other member states.

– *Holzmann, Hervé and Demmel (1996)*

In addition to the 'direct' externalities of increasing inflation, higher interest rates and an appreciation of the currency, a number of 'indirect' negative externalities may arise within the Eurozone. One example is the possible underfunding of supranational public goods. Within each monetary and political union, a number of public goods exist which benefit the entirety of its member states. Examples are defense capacities, research and development, or a common agricultural policy. Each member country perceives a rivalry between (net) contributions to these public goods and national expenditure. While all member countries draw a benefit from consuming these public goods, they also have an incentive to free-ride, i.e. to spend a larger part of their national budget on national expenditure only, hoping that the remaining member countries will sufficiently finance the public good. As a result, funding of these goods may remain far below the optimal level (Eichengreen, Obstfeldt and Spaventa 1992, Collignon 2011).

Hence, the Eurozone in its current form displays all characteristics of a tragedy of the commons. The 19 different national governments have a strong incentive to increase the income generated from seigniorage and to finance their deficits via the ECB as well as to minimize their contribution to the European budget. The existing legal barriers have proven ineffective to prevent this opportunistic behavior. This is likely to result in a number of adverse effects, particularly in an increase of inflation, which will affect every single member and threaten the stability of the union as a whole. These negative externalities are either unanticipated by the different member states, or they are willingly accepted in light of

the individual benefits associated with higher deficit and debt levels. Consequently, Bagus (2011) has adequately coined this development as the "tragedy of the euro".[106]

It is easy to see why this view is not widely recognized yet: As in other Western economies, the Eurozone's inflation rate currently ranges far below the target rate of two percent (see Figures 8 and 21). In fact, increasing the rate of inflation is one of the primary motives behind the ECB's recent QE programme. Hence, at a first glance, the lack of rising inflation seems to refute the "tragedy of the euro". However, as the ECB continues to enhance the monetary base, it increases the risk of creating a 'ketchup effect', i.e. a sudden acceleration in inflation which may be very difficult to contain (Homburg 2011a, Mayer 2015). Under this regard, the externality of rising prices could unfold without any warning, leaving the ECB little time to react.

Could this "tragedy of the euro" be prevented by reaching a political settlement? After all, the 19 different Eurozone governments share an important goal: they do not want the common to disappear. In addition to that, these governments have a number of advantages compared to the herdsmen in Hardin's (1968) example. Firstly, they have a significant number of advisors who sensitize them to the weaknesses of their monetary union. The Eurozone is home to a large number of highly specialized economists (in addition to the many foreign economists who also participate in the debate), whose very purpose it is to advise its policymakers in economic matters. Secondly, the large impact of the Great Recession and the sovereign debt crisis has almost resulted in the financial collapse of a number of its member states. Hence, unlike Hardin's (1968) herdsmen, the Eurozone's policymakers have recently been living under a substantial fear of losing their common. If their policy choices are affected by past experience, it could be expected that they exploit the common resource more carefully in the future. And thirdly (and most importantly), the individual countries' governments can interact with each other. They are able to develop a rule-based system in accessing the common resource, and they may punish any member who does not obey these rules.

Therefore, it has to be asked why a political settlement should be out of reach. If the 19 different governments want to sustain their common resource, and if their recent experience has demonstrated that reckless overuse might threaten exactly that, it should be in the best interest of each government to reach a sustainable agreement. Four possible solutions have been presented earlier in this section. If it is assumed that, for each

[106] Due to the limited scope of the present analysis, Section 6.2 does not discuss the 'tragedy of the euro' in its entire complexity. However, the abbreviated overview given in the present section suffices to highlight the most important implications for the Eurozone. For further detail, see Bagus (2011), Dinger, Steinkamp and Westermann (2012), Tornell (2013), and Wolf (2013).

government, all of these solutions are preferable to an unregulated breakdown of the common, it should be possible to avoid the "tragedy of the euro".

In order to answer to this presumption, it is important to add two additional dynamics to the discussion. Firstly, unlike Hardin's (1968) herdsmen, the different countries are not homogenous. Some of them might consider the access to the common resource as essential for their own survival, while other countries would not be willing to save it at all costs. Imagine that, in addition to the common, the herdsmen possess private land as well. But while some of the herdsmen own impressive estates which are only a bit smaller than the common, others only own a very little parcel. Some of the herdsmen might not own any land at all. Consequently, this also results in different incentives in overconsuming the common resource. Secondly, governments may prefer to follow a short-sighted political rationale rather than a long-term economic one. In any democracy, politicians are oriented towards the next election, as the maximization of the election result is equivalent to the maximization of their own welfare. Because of this, they tend to favor policies which are seen as popular among the voters, and to shy at any policy measure which is expected to be unpopular. When financing a public project, for instance, any government has an incentive to raise the necessary funds via public borrowing instead of raising taxes or reducing transfers, which would be unpopular among the voters. While doing so may be entirely rationale from the government's point of view, it increases the debt burden of the subsequent generation and decreases the country's financial stability in the long run.

It follows that a twofold "tragedy of the euro" is taking place on an international as well as on an intertemporal level (Homburg 2012). A political solution is hampered by deviating (and sometimes even diametrically opposed) preferences among the different member countries and by a tendency to favor short-term political gains over long-term stability. Under this regard, it may be explained why a far-reaching reform of the existing monetary and fiscal framework seems unlikely.

Consider the first scenario, under which the Eurozone's member states would adopt a US-type of fiscal federalism. This would prevent individual governments from increasing government deficit and public debt beyond sustainable levels. It would also enable a federal authority to legally and frequently conduct fiscal transfers between the Eurozone's regions, which would accelerate economic convergence within the union. For these reasons, the implementation of fiscal federalism could benefit the Eurozone's long-term stability. However, ceding their fiscal competences will be considered as unacceptable by most governments. On the one hand, those governments which have benefitted from massively

increasing their levels of public debt (particularly in the Periphery and in a number of Core countries, see Figure 66) would fear that a fiscal authority might force them into austerity, as this would cost them the popular support of their voters. On the other hand, the governments in the wealthier and financially more stable countries (such as Germany) anticipate that such a federation would result in a constant outflow of fiscal transfers towards less wealthy regions. Not only would these governments fear that such transfers would develop poorer countries at the expense of their own economic growth, but they also remember the negative public reaction towards the 'bail-out' and 'rescue packages' during the sovereign debt crisis. Hence, the formation of a fiscal federation (i.e., a European state) constitutes a very unlikely scenario.

The same is true for the case of a significant strengthening of the fiscal framework under avoidance of fiscal federalism. While this would increase the Eurozone's efficiency and reduce its vulnerability to economic shocks in the long run, it is not in the short-term interest of the national governments. As has been shown in Figure 66, only a single Core country (Luxembourg) and none of the Periphery countries currently meet the SGP's deficit and debt criteria. Hence, the vast majority of the governments would have no interest in enforcing the existing rules if doing so might result in their own punishment and in the loss of popular support. In addition to that, the enforcement of fiscal discipline would prevent the emergence of high levels of debt in the future. As the different governments might feel that this could corrode their capabilities to accommodate their voters and to react to future crises, the significant strengthening of the fiscal framework is therefore highly unlikely as well.

The third possible scenario constitutes the separation of the monetary union into smaller and rather optimal currency areas. The idea behind this is that currency unions may be more stable if they are comprised of rather similar members. As has been shown in Section 5.2.1, the Core and Periphery countries strongly differ in their monetary policy requirements. Hence, a "Core Zone" and a "Periphery Zone" (with the members of the New country group being divided among these two monetary unions) could prove to be more stable than the current Eurozone.[107] For instance, this would enable a possible "Core Central Bank" to raise its target rate without harming the Periphery. Another initial result would be the appreciation of the "Core euro" towards the Periphery's counterpart. However, such a divide of the

[107] There have been a large number of varying proposals on how the Eurozone could reasonably be divided. For instance, Mayer (2013) hypothesizes a North-South divide via the formation of a "Mediterranean Council" and a "Central and Norther European Council". In this scenario, the "Central and Northern European Council" would launch a parallel currency – the CeN – which would appreciate against the euro. The European Union would essentially become "an organizational wrapper for the unions within the union". The remaining EMU members plus Norway, Switzerland and Turkey would eventually either join one of the two currency areas, or keep their own currencies while joining a new pan-European free trade area (the EUFTA).

Eurozone would not solve the "tragedy of the euro", as the governments' incentives to increase their revenues from seigniorage and to finance their deficits via the central bank would remain unchanged. Without political unification, both monetary unions would share the fate of the former Eurozone. Hence, such a separation would only lead to additional costs while delaying a sustainable solution of the "tragedy of the euro" (Homburg 2013b).

The final possible scenario calls for a dissolution of the Eurozone. The rationale behind this is straightforward: If the "tragedy of the euro" is not solvable, the individual member countries could be better off by leaving the currency union than by delaying the detrimental status quo for two reasons. Firstly, the threat of 'diversity stagnation' would be overcome as each country could conduct an individual monetary policy suitable to its own needs. And secondly, the danger of a common fiscal recklessness would be prevented. Each country would be forced to maintain a higher degree of fiscal discipline since it could not count on a bail-out in case of financial instability. And even if a country would continue to run unsustainable levels of deficits and debts, these individual actions would not be conducted at the expense of other European states.

However, this last scenario – while it could lead to higher stability and better performance in the long run – is unacceptable from the point of view of most governments. To begin with, some of the governments have greatly benefitted from financing their deficits at the ECB and from the income generated via seigniorage. Dissolving the monetary union would mean to lose access to this common resource. Coupled with the need of maintaining a higher degree of fiscal sustainability in the future, the governments in the more indebted countries would fear that this could cost them the support of their voters. This fear is reinforced by the fact that the dissolution of the Eurozone would necessitate these governments to settle their TARGET2 liabilities (see Figure 67).

In addition to that, the common currency is a strong symbol, as it has always been advertised as an important milestone towards European integration. Giving it up would be regarded as a setback for the idea of a united Europe (irrespective of whether or not this might be true). The inhabitants of the Core and Periphery countries have become used to the euro, and the announcement of a new currency reform would spark fears and insecurities. This creates a strong incentive for the current governments to sustain the euro, as none of them would want to be held responsible for its failure.

It follows that, while the dissolution of the Eurozone could possibly lead to higher stability in the long run, it might constitute the least preferred scenario from the individual governments' point of view. The animosity towards this option is exemplified by the strong

reluctance of most governments to even discuss its possibility. Hence, when Draghi (2012) announced that the ECB would do "whatever it takes" to preserve the euro, he also reflected the sentiments of these governments, who are willing to go to great lengths in order to serve this goal. As Homburg (2011a) put it, the Eurozone's policymakers will therefore exhibit a high degree of creativity in protracting the dissolution of the Eurozone for as long as possible.

What are the implications for the future of the Eurozone? Sections 5 and 6 have clearly presented the weaknesses of the current monetary and fiscal framework and the need for a reform. The current status quo is untenable, as it impairs the economic performance of the different member countries and promotes the conduct of unsustainable policies. But while further fiscal integration – and possibly even the dissolution of the Eurozone – would be preferable to the preservation of the current situation, the implementation of such a profound reform is highly unlikely. The conflicting preferences of its member countries and the incentives of their governments consolidate the status quo and prevent a political solution. Neither the ECB's expansionary monetary policy nor a frequently discussed fiscal stimulus will solve the Eurozone's macroeconomic problems, as they fail to address the fundamental problem which lies within the tragedy of the commons (Tornell and Westermann 2012, Duprat 2015). The twofold "tragedy of the euro", which will most likely continue to diminish the Eurozone's economic potential, is therefore adequately summed up by the words of Orphanides (2014):

The tragedy for Europe is that politics has dominated over economics. This has resulted in an unbalanced and divisive incidence of the costs of the crisis across the euro area. The euro was meant to complete the European project. Instead, its laws have been exploited for local political gain to the detriment of Europe.

– *Orphanides (2014)*

7 Conclusion and Recommendation for Further Research

Does the Eurozone face an acute threat of entering an era of secular stagnation due to a permanently negative natural real rate, as defined by Summers (2014a, 2014b)? Finding an answer to this question was the primary motivation behind this paper. To this end, a contemporary estimate for the Eurozone's natural real rate was obtained. While it was found that the rate had significantly decreased in recent years (from 2.14% in 01/1997 to 0.45% in 03/2015), it had not become negative and was located more than one percentage point above the actual real rate. This constitutes an important contribution to the debate on secular stagnation: While many scholars assume that the Eurozone's natural real rate has become negative based on theoretical considerations, the empirical assessment of the present paper refuted this proposition. As a possible explanation of this contradiction, it was hypothesized that the prevalent formal contributions to secular stagnation – particularly the model developed by Eggertsson and Mehrotra (2014) – suffer from the exclusion of *land*.

In addition to that, it has been investigated whether the Eurozone might suffer from secular stagnation in the long run, as defined as an enduring decrease in potential output growth per capita. While it was found that the 'headwinds' defined by Gordon (2012, 2014) might pose a challenge to future economic growth, current evidence is by far not sufficient to justify the notion of a protracted stagnation. Similarly, it was also deemed unlikely that secular stagnation could be triggered by a slower expansion of the technological frontier. While it is generally difficult to make accurate predictions on future technological growth, a protracted slowdown seems improbable given the improvements in human capital and the ever increasing share of global resources devoted to R&D.

Based on the author's estimate of the Eurozone's natural real rate, a variant of the Taylor rule has been implemented in order to assess the appropriateness of the ECB's single monetary policy between 1999 and 2015. It was found that the target rate set by the ECB has largely been adequate for the Eurozone as a whole given the decline in the natural real rate. But at the same time, it was far from ideal from the perspective of the different country groups (let alone from the individual member countries' point of view). The monetary policy needs of the Core and Periphery have not converged, but rather diverged after the implementation of the euro (and particularly after the onset of the Great Recession). Because of these large inter-state differences, the ECB has not been able to implement a target rate where "one size fits all". Hence, the common monetary policy prevents the Eurozone's member states from fully exploiting their economic potential and might even lead to a reduction of said potential in the future. As this development is unlikely

to be reversed in the near future, the present paper coins the term ‘diversity stagnation’ and argues that this threat should be regarded as much more acute than the alleged threat of secular stagnation.

In order to compile a solution for the threat of ‘diversity stagnation’, a comparison with the USA was conducted. It was found that, unlike the ECB, the Fed is able to set an appropriate target rate for its different districts due to a lower variation in the monetary policy requirements. A subsequent investigation of the Eurozone’s fiscal and monetary framework showed that two factors are particularly causative for the failure of emulating the US-American experience: the lack of fiscal federalism on the one hand and weak enforcement of the existing legal framework on the other hand.

Based on these findings, it was discussed whether the Eurozone could overcome the problems of ‘diversity stagnation’ and unsustainable fiscal policies by means of a reform of its monetary and fiscal framework. Four different scenarios – ranging from the implementation of fiscal federalism to a dissolution of the Eurozone – were highlighted. While it was argued that most of these suggestions could improve the Eurozone’s economic outlook, the realization of any of these propositions is highly unlikely. The different governments, influenced by inter-state rivalries and focused on short-term political gains instead of long-term economic efficiency, tend to favor the status quo over the implementation of a far-reaching reform. This results in a classic example of the tragedy of the commons which will most likely continue to impair the Eurozone’s stability and economic performance.

In summary, the present analysis answers the research questions formulated in Section 1 as follows. The Eurozone does not face a serious threat of entering an era of secular stagnation, neither in the short to medium term (research question 1a) nor in the long run (research question 1b). If the decline in the natural real rate is taken into account, the ECB’s target rate has largely been appropriate for the Eurozone as a whole, but not for the individual member states or the aggregated country groups (research question 2). Inter-state differences pose a major obstacle for the Eurozone, as the ECB is unable to conduct a monetary policy which accomodates the different member countries’ needs. This erodes the Eurozone’s economic potential and may lead to a prolonged ‘diversity stagnation’. Furthermore, the different incentives among its member states and the insuffiently enforced legal framework encourage the conduct of unsustainable fiscal policies (research question 3). Far-reaching reforms of the monetary and/or fiscal framework could improve the Eurozone’s economic outlook. But while several possible scenarios exist, all of them are conflicting with the incentives of the

different national governments. Hence, it seems unlikely that the Eurozone's macroeconomic problems will be overcome in the near future (research question 4).

This analysis concludes by delivering three different recommendations for future research. Firstly, the development of the Eurozone's natural real rate of interest should be investigated and updated more frequently. While Laubach and Williams' (2003) estimate of the US economy's natural real rate is updated on a quarterly basis, there exists no such equivalent in the case of the Eurozone. Apart from the author's results, the most recent estimates are those of Bouis et al. (2013) and Rawdanowicz et al. (2014), whose observation period ended more than two years ago. As the natural real rate represents a central element in the recent debate on secular stagnation, a regular update would provide valuable information to the academic world.

Secondly, it is recommended that the debate on secular stagnation pays more attention to the importance of *land*, which is currently ignored by the majority of academic contributions. As shown by Homburg (1991, 2014), overaccumulation – and, consequently, secular stagnation – may not occur if the economy is endowed with *land*. To this end, Eggertsson and Mehrotra's (2014) formal model, which has recently established itself as a prevalent theoretical framework for analyzing secular stagnation, should be extended in order to accommodate the factor *land*.

Thirdly, it is proposed that 'diversity stagnation' – the loss in efficiency and potential output that results from the Eurozone's common monetary policy – should be quantified along with the benefits associated with it (such as the gains from trade and competition). If the net effect of the single currency turns out to be negative, this result would constitute a strong argument for a far-reaching reform (or, on the other hand, for a dissolution) of the Eurozone. This could make it more difficult for European governments to avoid any public discussion on a profound change of the status quo. But even if the net effect remains positive, a quantification of the sizable economic losses could make it more apparent to the public that the common currency does not come without its costs, and that there is significant room for improvement.

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