Ministry of Economy and Finance

Department of the Treasury

Analisi e Programmazione Economico Finanziaria

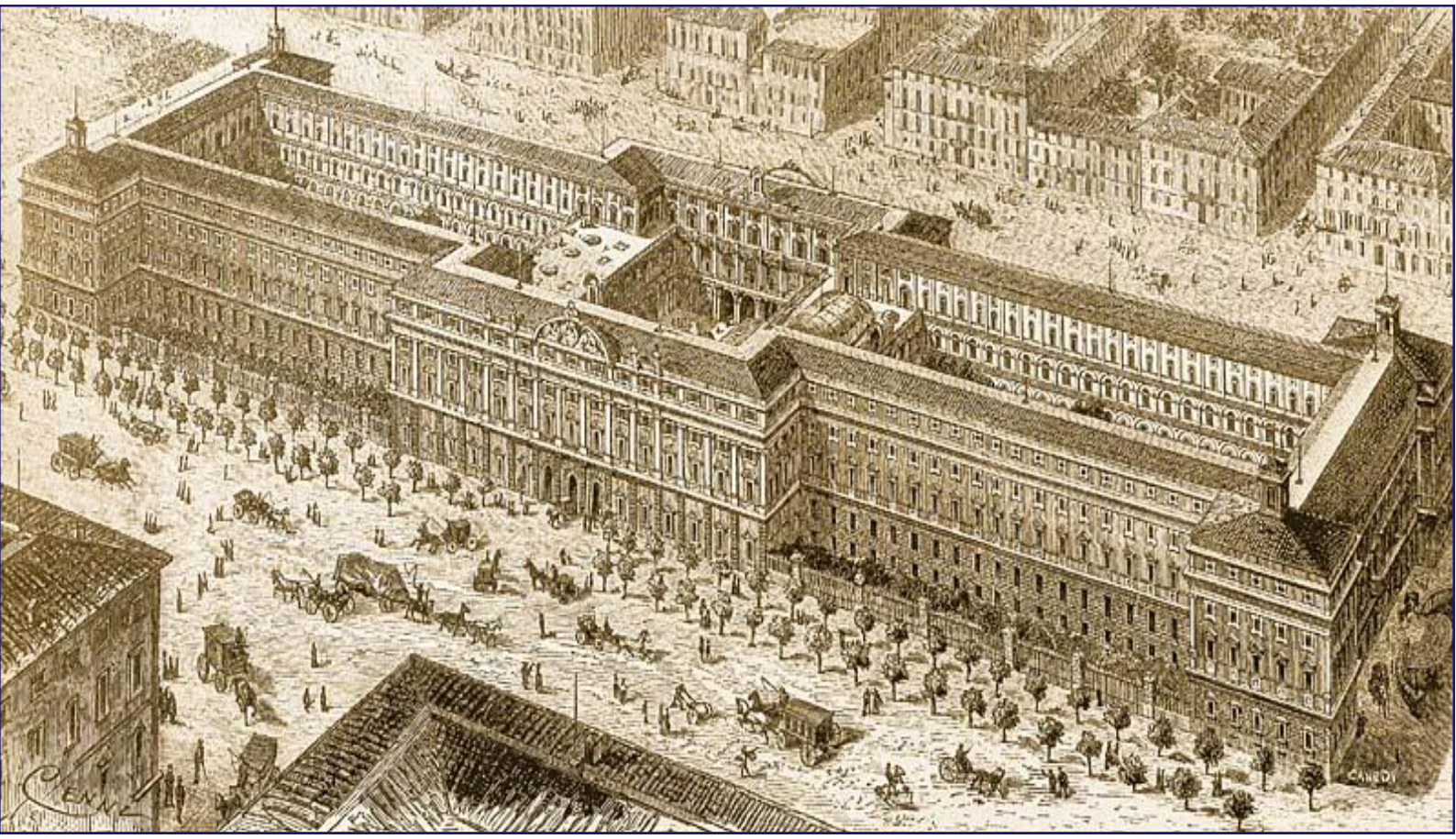
Working Papers

N°4 - August 2017

ISSN 1972-411X

Are there common structural determinants of potential output growth in Europe? An empirical exercise for 11 EMU countries

Roberta De Santis, Piero Esposito and Elena Masi



Working Papers

The working paper series promotes the dissemination of economic research produced in the Department of the Treasury (DT) of the Italian Ministry of Economy and Finance (MEF) or presented by external economists on the occasion of seminars organized by MEF on topics of institutional interest to the DT, with the aim of stimulating comments and suggestions.
The views expressed in the working papers are those of the authors and do not necessarily reflect those of the MEF and the DT.

Are there common structural determinants of potential output growth in Europe? An empirical exercise for 11 EMU countries

Roberta De Santis*, Piero Esposito** ed Elena Masi***

Abstract

GDP growth in the Eurozone during the last twenty years continuously decreased. In addition, the global financial crisis and subsequent events seem to have, on average, shifted the trajectory of the Eurozone's potential output downward. A key question is whether this trend is a permanent result of "secular stagnation" or if economic policies might improve the situation. In this paper, we test the impact of several structural determinants of potential output growth using a dynamic panel data methodology for 11 main EMU members for the period 1996-2014. We also take into account the role of fiscal policy stance and debt dynamics to assess whether European fiscal rules, especially in the aftermath of the financial and sovereign debt crises, contributed to the slowdown of potential growth. Estimated results suggest that population, tertiary education, research and development expenditure, trade and financial openness, and institutional quality contributed significantly to potential output growth in the EMU during the period under examination. We further find that debt accumulation affects positively and significantly potential growth for debt values up to 90% of GDP.

JEL Classification: O29, O41, O43, O47.
Keywords: determinants of growth, potential output growth, reforms, institutional quality, fiscal rules, secular stagnation.

* Istat - Mef DT rdesantis@istat.it

** Luiss SEP pesposito@luiss.it

*** Aics - Mef DT elena.masi@aics.gov.it

CONTENTS

1 INTRODUCTION

The last global financial crisis seems to have, on average, shifted down the trajectory of potential Eurozone output. Even though the near-term prospects might have improved, fragile and slow recovery persist in many EMU member states. Some economists argue that the euro area could be facing 'secular stagnation'—long-term economic stagnation characterized by a shrinking work force, low demand, deflationary trends, excess savings, and low investment, despite low interest rates.

The ongoing crisis' complexity and the EMU's heterogeneous economic situations makes it difficult to predict future developments, as there might not be a "one size fits all" cure for long-term stagnation. Since the start of the international financial and economic crises, many conventional theoretical economic assumptions have come under question because of the underlying policies' low effectiveness. In this framework, our paper intends to assess the determinants of potential output growth common to 11 EMU countries for the period 1996-2014. Moreover, we test whether fiscal variables have influenced potential output growth.

Refining the understanding of the determinants of long-term growth might offer relevant policy implications. The assessment of fiscal variables role in the evolution of potential output contributes to the lively debate on the desirability of fiscal austerity in Europe. The measures adopted thus far have not yet proved to be a cure-all for financial market concerns about debt and fiscal sustainability. They have, however, coincided with renewed economic slowdown or even contraction in many countries.

Our contribution to the existing literature is fourfold. First, we provide up-to-date evidence on the determinants of potential output in the EMU by focusing on a period that includes the single currency's introduction and the two financial crises.

To the best of our knowledge, the literature in this field is extremely scarce and mostly refers to the pre-crisis period. Second, we contribute to the debate on the effects of fiscal austerity in Europe by assessing the effect of the fiscal policy stance and debt dynamics on the EMU's potential output growth. In this respect, we introduce nonlinearities in the relation between fiscal policy and potential growth with a twofold aim: to assess whether positive or negative effects of fiscal consolidation depend on the actual level of the cyclically adjusted primary balance and to estimate thresholds above which public debt begins to be detrimental to long-run growth.

Third, from a methodological point of view, we build on Kapetanios et al. (2011) and Neil (2015) by using a dynamic GMM approach with fixed effects and cross sectional averages of the variables introduced in the specification.

This allows us to control for potential sources of endogeneity as well as for cross correlation across residuals. Finally, we focus on country-specific dynamics to simulate the specific contributions of the different variables in each economy during the two periods before and after the 2008-2009 global financial crisis.

The paper is organized as follows: section 2 presents a brief survey of the literature, section 3 provides some stylized facts on potential output growth in Europe over the past two decades, section 4 describes the dataset, equations, and empirical strategy, and section 5 presents the

estimated results. Section 6 presents impact analyses at individual country level whereas section 7 provides a deeper focus on the nonlinear effect of debt levels and fiscal consolidation. Conclusions and policy implications follow.

2 A BRIEF SURVEY OF LITERATURE

In this paper, we refer to the hypotheses of traditional theoretical economic growth models and we rely on previous empirical papers in selecting possible determinants of potential output growth.

In the long history of growth theory, a large number of factors is found to play a role in determining the long-run economic performance of countries at different stages of development. Standard determinants include demographic factors like population size and growth, the share of the working age population, as well as enrolment rates in the different education levels[1]. The role of human capital has been found to be potentially positive for economic growth (see Romer 1994, Cardarelli and Lusinyan 2015). However, Prichett (2001), for instance, finds a negative effect. The author explains these findings as possibly decreasing returns for schooling, unfavorable governance structures, and, finally, decreasing education quality. Endogenous growth theory stresses the role of technological progress and innovation; in addition, the degree of openness of both goods and financial markets is often considered a fundamental condition for promoting growth.

We also introduce one institutional quality indicator in the estimates, “rule of law”, capturing perceptions of the extent to which agents have confidence in and abide by the society’s rules.

In Table 1, we present a brief survey of the relevant papers, selecting possible determinants of potential output growth using Bayesian Model Averaging (BMA, Hoeting et al. 1999) and its extensions. This technique allows the selection of significant determinants of long-run growth among a wide set of factors, thus overcoming the problems of multicollinearity and efficiency loss due to the presence of an excessive number of regressors

Among the most relevant papers, Sala-i-Martin et al. (2004) estimate conditional convergence based on a Solow growth model for a sample of 87 countries between 1960 and 1996. Their estimates confirm the importance of factor accumulation, in line with the catching-up theory, and find that primary school enrolment rate is an important determinant of long-run economic growth. Moral-Benito (2012) investigates the determinants of economic growth for a panel of 73 countries over the period 1960-2000. He finds evidence of a strong role played by standard catching up variables, as well as population size and growth, geographical distances, and political rights.

More recently, Leon-Gonzales and Vinagayathasan (2015) analysed the case of 27 developing Asian economies observed between 1980 and 2009 and confirm the major role played by investment and trade opening in fostering the area’s GDP growth. Interestingly enough, they also find a negative impact for government expenditure.

[1] Aghion and Howitt (2005), among others, argue that primary and secondary school attendance is important for countries that are catching up with the technological frontier by imitation and may be more relevant in the European context for the post-war period. For the more recent period, it is tertiary education that becomes crucial as leading-edge innovation has become the driving factor for growth.

While important for the assessment of factors contributing to the growth of less developed countries, the abovementioned studies might not be an ideal guide for investigating the determinants of potential output in advanced economies. Factor accumulation, basic education, and improvements in the health condition are indeed fundamental ingredients of a successful development strategy. However, advanced economies are much more dependent on aspects related to the innovation process, the degree of competition, and the quality of institutions.

In addition, the globalization process over the last 25 years has massively changed the countries' international competitiveness, with different outcomes in advanced and developing countries. For this reason, studies on long-run growth should take into account group heterogeneity when identifying the main determinants of this process.

Table 1: Determinants of potential output growth in the relevant literature

Authors	Econometric strategy	Most Significant determinants
Sala-i-Martin, Doppelhofer, and Miller (2004)	Cross section of 87 countries between 1960 and 1997; Bayesian Averaging of Classical Estimates (BACE).	Factors accumulation; Population growth; Relative price of investment; Primary school enrolment Initial GDP per capita
Moral-Benito (2012)	He relies on panel data and uses Panel of 73 countries between 1960 and 2000, Bayesian Model Averaging of Maximum Likelihood Estimates (BAMLE) and Bayesian Model Averaging (BMA).	Initial income and population; Life expectancy; Urban and total population growth; Longest air distance flow of goods capitals and services; Political rights; Degree of openness; Relative price of investment;
Leon-Gonzales and Vinagayathasan (2015)	Panel of 27 developing Asian economies between 1980 and 2009; BMA.	Investment rate; Trade openness; Government expenditure (negative)
Lanzafame et al. (2016)	Panel of 70 countries between 1970 and 2009; BMA.	Trend working age population; Tertiary education; Technological gap with the US; Labour market rigidity; Trade openness; Financial market integration; Institutional quality

Source: Lanzafame et al. (2016).

A step in this direction was taken by Lanzafame et al. (2016), whose study focuses on the determinants of potential output in middle and high income countries. They estimate growth determinants on a sample of 70 countries between 1970 and 2009 and include Solow-Swan model growth model variables, proxies for human capital, and variables related to the quality of institutions, as well as to the globalization process. They find significant impacts for tertiary education, technology gap with the United States, labour market rigidity, trade openness, financial market integration, and institutional quality.

This paper uses the model selection of Lanzafame et al. (2016) as a baseline specification to assess the determinants of potential output in the euro area. We do so because all these variables are commonly accepted in the literature as determinants of economic growth and have a solid theoretical foundation. We expand this baseline specification by looking at specific factors related to the creation of the monetary union. In particular, we focus on the role played by fiscal policy and public debt, as they represented the main European constraint on the policy

action of member states. The Stability and Growth Pact introduced limits on the use of fiscal policy to stimulate the economy, especially for countries needing to reduce the debt-to-GDP ratio to sustainable levels. However, while the treaties impose a 60% threshold, a higher level of public debt can also be sustainable provided that the underlying dynamics are decreasing and converging to lower values.

The long and deep recession that affected the euro area in the years following the global financial crisis generated intense debate on the effects of fiscal consolidation during recessions as implied in the application of European rules (see Everaert et al. 2015 for a recent study on the euro area). Theoretical models using a neoclassical framework with rational expectations provide several arguments against the use of expansionary fiscal policy. The Ricardian equivalence likely offsets the effect of a fiscal expansion due to the expectation of future consolidations to avoid excessive debt build-up. Another argument is the crowding out effect of fiscal deficits on private investment due to higher interest rates. In addition, fiscal consolidation is assumed to benefit long-term growth because of the expectation of future improvements in the economic conditions stemming from higher government credibility and lower risk premia. On the latter, Corsetti et al (2012) argue that, in the presence of high sovereign risk, the negative effect of a fiscal consolidation is offset by the fall in sovereign risk caused by the increased credibility and sustainability of public finances.

These arguments found confirmation in several empirical studies (see Briotti 2005 for a survey). However, the results of the theoretical literature depend on specific assumptions, which are not always present in reality. In particular, Keynesian effects, i.e. positive effects of expansionary fiscal policies, are more likely to manifest when the economic downturn is particularly severe. Several studies confirm that the size of the fiscal multiplier is higher during recessions (Auerbach, and Gorodnichenko 2012, Riera-Crichton et al. 2014, Müller 2014, Blanchard and Leigh 2013). Moreover, recent analyses published by the OECD (2016) argue that the current low interest rates have created fiscal space and suggest that countries should make use of it by loosening the fiscal stance above previously planned levels.

This evidence fits the case of peripheral countries during the European sovereign debt crisis. The prolonged recessions affected potential output by reducing the investment rate. In this context, fiscal consolidation implemented to improve debt sustainability might have contributed to the fall of potential output through the multiplier effect. In particular, an excessive fiscal consolidation might lead to lower potential output because it amplifies recessionary tendencies and offsets the positive long-run effects of fiscal consolidation. In the econometric analysis, we will assess whether fiscal policy and debt dynamics have long-run effects on economic growth and, if so, the direction of these effects.

3 POTENTIAL OUTPUT AND "SECULAR STAGNATION" IN THE EUROZONE

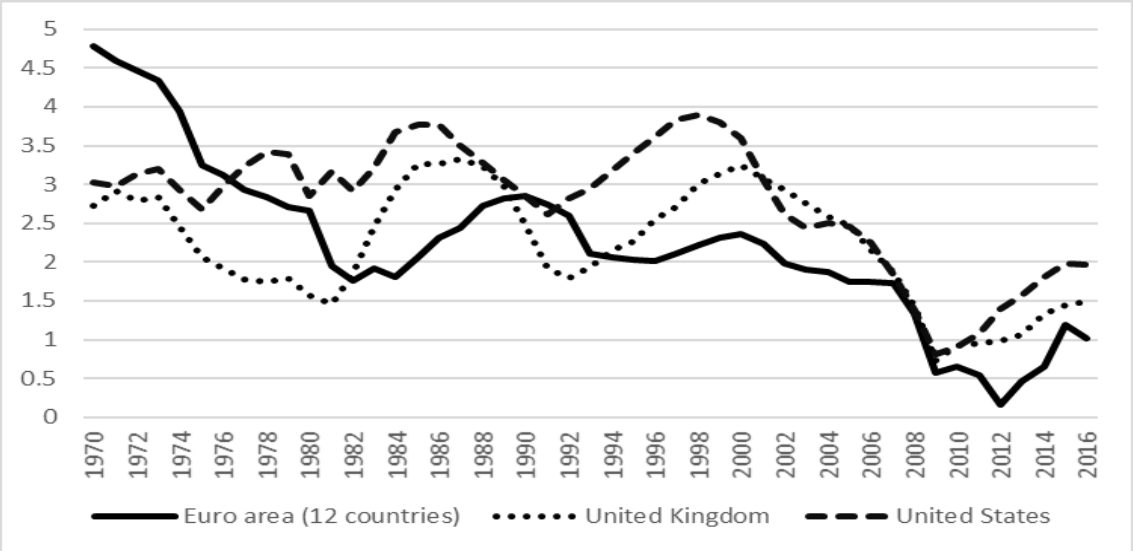
During the last twenty years, there has been a generalized slowdown in the growth rate of potential output, which hit the advanced European economies more severely. In Figure 1, we show the growth rate of potential output for the euro area, the UK, and the US calculated by the European Commission using the production function methodology (Havik et al 2014).

In Europe, potential growth experienced a major slowdown during the 1970s, followed by a recovery during the 1980s. Since then, the trend has been downward, with a temporary recovery at the end of the 1990s. In the years following the global financial crisis, potential growth reached its historical minimum, always staying below 1%. In the UK and the US, until the end of the 1990s, potential growth fluctuated but did not follow a clear downward trend. On the contrary, since the end of the 1990s, these countries experienced the same downward trend as the euro area, but their recovery after the 2009 crisis has been more marked, although well below historical levels.

It is worth noting that the aggregate picture masks heterogeneous behaviors at the country level within the EMU. Therefore, in Table 2, we show details for the individual members of the euro area. Cross-country differences in average potential growth were modest in the 1970s, as shown by the coefficient of variation. In the 1980s, cross country differences increased due to the below average performance of Greece, Belgium, and the Netherlands, and to the outstanding performances of Ireland and Luxembourg.

In the 1990s, Italy became the least growing country, with an average rate of 1.7%, whereas the average performance of the euro area did not change with respect to the previous decade. Things changed dramatically during the 2000s with a slowdown in average potential growth affecting most of the countries, particularly Germany, the Netherlands, Italy, and Portugal. In Ireland as well, potential growth slowed down, but the average rate was still the area's highest (5.6%). On the other hand, Greece, Spain, and Finland experienced an acceleration of potential growth with respect to the previous decade.

Fig. 1 **Growth rate of potential output**



Source: AMECO.

After the global financial crisis, the picture became even more heterogeneous. While potential output in most countries decelerated significantly with respect to the previous decade, Southern European countries and Finland experienced negative or no potential growth. Germany is the only exception to this pattern, as its average potential growth remained fairly stable.

The generalized slowdown of potential output growth since the end of the 1990s is often associated with the secular stagnation process. Especially in Europe, this assumption seems to be more convincing due to the steady loss of potential since the 1970s. Secular stagnation is explained by the continuous fall in nominal interest rates during the Great Moderation as a result of low inflation policies, which, in most countries, meant an inflation target of 2%. This explanation, as pointed out by Krugman (2014), relates the drop in potential growth to the zero lower bound (ZLB) and persistently low inflation.

These conditions hamper the possibility of real interest rates becoming negative and restoring the equilibrium in a period of prolonged slowdown. This argument fits the European case, as one the most concerning aspects of the current fragile recovery in the euro area has been a persistent investment shortage.

Table 2 Average growth rate of potential output, 1970-2016

	1970-1979	1980-1989	1990-1999	2000-2007	2010-2016
Belgium	3.5	1.8	2.2	2.1	1.1
Germany	3.0	2.3	2.2	1.4	1.3
Ireland	4.7	3.2	6.7	5.6	4.5
Greece	4.8	0.7	2.3	3.5	-2.1
Spain	4.2	2.2	2.8	3.5	0.0
France	4.0	2.3	2.1	1.8	1.0
Italy	3.9	2.4	1.7	1.2	-0.5
Luxembourg	2.9	4.4	4.9	4.6	2.6
Netherlands	3.3	1.9	3.3	2.2	0.7
Austria	4.0	2.1	2.6	2.2	1.0
Portugal	4.7	3.2	3.2	1.7	-0.4
Finland	4.2	2.8	2.2	3.1	0.0
euro area 12	3.7	2.2	2.3	1.9	0.7
Coeff. of variation	0.2	0.4	0.5	0.5	2.1
United Kingdom	2.3	2.6	2.4	2.6	1.2
United States	3.1	3.3	3.3	2.6	1.5

Source: elaboration on AMECO.

Other explanations for the European slowdown point to changes in the macroeconomic fundamentals. Population ageing and increased per capita savings (Carvalho et al. 2016) reduce potential growth, but there are other factors suggesting that the pre-crisis situation is unlikely to be restored. One is the rising cost of capital resulting from tougher financial regulation, which cannot be offset by interest rates constrained by the ZLB. Another is the debt overhang that implies a long deleveraging process. Low investment demand could also become persistent due to the Eurozone's weak productivity performance (Jimeno, Smets and Yiangou 2014).

The low productivity dynamics is one of the main features differentiating Europe from the other advanced economies during the recent years. This is clear from looking at Table 3, which shows the gap in labour productivity with respect to the United States. All countries except Ireland and Greece experienced a continuous deterioration of labour productivity dynamics with respect to the US. Ireland has been showing a more pronounced productivity dynamic relative to the US over the whole period, whereas Greece performed better than the US only until the

global financial crisis mostly because of positive but temporary effect of foreign capital inflows. In all countries, the global financial crisis brought about a strong increase in the gaps, whereas the increase proceeded at slower pace, on average, in the following years. In 2015, technological gaps were higher in Southern Europe, with the largest gaps in Portugal, Spain and Greece. Although 2015 levels reveal a clear dichotomy between core and periphery, it is interesting to note that the German gap in 2015 is 21.8%, only slightly below the Italian (23.4%)[2].

In a context of low productivity growth, high public debt, and high cost of capital, the investment dynamic has been further pushed down by consolidation policies imposed since 2011 in order to reduce the huge debt accumulated during the global financial crisis. The effectiveness of consolidation policies depends on the way they are implemented. With undifferentiated expenditure cuts and little or no structural reforms, fiscal policy is likely to have a standard Keynesian impact, where consolidation is detrimental to growth.

Table 3 Labour productivity gap with respect to the United States

	1999	2007	2010	2015
Ireland	-3.0	-9.4	-11.2	-38.7
Belgium	-10.0	-7.8	-2.2	-0.6
France	-0.4	2.7	6.9	8.2
Finland	1.9	-2.4	5.6	9.8
Netherlands	2.7	5.3	9.9	10.1
Austria	2.8	3.7	10.0	12.7
Germany	13.5	15.9	21.2	21.8
Italy	2.1	12.9	18.8	23.4
Spain	23.6	32.0	31.1	30.3
Greece	40.1	31.7	39.8	44.7
Portugal	51.9	53.1	53.7	54.7

Source: elaboration on AMECO.

** Labour productivity is expressed in constant prices and exchange rates, base year 2010.*

Although there is growing empirical literature reporting Non-Keynesian effects (see Briotti 2005 for a survey), the conditions for these effects materializing depend on expectations about future output and the absence of liquidity constraints. Jimeno et al. (2014) show that gains from structural reforms can be substantially higher in Europe than in the US, but they require not only a strong commitment at the country level, but also an improvement in the integration and efficiency of European capital markets.

[2] Gap levels depend on the base year used to covert USD into euro. In 2010, the exchange rate was 1.33, approximately 12% higher that the period's average, so the resulting US productivity is scaled down by a similar percentage.

4 EQUATION, DATASET, AND ECONOMETRIC STRATEGY

We use an unbalanced panel data to investigate potential output growth and its determinants for 11 EMU members (the original 12 members excluding Luxembourg), over the period 1998–2014[3]. Our work uses European Commission estimates of potential output (AMECO), which are produced by applying the Production Function methodology (Havik et al 2014). Our sample ends in 2014 due to the lack of recent data on many structural variables. While several criticisms have been raised about the reliability of potential output estimates (see, for example, Darvas and Simon 2015, Ciucci and Zoppè 2017), the use of potential output is justified by the focus on long-run growth.

Estimates of potential output, although imprecise, provide a better picture of long-term growth with respect to actual GDP. Based on the theoretical and empirical literature discussed in the previous sections, we include Solow-Swan growth model variables in our list of potential output growth determinants. These include the log total population (pop), the population with tertiary education (teratt), and the log of research and development expenditure (r&d). The labour productivity gap with respect to the US is also introduced (tech_gap) as a general measure of technological catching up. As a measure of international knowledge spillovers, we include trade openness (tradeop), defined as the share of total trade to GDP. We further introduce the Chinn Ito (2008) "de iure" measure of capital account opening (kaopen) to measure progress in financial opening, and an index of institutional quality (rulaw) that captures perceptions of the extent to which agents have confidence in and abide by societal rules and, in particular, the quality of contract enforcement, property rights, the police, and the courts.4

Finally, as additional test we will include variables accounting for the evolution of public finances in the analysis. These are the debt-to-GDP ratio (debt) and the cyclically adjusted primary balance (pbal_ca). The former is introduced to take the relationship between debt dynamics and GDP growth into account. The cyclically adjusted primary balance is introduced to capture the effect of discretional fiscal policy. Both variables will be introduced linearly and as second order polynomial term. In addition, we will introduce the interaction between the two variables. The budget variable is expressed in % of potential output whereas the debt level is measured in % of GDP.

The final specification, as well as the estimation technique, depend on the statistical properties of the variables. Ruling-out a cointegration approach due to the high number of regressors, the strategy is to include non-stationary variables in first differences and stationary variables in levels.

The first two columns of Table 4 shows the Pesaran (2007) unit root test for all variables, which shows that potential output, R&D expenditure, technological gap, and trade opening are non-stationary in levels but stationary in first differences. The remaining variables are stationary both in levels and first differences, although the significance for the two variables related to public finances is only 10%.

[3] 11 countries for 18 years should produce 198 observations. In our panel we have 180 observations. The difference in the observations is due to the use of 4 lags as instruments for the lagged potential growth and to some missing values for Greece.

[4] See Table A1 in the Appendix for a full description and data sources for the variables.

Table 4 Unit root test and test for cross sectional dependence (CSD)

	Unit root test		CSD
	levels	first differences	Test
Δpgdp	0.939	-4.385***	31.9***
pop	-3.649***	-3.334**	22.0***
tradeop	-1.891	-2.320**	31.9***
r&d	-1.400	-2.195***	19.4***
tech_gap	-1.632	-2.554***	27.1***
kaopen	-3.451***	-5.071***	31.7***
teratt	-3.174***	-2.536***	24.7***
rulaw	-2.374**	-2.316**	0.6
pbal_ca	-2.148*	-3.264***	12.5***
debt	-2.240*	-2.831**	18.1***

*** p<0.01, ** p<0.05, * p<0.1. Unit root is tested by using the Im, Pesaran,,and Shin (2003) test. CSD is tested by using the Pesaran (2004) test.

The log-growth rate of potential output (pgdp) is a persistent variable, hence we have to include the lagged dependent variable among regressors and estimate a dynamic panel in order to control for potential serial correlation and short-run adjustment costs.

A second problem comes from the cross sectional dependence (CSD) across panels due to common factors affecting each variable in all countries. The third column of Table 5 reports the Pesaran (2004) test for CSD, which shows that all variables, except for the rule of law index, are affected by this problem. In order to control for CSD, we use a Common Correlated Effects (CCE) type estimator (Pesaran 2006, Kapetanios et al. 2011). This estimator allows us to control for common stochastic factors by introducing cross sectional averages of all variables in the regression.

The basic specification, where only structural supply side variables are introduced, takes the following form:

$$\Delta pgdp_{it} = \beta_1 \Delta pgdp_{i,t-1} + \beta_2 \Delta r\&d_{it-1} + \beta_3 \Delta tradeop_{it-1} + \beta_4 pop_{it-1} + \beta_5 terat_{it-1} + \beta_6 kaopen_{it-1} + \beta_7 \Delta tech\_gap_{it-1} + \beta_8 rulaw_{it-1} + \sum \theta_i + \Theta + \varepsilon_{i,t} \quad [1]$$

where ϑi is a set of country-specific fixed effects and vector Θ includes the cross sectional averages of all variables. In dynamic panels, the lagged dependent variable is typically endogenous due to its correlation with the fixed effects. This is controlled by using an IVV/GMM approach (Neal 2015) where the lagged potential output growth is instrumented by lags from 2 to 4. Standard errors are heteroscedasticity and autocorrelation consistent (HAC).

5 DISCUSSION OF THE RESULTS

In this paragraph, we discuss the estimation results for the base equation [1]. Results and the conventional diagnostic tests are shown in Table 5. Column (4) shows the results for the basic specification; in column 1-3, we add the progressively the selected determinants in order to assess their contribution to the explanatory power of the selected specification.

Table 5 Determinants of potential output growth in the EMU (1996-2014)

	(1)	(2)	(3)	(4)
$\Delta pgdp_{t-1}$	0.900***	0.889***	0.839***	0.823***
	(0.0331)	(0.030)	(0.027)	(0.026)
$\Delta r\&d_{t-1}$	0.011*	0.0108**	0.0118**	0.0123**
	(0.005)	(0.005)	(0.005)	(0.005)
$Teratt_{t-1}$	-0.001	-0.000	0.0203*	0.018*
	(0.012)	(0.012)	(0.012)	(0.011)
$\Delta tech\_gap_t$	-0.025	-0.025	-0.036	-0.039*
	(0.022)	(0.023)	(0.023)	(0.023)
$\Delta tradeop_{t-1}$		0.021***	0.017***	0.016***
		(0.006)	(0.005)	(0.005)
$Kaopen_{t-1}$		0.002	0.003**	0.003**
		(0.002)	(0.001)	(0.001)
Pop_{t-1}			-0.0653***	-0.071***
			(0.016)	(0.014)
$Rulaw_t$				0.004**
				(0.002)
Observations	180	180	180	180
Under id.	19.8***	20.05***	15.1**	16.8***
Weak id.	423.5***	422.3***	368.9***	458.5***
Hansen J	4.2	4.3	3.2	3.2
Endog. ($pgdp_{t-1}$)	2.1	1.4	1.2	1.2
CSD	-1.53	-1.59	-1.61	-1.54

Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1. Hansen J=Hansen test of over-identifying restrictions. Under id.= Kleibergen-Paap LM underidentification test. Weak id.= Kleibergen-Paap Wald weak identification test. Endog= endogeneity test. CSD=Pesaran (2004) test for cross sectional dependence.

The estimates perform well in terms of identification—the Hansen test shows that the over-identifying restrictions are valid, and residuals are not cross correlated, as shown by the CSD test.

For the basic specification (column 4), the estimated coefficients are all statistically significant and signs are in line with the relevant literature (Appendix: Table A3). More specifically, population is a proxy of the country size, whose impact on growth is not clear ex-ante and is mostly an empirical matter due to the presence of both positive and negative effects (see Alesina, Spolaore and Wacziarg 2005).

Our estimates show, in line with Koenig (2015), that population size had a negative and significant impact on growth dynamics for European countries. As for human capital, the share of the population with tertiary education, as expected, has a positive and significant coefficient. In line with the literature on endogenous growth, expenditure variations for R&D have a positive and significant coefficient, and the technological gap's increase relative to the technological leader (US) has a negative and significant sign (Acemoglu 2009).

For the economic openness variables, both trade openness and financial integration exert a positive and significant impact on potential output. Financial integration theoretically improves potential output under the assumption that cross-border capital flows are directed mostly toward productive investment. However, it is worth underlining that several studies on the EMU show that financial integration might have worsened the productivity dynamics of the weakest member states. This is particularly fitting if we consider the peripheral countries. Recently, Hale

and Obstfeld (2014) found that after the euro's introduction, core EMU countries increased their borrowing from outside the EMU and their lending to the EMU's periphery. The authors also showed that greater financial integration between core and peripheral EMU members had an asymmetric effect on both sets of countries[5].

Finally, the rule of law index shows a positive and significant coefficient. This is in line with the literature, which emphasizes the relevance of governance and institutional quality for economic development (Acemoglu et al. 2005). In sum, the estimates confirm that potential output's growth rate is significantly affected by the dynamics of technology, human capital, institutional quality, and degree of goods, as well as financial market openness.

6 AN IMPACT ANALYSIS EXERCISE

In what follows, we evaluate the long-term average percentage contribution[6] of the various supply side determinants of potential output growth for the two post euro subsamples—pre-crisis and post-crisis[7]. To perform the impact exercise, we consider the regression coefficients of the base specification (1) reported in Table 5, column (4).

The results of the impact analysis suggest that the population on average contributed negatively to potential output growth rate dynamics between 1999 and 2007. The impact's magnitude is heterogeneous among countries depending on national population growth rates, with the greatest negative impact in Ireland and Spain, where the population grew at a faster pace in the last decade (Chart 2).

With the exception of Spain, where trade openness fell between 1999 and 2007, it contributed positively to potential output growth rate dynamics on average. It seems that, in particular, the Netherlands and Germany benefited more than the other countries in terms of potential output growth from the further integration of the Single Market. Among the peripheral countries, Italy and Portugal have the highest positive contribution of trade openness to potential output growth rate dynamics.

Turning to financial integration, as underlined in the previous paragraph, financial flows in peripheral countries have been mostly driven by the expectation of high yields, consequently favoring financial and speculative investment over FDI and other forms of productive investment. Therefore, it seems reasonable that the impact on potential output growth rate dynamics has been negligible, with the exception of Greece and Spain.

The share of the population with tertiary education contributed positively to potential output growth rate dynamics with the greatest contribution in France and Finland, which experienced higher increases.

---

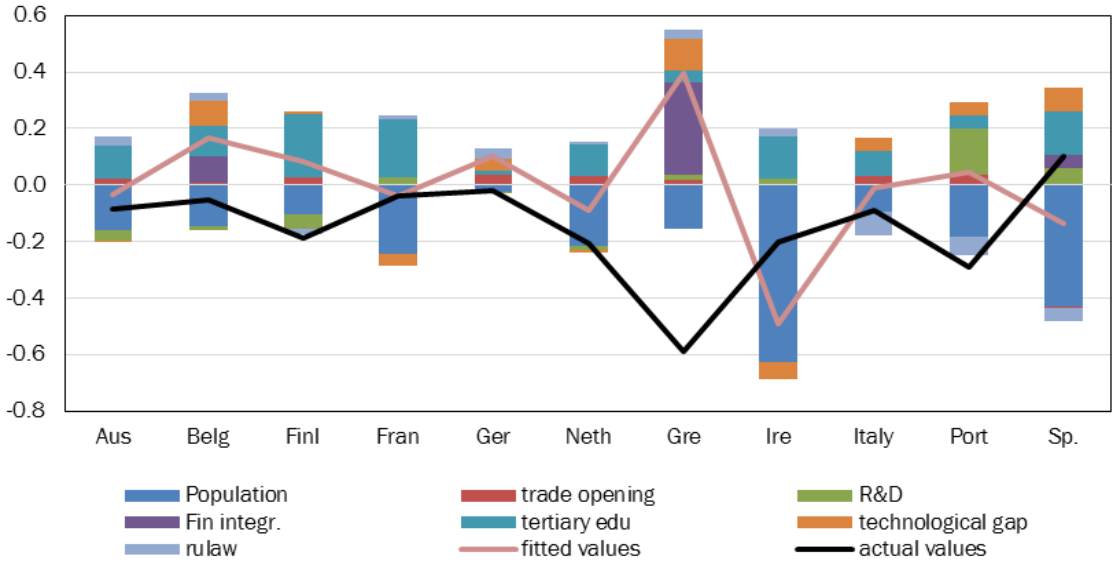
[5] Cesaroni and De Santis (2016), as well as Esposito (2017), find similar asymmetric effects of financial integration on trade and current account balances.

[6] We obtained estimates of long-run effects simply by applying the following transformation: β long-run : $\beta_i/(1-\beta_1)$.

[7] More specifically, we evaluate the contribution of the various regressors to overall potential output variation between 1999 and 2007 (2008 is the year of the crisis) and between 2008 and 2014. The sum of the contributions are equal to the model's predicted value excluding the impact of fixed effects. We also report the actual and predicted values of the potential output growth rates over the two sub periods for each country.

The contribution of R&D expenditure variation and technological gaps have been, with some exceptions, positive, but contributions' magnitude was heterogeneous. The positive impact of the technological gap means that the technological distance with the US actually decreased between 1999 and 2007 in many countries.

Fig. 2 **Contributions to potential output growth (%, 1999–2007)**



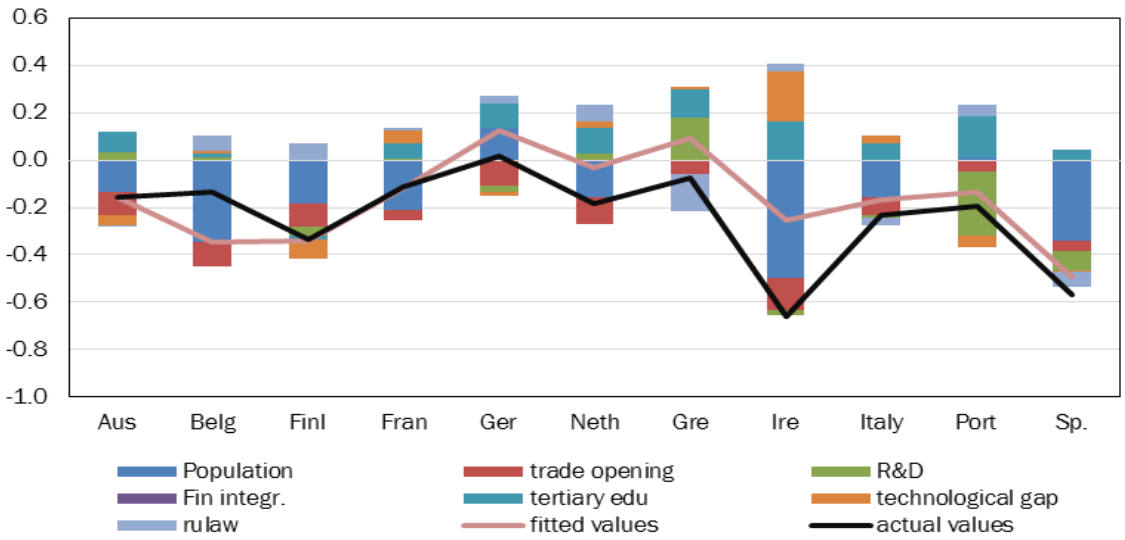
The contribution of the institutional quality indicator was small but positive in core countries excluding Finland, as well as in Ireland. A negative contribution is found in Italy and, to a lower extent, in Spain and Portugal, as a result of the index's falling levels. In fact, within the EMU, despite the disciplinary effects of the EU treaties, institutional quality differs across countries.

These findings might have potentially relevant policy implications for the role of institutional quality as a possible determinant of recovery and convergence within the EMU, especially in peripheral countries. This suggests a clear direction for further redesign and reform of institutions at the EU and EMU levels, which have already been triggered by the financial and sovereign debt crises (Cesaroni and De Santis 2017).

According to the six dimensions of World Bank Governance indicators (see Kaufmann, Kraay and Mastruzzi 2010 for details on the indices), the core countries have performed systematically better than the periphery and the difference widened after the euro's introduction. In interpreting this result, however, we need to take into account all the caveats of using signals from qualitative survey indicators.

If we consider the post-crisis period, the major change in all countries is mostly a positive to negative shift of the trade openness coefficients due to international trade's sharp structural fall in the financial crisis' aftermath (Chart 3). The result is mostly in line with the literature on great trade collapse (Levechenko et al 2010). Population size also exerted downward pressure on potential growth in most countries. R&D expenditure's deceleration contributed to this dynamic in Portugal and Spain. Finally, it is worth noting that the rule of law index improved in most countries, contributing to the recovery of potential growth. The only exception is Italy, where this index fell further during the post-crisis period.

Fig. 3 Contributions to potential output growth (2008–2014)



7 THE IMPACT OF DEBT DYNAMICS AND FISCAL POLICY STANCE ON POTENTIAL OUTPUT

In this section, we look at the impact of debt dynamics and fiscal policy stance on potential output. We do so by adding the variables related to the policy stance and debt dynamics to equation (1). More specifically, equation (1) will be augmented by first introducing the debt-to-GDP ratio and the cyclically adjusted primary balance. In further specifications nonlinear combinations of these two variables will be tested. These are the square term of both debt-to-GDP ratio and cyclically adjusted primary balance, and the interaction between these two variables.

The effect of public debt is found in the literature to have a non-linear effect, with a positive impact for low levels and a non-significant or negative impact for high levels of indebtedness (see Checherita and Rother 2010). This evidence points to a quadratic relation between debt and potential growth. The estimation of the threshold level, above which debt accumulation ceases to provide beneficial effects has important policy implications.

The estimation of a quadratic relation between the cyclically adjusted primary balance and potential growth is able to tell us whether the effect of fiscal consolidation changes depending on the size of the balance.

For example, consolidation might be more effective when a country is running a structural deficit. Similarly, an excessive consolidation effort, i.e. a tendency toward positive and increasing surpluses, might strengthen recessionary forces and slowdown potential output growth due to the low investment rate[8].

Finally, the interaction between pbal_ca and the debt-to-GDP ratio gives an indication on whether structural consolidation has different impacts depending on the level of debt. This is because for low levels of public debt, an expansionary policy stance aimed at financing

[8] Nonlinear terms should be interpreted as follows: the linear term indicates the marginal impact of a change in the underlying variable, calculated on the average; the nonlinear term tells us how the slope changes when moving away from the average.

investment and productive public expenditure is beneficial to growth.

On the other hand, the impact of fiscal consolidation might turn positive and increasing for debt levels above a certain threshold. This is similar to the quadratic relation between debt and potential growth. The difference lies in the fact that the latter includes not only changes in the structural balance but also cyclical dynamics and changes in the interests paid.

Estimation results are shown in Table 6 where the first columns report the specification with linear terms only while columns 2-4 introduce sequentially the different nonlinearities. The debt-to-GDP ratio is the only significant variable throughout the 4 specifications non linarites are significant only when they are all included in the regression (column 4). The linear term indicates the impact for a debt to GDP ratio of 60%. The negative sign of the quadratic term indicates that there is as an inverse U-shaped relation between the debt-to-GDP ratio and potential growth, with the marginal impact being decreasing and passing from positive to negative values. As for the primary balance, both linear and quadratic terms are positive and significant, suggesting that the impact for a balanced budget (i.e. the linear term) is positive but the overall impact is increasing with the level of the balance. Finally, the interaction between debt and balance is not significant.

In order to understand for which values the nonlinear terms exert significant marginal impacts, in Chart 4 we plot these impacts for different values of the debt-to-GDP ratio (between 0% and 200%) and the cyclically adjusted primary balance (from -5% to +5%)[9].

The upper panel indicate that debt accumulation exert positive effects on potential growth for values below 128% while the impact turn negative above this level. However, if we look at confidence intervals, we can see that the significance of the positive effect disappears (at 5% level) when the debt level approaches 90% of GDP.

The estimated threshold is higher than those estimated by Reinhart and Rogoff (2010), and Checherita and Rother (2010). The latter, in particular, estimated a turning point for EMU countries at around 90%, with a confidence interval ranging from 75% to 120%.

The difference between their result and ours might be explained by the fact that their study, similarly to Reinhart and Rogoff (2010), only considers the pre-2008 sample. As a consequence of the global financial crisis, all countries experienced a generalized debt increase so that the threshold might have been moved forward accordingly.

[9] Confidence intervals are obtained from the variance of the marginal impact a+2bx for each specific level of the variable x. In order to obtain the turning point, we equal the marginal impact to zero and solve for the debt level.

Table 6 Determinants of potential output growth in the EMU (1996-2014): role of public finances

	(1)	(2)	(3)	(4)
$\Delta pgdp_{t-1}$	0.879***	0.856***	0.860***	0.828***
	[0.028]	[0.040]	[0.042]	[0.036]
$\Delta r\&d_{t-1}$	0.016**	0.018**	0.019**	0.017**
	[0.005]	[0.006]	[0.006]	[0.006]
$Teratt_{t-1}$	0.006	0.007	0.004	0.006
	[0.009]	[0.010]	[0.010]	[0.010]
$\Delta tech\_gap_t$	-0.021	-0.019	-0.019	-0.011
	[0.019]	[0.019]	[0.022]	[0.019]
$\Delta tradeop_{t-1}$	0.012**	0.010*	0.010*	0.007
	[0.005]	[0.005]	[0.006]	[0.005]
$kaopen_{t-1}$	0.005***	0.005***	0.006**	0.005**
	[0.001]	[0.001]	[0.002]	[0.002]
pop_{t-1}	-0.052***	-0.047***	-0.045***	-0.046***
	[0.012]	[0.013]	[0.013]	[0.013]
$rulaw_t$	0.006**	0.005**	0.005*	0.004
	[0.002]	[0.003]	[0.003]	[0.002]
$debt_t$	0.010**	0.012**	0.012**	0.013**
	[0.003]	[0.004]	[0.004]	[0.004]
$pbal\_ca_{t-1}$	-0.003	0.007	0.019	0.041**
	[0.010]	[0.014]	[0.023]	[0.021]
$debt^2_t$		-0.005	-0.004	-0.010**
		[0.006]	[0.007]	[0.005]
$Pbal\_ca^2_{t-1}$			0.092	0.123**
			[0.071]	[0.059]
$Pbal\_ca_{t-1}*debt_{t-1}$				-0.034
				[0.064]
Observations	180	180	180	180
Under id.	22.2***	18.4***	13.1**	16.5***
Weak id.	45.1***	8.7*	5.0	6.3*
Hansen J	5.04	5.98	7.03	7.513
Endog (debt-1)	1.5	0.6	1.2	0.2
CSD	1.59	1.42	1.63	1.53

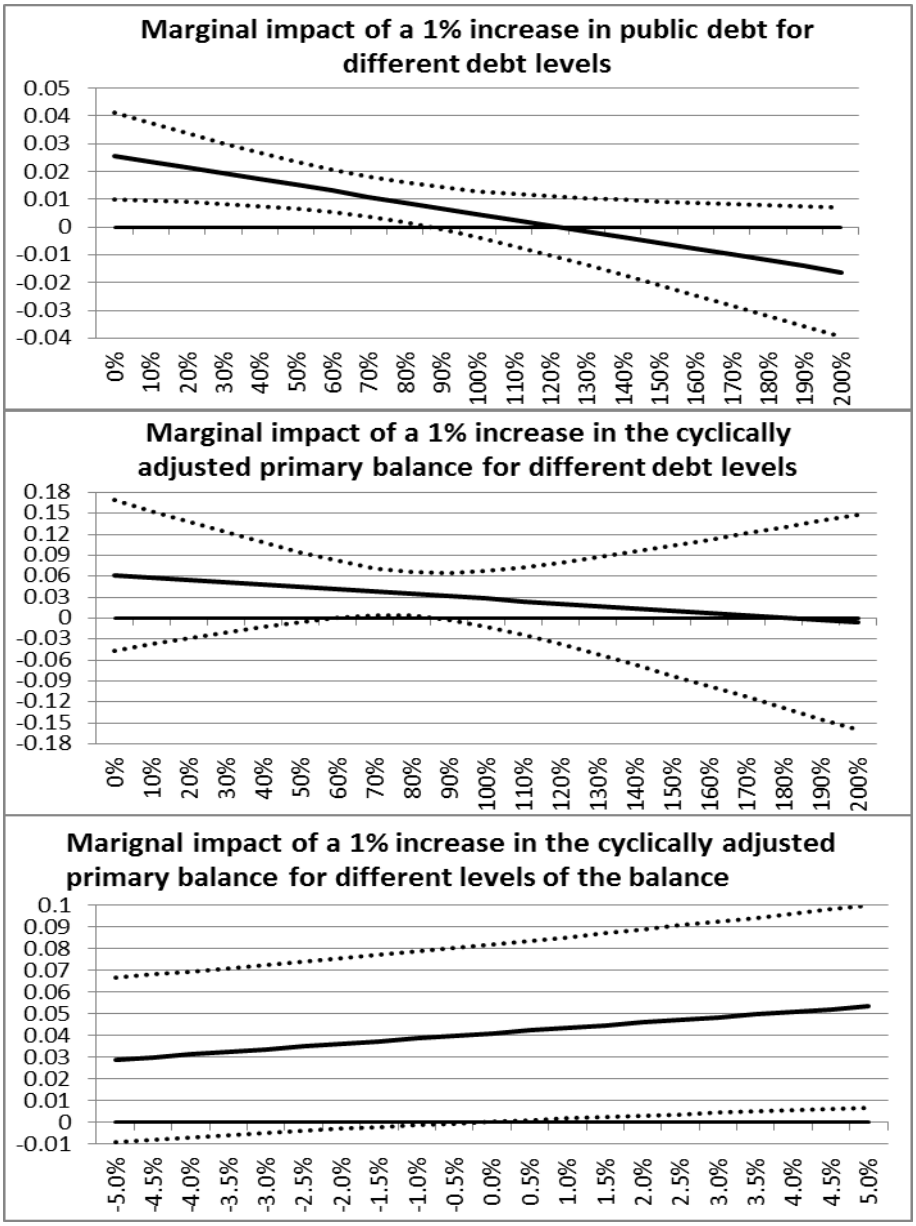
Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1. Hansen J=Hansen test of over-identifying restrictions. Under id.= Kleibergen-Paap LM underidentification test. Weak id.= Kleibergen-Paap Wald weak identification test. Endog= endogeneity test. CSD=Pesaran (2004) test for cross sectional dependence.

The marginal impact of the primary balance is positive throughout most of the debt range (Chart 4, middle panel) but it is barely significant only within the interval 60%-90%. Keeping constant the debt level, the impact of the primary balance is slightly increasing with the level of the balance (Chart 4, lower panel), but it is significant only for positive balances.

To sum up, the results indicate that fiscal consolidation and holding a surplus in the structural primary balance are beneficial to long-run growth. However, the accumulation of public debt can generate significant Keynesian (i.e. positive) effects for debt levels up to 90%. Above this value, the effect is insignificant and tend to become negative.

This result has important implications as it suggests that a threshold of 90% for the debt-to-GDP ratio instead of the 60% implied in the European fiscal policy rules can actually favor long-term growth provided that the sustainability of public debt is not at risk.

Fig. 4 Marginal impacts of the nonlinear combinations of debt and cyclically adjusted primary balance



Looking at the debt dynamics of individual European countries (Table 7), only Belgium, Italy and Greece had a debt level above the 90% threshold, but while the first two countries experienced a downward trend between 1999 and 2007, improving by consequence potential growth, Greece experienced a slight increase in the debt to GDP ratio.

As consequence of the 2008-2009 global financial crisis, the debt level reached the 120% threshold in Italy, Greece and Portugal. This means that, for these three countries, there are no significant benefits to further debt accumulation while negative impacts, due to the impact of high sovereign risk on market confidence and the excessive burden of interest payments, are likely to prevail and generate negative consequences both for long-run growth and for the

sustainability of public debt. Some concerns also stem from the evolution of public debt in Belgium, France, and Spain. All three countries have in 2016 a debt level above 90% of GDP, and a debt reduction can still exert positive effect on potential growth. Finally, after a strong increase due to the bail-out of the banking system, Ireland managed to reduce its public debt from the 199% peak reached in 2013 to 75% in 2016. According to our estimates, this should have helped the country to increase the growth rate of potential output.

Table 7 Debt to GDP ratio

	1999	2007	2010	2013	2016
Austria	66.4	64.8	82.4	81.3	83.5
Belgium	114.4	87.0	99.7	105.4	107.0
Finland	44.1	34.0	47.1	56.5	65.4
France	60.2	64.4	81.7	92.3	96.4
Germany	60.0	63.5	81.0	77.5	68.1
Greece	98.9	103.1	146.3	177.4	181.6
Ireland	46.6	23.9	86.3	119.5	75.4
Italy	109.7	99.8	115.4	129.0	133.0
Netherlands	58.2	42.4	59.0	67.7	63.0
Portugal	51.0	68.4	96.2	129.0	130.3
Spain	60.9	35.5	60.1	95.4	99.5

Source: AMECO.

8 CONCLUSIONS AND POLICY IMPLICATIONS

During the last twenty years, there has been a generalized slowdown in the growth rate of potential output, which hit the advanced European economies more severely. Our results suggest that, in line with endogenous growth models, between 1996 and 2014, tertiary education, research and development expenditure, technological catching up, trade and financial openness, as well as institutional quality, on average, contributed positively to potential output growth in the EMU.

In particular, before the crisis trade opening has been particularly beneficial for potential growth in Germany, the Netherlands, Italy, and Portugal, whereas France and Finland benefitted largely from improvements in the tertiary enrollment rate. In the same period, institutional quality in the periphery worsened in most peripheral countries, reducing by consequence potential growth. After the crisis, most variables exerted a negative contribution to the potential growth of the whole EMU as a result of the slowdown in in the economic activity, especially investment.

These results imply that structural economic policies might have a role in revitalizing anemic European growth. Policies aimed at stimulating innovation and enrollment into tertiary education, increasing economic and financial integration, and improving the institutional quality within countries are fundamental in avoiding a secular stagnation. In addition, we find that debt accumulation and fiscal policy played a role in the dynamics of potential output. While finding that running a structural surplus is beneficial to long-run growth, we find that public debt had a non-linear effect on potential growth. For low debt levels, positive effects can occur as debt is

used to finance public investments or productive public expenditure. On the contrary, debt accumulation above a certain level might be detrimental to growth due to its negative effect on private savings and investment, as well as long-term interest rates, in line with the Ricardian Equivalence.

Our results indicate that an increase in public debt has a negative impact on potential growth for levels above 128%. However, the marginal impact is statistically null already at levels slightly below 90%. The estimated thresholds are higher than those estimated in other works because we include the years following the 2008-2009 global financial crisis, when the whole EMU experienced a generalized increase in public debt.

Public debt played a role in the reduction of potential growth after the crisis in Southern European countries like Greece, Italy, and Portugal, but two core countries, namely France and Belgium, are moving toward a debt level above the maximum threshold to exert positive effects on potential growth. All these countries should reduce public debt in order to ensure its sustainability, but our results further suggest that a 90% threshold would allow to fully exploit the benefits of debt accumulation.

In conclusion, our findings suggest that, even in the case of diminished effectiveness of centralized monetary policy, structural reforms directed at the components that the analysis indicated as being determinants of potential growth should be implemented. In addition, our evidence suggests that in assessing the sustainability of public debt policymakers and researcher should take into account the effect of debt accumulation on potential growth. This is particularly important for the case of the EMU due to the low growth performance of the area.

APPENDIX

Table A1 Data description

Potential output	*Levels, Autumn Forecast 2016*	*Source: AMECO*
Trade openness	*(Exports +Imports)/GDP*	*Source: OECD*
Population	*Levels*	*Source: World Bank*
Financial openness	*The index is the first principal component of the binary variables pertaining to cross-border financial transactions based on the IMF's categorical enumeration taken from the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).*	*Source: Chinn andIto (2008)*
R&D expenditure	*% of GDP*	*Source: OECD*
Rule of Law	*An index capturing perceptions of the extent to which agents have confidence in and abide by the rules of society. The index is based on over 30 individual data sources produced by a variety of survey institutes, think tanks, non-governmental organizations, international organizations, and private sector firms. Estimate of governance ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance. For a full methodological explanation see Kaufmann, Kraay and Mastruzzi (2010).*	*Source: World Bank WGI*
Tertiary education	*% population 30-34 years*	*Source Eurostat*
Technological gap	*Technological gap variable, constructed as follows: one minus the ratio of the level of labor productivity to that of the US (in PPPs), multiplied by 100. Labor productivity computed as ratio rgdpo/emp, where rgdpo is output-side real GDP at chained PPPs (in million 2005 US dollars) and emp is number of persons engaged (in millions)*	*Source OECD*
Debt	*Debt to GDP ratio*	*Source: AMECO*
Cyclically adjusted primary balance	*% of potential output;*	*Source: AMECO*

Table A2 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
lnpot_out	474	5.781628	1.109934	3.30688	7.916553
tradeop	464	.518117	.4153602	.0031954	2.128161
lnrd_exp	205	.4532563	.4936731	-.8460653	1.321444
lnpop	494	2.793904	1.016267	1.079531	4.413243
kaopen	478	1.230543	1.364287	-1.8889	2.38967
rulaw	209	1.378367	.445928	.337016	2.12056
teratt	227	.2960479	.1072502	.086	.526
tech_gap2 D1.	445	-.0046987	.0234893	-.0875876	.1056111
debt_gdp_	292	.7358456	.3032403	.140479	1.796826
lnpbal_ca_	257	.0179866	.0819064	-.6142735	.2158904
lnpbal_ca_	257	.0179866	.0819064	-.6142735	.2158904
lnpexp_ca_	257	5.288791	1.100402	3.311251	7.059512
lnrev_ca_	257	5.306778	1.088883	3.398559	7.111108

Table A3 Determinants of potential output growth in the relevant literature—expected signs

Category	Variable	Expected sign	Empirical sign
Macroeconomic variables	GDP per capita/population	+	+ [1], [2], [3],
	Population	-	+/-[9]., - [10],
Human capital acc. and techn. progr.	Education	+	+ [1], [3],
	R&D expenditure	+	+ [1],
	Technological gap	-	-[1],
External environment variables	Financial integration	-/+	+ [1], [4],- [6], +/- [11],
	Trade op.	+	+ [1], [2], [3],
Institutions and governance	Institutional quality indic	+	+[2], [4], [5],
Fiscal variables	Public debt	-/+	-/+ [7] - /+[8]
	Fiscal balance	-/+	-/+ [7] - /+[8]

Note: The empirical findings in the table summarize Lanzafame et al. (2016) [1], Moral Benito (2012) [2], Leon- Gonzales et al. (2013) [3], Sala-i-Martin et al. (2004) [4], Acemoglu et al. (2005)[5], Fitzgerald (2005) [6], Briotti (2005) [7], and Corsetti et al. (2012) [8]. Alesina, Spolaore and Wacziarg (2005) [9]. Koenig (2015) [10], Hale and Obstfeld (2014) [11].

REFERENCES

Acemoglu, D., S. Johnson, and J. Robinson, 2005. Institutions as a Fundamental Cause of Long-Run Growth. In P. Aghion and S. Durlaff, eds. Handbook of Economic Growth Vol. IA. Elsevier B.V.

Acemoglu, D. (2009). "Endogenous Technological Change". Introduction to Modern Economic Growth. Princeton University Press. pp. 411–533. ISBN 978-0-691-13292-1.

Alesina A., Spolaore E., and Wacziarg G., 2005. Trade, growth and the Size of Countries. In P. Aghion and S. Durlaff, eds. Handbook of Economic Growth Vol. IA. Elsevier B.V.

Auerbach J. and Y. Gorodnichenko, (2012). "Measuring the Output Responses to Fiscal Policy," American Economic Journal: Economic Policy, American Economic Association, vol. 4(2), pages 1-27, May

Baum, A., C. Checherita and P. Rother, (2013), “Debt and Growth: New Evidence from the Euro Area”, Journal of International Money and Finance, Vol. 32, pp. 809–21.

Blanchard O. and D. Leigh (2013). Growth Forecast Errors and Fiscal Multipliers. Available: IMF wp n 1301.

Briotti M.G. (2005) Economic reactions to public finance consolidation: a survey of the literature. ECB occasional paper no. 38. European Central Bank

Cardarelli R. and L. Lusinyan 2015 U.S. Total Factor Productivity Slowdown: Evidence from the U.S. States, IMF WP n116

Carvalho C., Ferrero A., Nechio, F., (2016). "Demographics and real interest rates: Inspecting the mechanism," European Economic Review, Elsevier, vol. 88(C), pages 208-226.

Cesaroni T. and De Santis R. (2016), “Current account “core periphery dualism” in the EMU”, The World Economy 2016, vol. 39, issue 10, pages 1514-1538.

Cesaroni T. and De Santis R. (2017), Dynamics of net foreign asset components in the EMU, Ministry of Economics and Finance, Department of the Treasury Working Paper forthcoming.

Chinn, M., and H. Ito. (2006) What Matters for Financial Development? Capital Controls, Institutions, and Interactions. Journal of Development Economics. 81 (1). pp. 163–92.

Ciucci, M., and Zoppè, A., (2017), “Potential output estimates and their role in the EU fiscal policy surveillance”, European Parliament Briefing, 16th January 2017.

Corsetti, G., K. Kuester, A. Meier and G. Müller (2012), "Sovereign risk, fiscal policy and macroeconomic stability", IMF Working paper 12/33.

Darvas, Z. and Simon A., (2015), “Filling the gap: open economy considerations for more reliable potential output estimates”, Bruegel Working Paper 1172015.

Esposito, P., (2017). “Trade creation, trade diversion and imbalances in the EMU”, Economic Modelling, 60: 462-472.

Everaert G., Heylen G., Schoonackers R., (2015). “Fiscal policy and TFP in the OECD: measuring direct and indirect effects.” Empirical Economics 49: 605–640

Hale, G. and M. Obstfield (2014), The Euro and the Geography of International Debt Flows, CEPR discussion paper n.9937

Havik K., Mc Morrow K., Orlandi F., Planas C., Raciborski R., Roeger W., Rossi A., Thum-Thysen A., Vandermeulen V., (2014). “The Production Function Methodology for Calculating Potential Growth Rates & Output Gaps”. European Economy. Economic Papers 535.

Hoeting, J.A., Madigan, D., Raftery, A.E. & Volinsky, C.T. (1999). Bayesian model averaging: A tutorial. Statistical Science, 14, 382- 417.

Jimeno, F Smets and J Yiangou (2014). Secular stagnation: A view from the Eurozone http://voxeu.org/article/secular-stagnation-view-eurozone

Kaufmann, D., A. Kraay, and M. Mastruzzi. 2010. The Worldwide Governance Indicators: Methodology and Analytical Issues. WB Policy Research WP No. 5430. Washington, DC: World Bank.

Koenig, J. (2015), European Integration and the Effects of Country Size on Growth. Journal of Economic Integration, 30 (3), 501-531

Krugman (2014), Four observations on secular stagnation, Vox-EU, 15th August 2015. http://voxeu.org/article/four-observations-secular-stagnation

Kumar, M. and J. Woo, 2010, “Public Debt and Growth”, IMF WP No. 10/174, July .

Lanzafame M, Felipe J., Sotocinal N. R. Cand C. Bayudan-Dacuycuy(2016) The Pillars of Potential Growth and the Role of Policy: A Panel Data Approach, Asian Development Bank,WP n.482

Leon-Gonzales, R., and T. Vinagayathasan. (2013). Robust Determinants of Growth in Asian Developing Economies: A Bayesian Panel Data Model Averaging Approach. GRIPS Discussion Paper 12–12. Tokyo.

Levchenko, Logan T. L. and L. L. Tesar, (2010). "The Collapse of International Trade During the 2008-2009 Crisis: In Search of the Smoking Gun," NBER Working Papers 16006, National Bureau of Economic Research, Inc.

Moral-Benito, E. (2012). Determinants of Economic Growth: A Bayesian Panel Data Approach. Review of Economics and Statistics. 94 (2). pp. 566–79.

Müller. (2014). Fiscal Austerity and the Multiplier in Times of Crisis. German Economic Review. 15 (2), 243-258.

Kapetanios, G., Pesaran, M.H., and T. Yamagata (2011), “Panels with non-stationary multifactor error structures”, Journal of Econometrics, 160(2), 326-348.

OECD (2016), “Using the fiscal levers to escape the low-growth trap”, OECD Economic Outlook, Volume 2016 Issue 2, Chapter 3.

Pesaran, M.H., (2007). “A simple panel unit root test in the presence of cross-section dependence”, Journal of Econometrics, 22 (2): 265–312

Pesaran, M.H., (2004). "‘General Diagnostic Tests for Cross Section Dependence in Panels’," Cambridge WP in Economics 0435, Faculty of Economics, University of Cambridge

Reinhart C and K Rogoff (2010), Growth in a Time of Debt, American Economic Review: Papers & Proceedings 100 (May 2010): 573–578

Riera-Crichton D., Vegh C. A., Vuletin G. (2014) Fiscal Multipliers in Recessions and Expansions Does It Matter Whether Government Spending Is Increasing or Decreasing?, Policy Research Working Paper 6994, World bank.

Sala-i-Martin, X., G. Doppelhofer, and R. I. Miller. (2004). Determinants of Long Term Growth: A Bayesian Averaging of Classical Estimates (BACE) Approach. American Economic Review. 94 (4). pp. 813–35.

Ministry of Economy and Finance

Department of the Treasury

Directorate I: Economic and Financial Analysis

Address:
Via XX Settembre, 97
00187 - Rome

Websites:
www.mef.gov.it
www.dt.tesoro.it

e-mail:
dt.segreteria.direzione1@dt.tesoro.it

Telephone:
+39 06 47614202
+39 06 47614197

Fax:
+39 06 47821886