



BANK ĊENTRALI TA' MALTA
EUROSISTEMA
CENTRAL BANK OF MALTA

SUPPLY-SIDE DECOMPOSITION OF ECONOMIC GROWTH IN EU COUNTRIES: A HISTORICAL PERSPECTIVE

BOX 1: SUPPLY-SIDE DECOMPOSITION OF ECONOMIC GROWTH IN EU COUNTRIES: A HISTORICAL PERSPECTIVE¹

Economic and institutional convergence is a prerequisite for increasing cohesion within the European Union. This process of convergence is facilitated through access to the single market, with its competition in product markets and a common set of rules, combined with limited transfers from the EU regional policy, targeted primarily on infrastructural projects, and economic development. However, this process, which has been negatively affected by the financial crisis of 2009 and the European sovereign debt crisis of 2012, risks being further derailed by the impact of the COVID-19 pandemic, especially if the recovery in activity is asymmetric across countries.

This box presents a simple growth accounting framework that decomposes GDP growth for all EU countries into a number of supply-side components. The latter includes total factor productivity, capital deepening, demographics and various labour market indicators, such as the unemployment rate, the participation rate and the share of working age population. This decomposition is not intended to identify or estimate potential output since, by definition, the change in these components must add up to GDP growth. However, this framework can be a useful complement to the analysis from the demand side and to identify the nature of the shocks that affected European economies over the past two decades. The identification of these supply-side trends, which tend to be persistent, is helpful to shed light on the underlying factors that could, eventually, assist or hamper the economic recovery after the COVID-19 pandemic.

A supply-side growth accounting framework

The supply-side decomposition of GDP is based on a simple growth accounting framework. According to this framework, an increase in GDP can be due to three factors: higher productivity (defined as GDP per employed person), higher labour utilisation (defined as the ratio of employment to the total population), or an increase in population.

$$GDP = \frac{GDP}{Employment} \times \frac{Employment}{Population} \times Population \quad (1)$$

Alternatively, GDP per capita can be expressed as the product of labour productivity and labour utilisation.²

Labour utilisation can be further decomposed into three factors:

$$\frac{Employment}{Population} = \frac{Employment}{Labour Supply} \times \frac{Labour Supply}{Working Age Population} \times \frac{Working Age Population}{Population} \quad (2)$$

¹ Prepared by Brian Micallef, the Manager of the Research Department at the Bank. The analysis presented in this box is based on the author's study: Micallef, B. (2020), "Real convergence in Malta and the EU countries after the financial crisis", *Journal of Economic Integration* 35(2), pp. 215-239. Helpful comments by Dr Aaron G. Grech are gratefully acknowledged. The views expressed in this article represent those of the author and should not be interpreted to reflect those of the Bank. Any remaining errors are the author's own.

² For an analysis of convergence based on GDP per capita, see Micallef, B. (2017), "The process of economic convergence in Malta and in the European Union", *Policy Note* March 2017, Central Bank of Malta.

The first term in (2) represents the share of employment in the labour force or, alternatively, one minus the unemployment rate, since an increase in the unemployment rate will reduce this ratio. The second term represents the labour participation rate, while the third term reflects the age structure of the population. The latter is defined as the ratio of working-age population (WAP) aged between 15 and 64 years to the total population.

Labour productivity can also be decomposed into two separate components. Assuming a constant return to scale Cobb Douglas production function with two factor inputs, capital and labour:

$$GDP = TFP \times Capital^{\alpha} \times Employment^{1-\alpha} \quad (3)$$

where TFP represents total factor productivity, and α and $1 - \alpha$ are the share of capital and labour, respectively, in the production function. For advanced economies, the share of capital is usually assumed to be 1/3, with the remaining 2/3 going to labour. Dividing both sides of (3) by employment gives the two main components of labour productivity:

$$Labour\ productivity = \frac{GDP}{Employment} = TFP \times \left(\frac{Capital}{Employment} \right)^{\alpha} \quad (4)$$

Hence, in this framework, productivity is a function of total factor productivity and the capital-to-employment ratio, also known as capital deepening.

The growth accounting framework is derived by substituting equations (2) and (4) into (1):

$$GDP = \left\{ TFP \times \left(\frac{Capital}{Employment} \right)^{\alpha} \right\} \times \left\{ \frac{Emp}{Lab.Supply} \times \frac{Lab.Supply}{WAP} \times \frac{WAP}{Population} \right\} \times Population \quad (5)$$

The growth rate of GDP is equal to the sum of the growth rate of the individual components, whereas the level of GDP is the product of these terms.

All data were sourced from Eurostat. The only exception is capital stock, which was obtained from the AMECO database. Missing data – mostly for the mid-1990s for some Member States – were in turn sourced from the respective IMF Article IV country reports. Data are in annual frequency, covering the period 1995-2018.

Results

Table 1 lists the decomposition of GDP growth for all EU countries, as well as the overall European Union and euro area averages, post-financial crisis. For comparison purposes, Table 2 displays the decomposition for the decade prior to the financial crisis (1997-2007).

At 5.7%, Malta had one of the highest growth rates post-crisis. All three main components – labour productivity, labour utilisation and population growth – contributed to GDP growth, although not to the same extent. The largest contributor was labour utilisation, mostly due to a higher participation rate. Malta's female participation rate increased from 40% in 2008 to 64% in 2018 because of measures to attract more females to the labour market such

Table 1
SUPPLY-SIDE DECOMPOSITION OF GDP GROWTH (2010-2018)

Percentage

	GDP	Labour Productivity	Capital deepening	TFP	Labour utilisation	1-Unr	Particip. Rate	Share of working age pop.	Pop.
EU28	1.6	1.1	0.2	0.9	0.3	0.2	0.5	-0.5	0.2
EA19	1.4	0.9	0.1	0.8	0.3	0.2	0.4	-0.3	0.2
Belgium	1.6	0.7	0.2	0.6	0.2	0.2	0.4	-0.4	0.6
Bulgaria	2.2	2.9	1.1	1.8	0.2	0.2	0.5	-0.5	-0.8
Czech Rep.	2.3	1.4	0.3	1.2	0.7	0.5	1.2	-1.0	0.1
Denmark	1.6	1.1	0.2	0.9	-0.1	0.1	0.1	-0.3	0.5
Germany	2.1	1.1	-0.1	1.2	0.7	0.5	0.6	-0.4	0.3
Estonia	3.6	2.4	0.7	1.6	1.4	1.0	1.0	-0.6	-0.1
Ireland	6.4	4.9	0.1	4.8	0.6	0.9	0.2	-0.5	0.8
Greece	-2.4	-1.0	0.2	-1.1	-1.1	-1.1	0.4	-0.4	-0.4
Spain	0.9	0.9	0.3	0.6	-0.1	0.4	0.0	-0.4	0.1
France	1.4	0.8	0.3	0.5	0.1	0.0	0.2	-0.1	0.4
Croatia	0.8	1.4	0.9	0.6	-0.1	0.1	0.0	-0.2	-0.5
Italy	0.2	0.1	0.0	0.2	0.0	-0.3	0.5	-0.2	0.2
Cyprus	1.0	0.5	0.4	0.0	-0.3	-0.3	0.2	-0.2	0.8
Latvia	2.6	2.5	-0.3	2.8	1.3	1.3	0.8	-0.8	-1.2
Lithuania	3.4	2.9	0.8	2.1	1.9	1.0	1.4	-0.5	-1.3
Luxembourg	3.2	0.8	0.3	0.5	0.1	0.0	-0.2	0.3	2.3
Hungary	2.5	0.5	0.0	0.5	2.3	0.8	1.9	-0.4	-0.3
Malta	5.7	1.3	-0.3	1.6	2.5	0.4	2.4	-0.3	1.8
Netherlands	1.4	0.8	0.2	0.6	0.1	0.1	0.5	-0.4	0.5
Austria	1.6	0.7	0.2	0.5	0.2	0.1	0.3	-0.2	0.6
Poland	3.5	3.1	1.3	1.8	0.5	0.5	1.0	-1.0	0.0
Portugal	0.6	0.7	-0.1	0.8	0.2	0.4	0.1	-0.4	-0.3
Romania	3.0	3.9	1.3	2.5	-0.3	0.2	0.6	-1.1	-0.5
Slovenia	1.7	1.2	-0.3	1.5	0.4	0.1	0.9	-0.7	0.2
Slovakia	3.1	2.2	0.1	2.1	0.9	0.7	0.7	-0.5	0.1
Finland	1.2	0.7	0.2	0.5	0.2	0.1	0.7	-0.7	0.4
Sweden	2.7	1.2	0.2	1.0	0.4	0.2	0.7	-0.5	1.0
United Kingdom	1.9	0.7	0.1	0.6	0.5	0.4	0.5	-0.4	0.7

Sources: Eurostat; author's calculations.

as free childcare, longer schooling hours, longer maternity leave and tax incentives.³ The decline in the unemployment rate also contributed to higher labour utilisation, whereas the age structure of the population – reflecting an aging domestic population – contributed negatively. The contribution of population growth, which averaged 1.8% during this period, is the second highest among EU countries. This reflects the influx of foreign workers, which increased from less than 3% of the workforce in 2004 to 22.5% in 2018.⁴ This inflow was concentrated on both ends of the skill spectrum and was crucial to overcome Malta's labour and skill shortages.⁵ Finally, since 2010, labour productivity increased on average by 1.3% per annum. Productivity was entirely driven by an increase in total factor productivity, which

³ Micallef, B. (2018), "Estimating the impact of structural reforms to increase the female participation rate in Malta", *International Journal of Social Science Studies* 6(8), pp. 73-84.

⁴ Rapa, A.M. (2019), "Developments in the foreign workforce in Malta", *Quarterly Review* 2019(4), pp. 35-40, Central Bank of Malta.

⁵ Grech, A.G. (2017), "Did Malta's accession to the EU raise its potential growth? A focus on the foreign workforce", *Journal of Economic Integration* 32(4), pp. 873-890.

Table 2
SUPPLY-SIDE DECOMPOSITION OF GDP GROWTH (1997-2007)

Percentage

	GDP	Labour Productivity	Capital deepening	TFP	Labour utilisation	1-Unr	Particip. Rate	Share of working age pop.	Pop.
EU28	2.6	1.6	0.4	1.2	0.7	0.3	0.4	0.1	0.3
EA19	2.4	1.0	0.3	0.7	1.0	0.3	0.6	0.0	0.4
Belgium	2.6	1.5	0.2	1.2	0.7	0.2	0.6	0.0	0.4
Bulgaria	2.6	2.2	1.0	1.2	1.1	0.3	0.7	0.2	-0.8
Czech Rep.	3.3	3.4	0.9	2.6	-0.1	-0.1	-0.4	0.4	0.0
Denmark	2.2	1.4	0.4	1.0	0.4	0.2	0.3	-0.2	0.3
Germany	1.6	1.1	0.3	0.8	0.6	0.0	0.6	-0.1	-0.1
Estonia	7.4	6.8	2.4	4.3	1.1	0.5	0.1	0.5	-0.5
Ireland	7.0	2.7	0.5	2.3	2.3	0.6	1.0	0.7	1.8
Greece	4.0	2.6	0.4	2.2	1.0	0.1	0.5	0.4	0.4
Spain	3.8	0.0	0.2	-0.2	2.7	1.1	1.3	0.3	1.2
France	2.4	1.2	0.3	0.9	0.5	0.3	0.2	0.1	0.6
Croatia	4.0	3.0	1.0	2.0	1.5	0.0	1.2	0.4	-0.5
Italy	1.5	0.2	0.2	0.1	1.0	0.5	0.8	-0.4	0.3
Cyprus	4.5	2.0	0.8	1.2	1.1	0.1	0.1	0.9	1.4
Latvia	7.9	6.6	0.3	6.3	2.2	1.0	0.9	0.3	-1.0
Lithuania	6.8	7.1	1.7	5.3	0.8	0.4	0.2	0.2	-1.0
Luxembourg	5.2	3.3	0.5	2.8	0.4	-0.1	0.7	-0.2	1.4
Hungary	3.7	3.0	0.9	2.1	1.0	0.2	0.5	0.2	-0.2
Malta	3.2	2.6	0.9	1.7	0.0	-0.1	-0.3	0.5	0.6
Netherlands	2.9	1.5	0.3	1.2	0.9	0.3	0.7	-0.1	0.5
Austria	2.6	1.7	0.5	1.2	0.6	0.0	0.6	0.0	0.4
Poland	4.5	4.3	1.1	3.1	0.2	0.4	-0.8	0.6	0.0
Portugal	2.3	1.3	0.8	0.5	0.5	-0.1	0.6	0.0	0.4
Romania	3.5	5.2	1.1	4.0	-0.8	0.1	-1.5	0.7	-0.7
Slovenia	4.4	3.7	1.2	2.5	0.5	0.2	0.3	0.0	0.1
Slovakia	5.1	4.5	1.1	3.3	0.5	0.0	-0.2	0.7	0.0
Finland	4.0	2.3	0.1	2.2	1.4	0.8	0.6	0.0	0.3
Sweden	3.4	2.2	0.2	2.0	0.9	0.5	0.2	0.3	0.3
United Kingdom	3.1	1.9	0.3	1.7	0.6	0.3	0.3	0.1	0.5

Sources: Eurostat; author's calculations.

had recovered strongly after the crisis following a trend decline from the 1990s.⁶ In contrast, capital deepening contributed negatively to growth as the increase in investment lagged strong employment growth. This finding is in line with a recently published study that documented a significant infrastructure gap in Malta.⁷ However, it also reflects the structural shift in economic activity towards the services sector at the expense of manufacturing, which usually requires more physical investment in plant and equipment than services. In fact, Malta registered the largest shift in the share of services among EU countries between 2007 and 2018, both in terms of gross value added and in employment. Furthermore, some high value added services tend to be more reliant on human – rather than physical –

⁶ Micallef, B. & Ellul, R. "Medium term estimates of potential output growth in Malta", in Grech, A.G. & Zerafa, S. (eds.), *Challenges and Opportunities of Sustainable Economic Growth: the case of Malta*, Central Bank of Malta, 2017.

⁷ Rapa, N. & Rapa, A. (2019), "The macroeconomic effects of closing the public sector capital gap in Malta", *Policy Note* July 2019, Central Bank of Malta.

capital, which explains why the economy continued to grow rapidly despite a decline in the investment ratio compared to the 1990s.⁸

Notable differences emerge when comparing Malta's post- and pre-crisis performance. In fact, Malta and Germany are the only two EU countries with a post-crisis growth higher than that registered before the crisis. All three components have contributed to this difference. In the case of Malta, the major difference comes from labour utilisation, which did not contribute anything to average GDP growth between 1997 and 2007. The components of labour utilisation have also inverted compared with the 2010-2018 period. Both the unemployment rate and the participation rate contributed negatively, whereas the age structure was still contributing positively as the aging effects had not yet kicked in. Second, the contribution of population growth was only a third of that post-crisis. The contribution from population pre-crisis was mostly due to the natural increase in the local population, whereas after 2010, immigration became population's main driver. Finally, the contribution of capital deepening was much stronger in the pre-crisis period, owing to both a higher investment rate and a slower rate of employment growth.

Almost all EU countries registered slower average growth post-crisis. GDP growth in the European Union and euro area averaged 1.6% and 1.4%, respectively, post-crisis, significantly lower than the 2.6% and 2.4% pre-crisis. Labour utilisation was the most severely affected, mostly because of an aging population, which resulted in a declining share of the working age population. Similarly, the contribution of population growth almost halved, from 0.3% to 0.4% pre-crisis to 0.2% post-crisis. Most of the labour productivity decline is driven by capital deepening, reflecting reduced investment post-crisis. The latter could be explained by a combination of subdued demand, heightened uncertainty and tighter financing conditions.⁹

The degree of growth slowdown differs considerably across the European Union and country-specific factors play an important role. Countries heavily affected by the financial crisis or the European sovereign debt crisis – such as Greece, Spain, Cyprus, and Slovenia – recorded the largest slowdown. This led to the so-called 'unbearable divergence' in the European Union, referring to persistent unemployment in a number of EU countries, along with economic, social, and political implications.¹⁰ In some of these countries, the pre-crisis growth masked the build-up of unsustainable imbalances and vulnerabilities, with the boom-bust dynamics in the aftermath of the crisis eventually unravelling years of convergence. The Baltic countries also experienced a marked slowdown between the two periods. In the Baltics, the pre-crisis boom was associated with fast credit growth, whereas the onset of the financial crisis limited the availability of foreign capital, pushing these countries into a severe recession.¹¹ Despite this slowdown, the average growth rate registered by the Baltic countries post-crisis still surpassed that of the European Union, reflecting their flexible labour market and thus helped to resume their convergence process. However, some

⁸ Grech, A.G. (2015), "The diversification of the Maltese economy", *Policy Note* September 2015, Central Bank of Malta.

⁹ ECB (2017), "Investment dynamics in advanced economies since the financial crisis", *Economic Bulletin Issue 6*, European Central Bank.

¹⁰ Boeri, T. & Jimeno, J.F. (2015), "The unbearable divergence of unemployment in Europe", *Working Paper*, No. 1534, Banco de Espana.

¹¹ Martin, R. (2010), "Boom and bust in the Baltic countries: Lessons to be learnt", *Intereconomics* 45(4), pp. 220-226.

euro area countries have exhibited a “non-convergence trap” that started well before the introduction of the euro currency.¹² This non-convergence trap occurs when “an economy does not progress from growth driven by accumulation of capital to growth led by innovation, then it stops converging towards the technology frontier”.¹³ This process is evidenced by the decline in the growth rate of TFP in some countries, most notably in Italy. In other countries, sector-specific developments are crucial to understand the growth performance. For instance, in Finland, developments in the semi-conductor and paper industries are partly behind its sharp growth slowdown. On the contrary, Germany’s increase in average GDP growth is mostly due to population growth (reflecting significant immigration), as the contributions from productivity and utilisation are broadly similar between the two periods.

Conclusion

The growth accounting framework presented in this article can be used to shed light on the sources of convergence or divergence in EU countries from a supply-side perspective. The experience of some euro area countries during the financial crisis and the European sovereign debt crisis highlights the importance of achieving sustainable economic growth without the accumulation of underlying imbalances. The analysis also identifies other important lessons for a country’s real convergence process, such as the need for a flexible adjustment process following an economic shock and the importance of having the right institutions conducive to innovation, technological adoption and productivity growth. Going forward, the importance of these lessons becomes more compelling as EU economies deal with structural challenges such as aging populations in conjunction with tackling the severe disruptions to economic activity during and after COVID-19.

¹² Aghion, P. & Bircan, C. (2017), “The middle-income trap from a Schumpeterian perspective”, *Research Paper Series*, February, London School of Economics.

¹³ Díaz del Hoyo, J.L., Dorucci, E., Heinz, F.F. & Muzikarova, S. (2017), “Real convergence in the euro area: a long-term perspective”, *Occasional Paper* No. 203, 61, European Central Bank.