
Advanced Macroeconomics

PID_00249476

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Recommended minimum time required: 4 hours



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Introduction

Macroeconomic realities since the financial crisis pose major challenges to traditional approaches. The recovery has been slower than expected, with growth in 2016 of 3.1% for the global economy, the lowest figure since 2010. Monetary policy in the main advanced economies entered *uncharted waters* when official interest rates reached zero and even became negative in some countries, and central banks have engaged in unorthodox or non-conventional strategies involving strongly expansive policies. In spite of all this, inflation has not become a serious problem (contrary to the traditional prediction of usual macroeconomic models): in fact, deflation emerged as a risk in Europe and other areas. The fiscal policies initially adopted after the crisis marked an expansionary path, with huge public deficits and rapid increases in public debt. But despite that (and again contrary to the traditional predictions of macroeconomic models), interest rates did not jump: in fact they reached historical minimum levels.

New realities pose new challenges to existing theories and explanations. This is the backdrop to this material on Advanced Macroeconomics.

Contents

These learning materials are organized in four units. The first unit begins by presenting some approaches that try to provide a framework to explain the new realities. As usual in Economics, we are faced with partly conflicting – and also partly complementary – approaches. The debate between the secular stagnation and financial drag hypotheses is interesting not only as a confrontation of economic ideas, but mainly as broad approaches to introduce many of the most important aspects of the recent controversies surrounding macroeconomic analysis and macroeconomic policies. After a general introduction, Unit 1 is devoted to monetary and financial aspects; the selected topics are: explanations behind and implications of low interest rates, new strategies in monetary policies, the discussion about financial fragilities in advanced and emerging economies, and new features in international financial flows.

Unit 2 deals with the real sector of the (macro) economies. It examines recent developments in fiscal policies and also in policies that try to influence the supply side, such as structural reforms. The implications of these developments on the functioning of labour markets, in connection with the profound technological changes experienced by modern societies, also give rise to important developments.

Macroeconomics is traditionally oriented towards short-term problems: as Keynes famously stated, to differentiate his approach from the classical approach more centred in the medium and long term, “in the long run we are all dead”. But the urgencies of the short term cannot be disconnected from economies’ and societies’ medium- and long-run problems. Recent developments in Macroeconomics are making this connection evident. For this reason the last two units are devoted to the dynamics of economic growth and their wider implications.

Unit 3 summarizes some important aspects for the analysis of economic growth, from the formulations of the classic economists to the Keynesian economists Harrod and Domar, as well as Solow’s decomposition factors explaining economic growth and the recent emphasis in the connections between the short term and the medium to long term.

Unit 4 presents the more popular models of economic growth, especially the neoclassical growth model presented in 1956 by Robert Solow, which for decades has been the benchmark for analytical and empirical work and remains an essential norm, as will be shown, for contemporary and prospective studies. Consideration also goes to models for endogenous technological progress, with implications for the role of ideas and R&D policies for growth strategies.

Format and methodology

These Advanced Macroeconomics materials have a specific format that relates to the nature of the course contents and the course’s position in the Curriculum.

Some issues are rooted in traditional approaches but are adapted to new realities, while others refer to recent issues that have given rise to novel approaches.

It is a course programmed for the final part of the Degree in Economics, for students who have already completed basic and intermediate studies of Macroeconomics, including the main macroeconomic models.

As such, it may be interesting to approach the subject matter in a manner somewhat different from the traditional way. Instead of *materials in a textbook format with activities and a bibliography that refers to the main contributions*, both classic and recent, *the material is a **guided tour** of selected papers and documents, with activity proposals to ensure understanding and the ability to apply the ideas to the course contents.*

The fact that the language used to teach the course is English greatly facilitates access to supplementary materials, most of which were originally written in this language.

Therefore, the supplementary materials presented are essentially *an orientation for a selected guided tour of some of the most relevant contributions*, appropriate to the level of a final-year degree course. A guiding thread is offered to understand the selected readings, to explain their contents and to connect the various approaches. Comments are made on the most relevant aspects so as to offer context, and the connections with applications to important past, present and/or future economic problems are left open.

Every unit has two core sections, marked with an asterisk (*), as well as additional complementary sections. The core sections have a broader scope and more references, which are also relevant for the complementary topics and the unit as a whole.

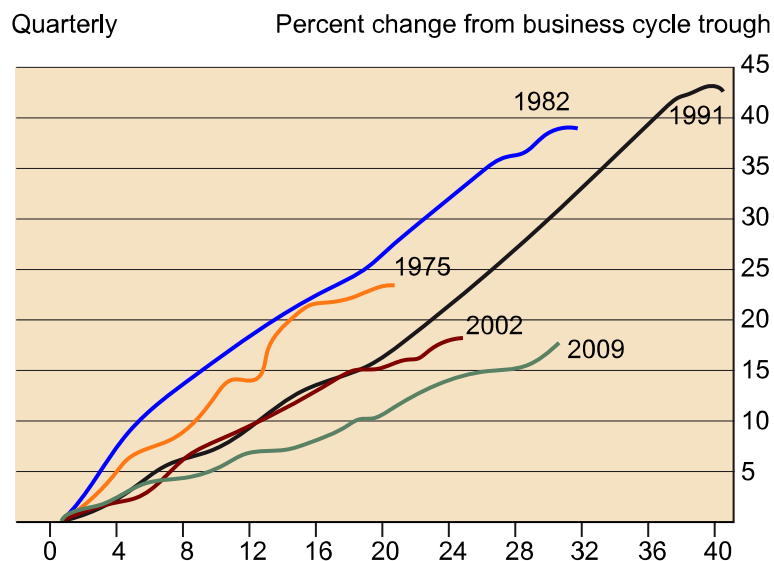
1. Monetary and financial topics

The recovery after the Great Recession (or Global Financial Crisis), starting around 2008-2009, has been slower than that following other recessions. Figure 1 shows how the Federal Reserve compared the evolution of growth after 5 recessions in the United States in the recent decades: recent behaviour shows some features linking the roots of the crisis, the macroeconomic policies adopted since the outbreak of the difficulties, and changes in the economic and socio-politic environment. New realities call for new explanations, reformulating previous knowledge or introducing new knowledge.

This unit focuses on developments in the monetary and financial fields. The crisis since 2008 has highlighted the need to connect analysis of the financial markets with the working of macroeconomics. And the innovations that have had to be introduced in the management of monetary policies also have given rise to interesting novelties, in relatively unprecedented contexts such as historical minimums for interest rates, reaching negative figures even.

The first section explains some approaches to economic evolution over recent years. Partly opposed, partly complementary, they offer useful, wide frameworks for the analysis of many interesting questions about the macroeconomic short-, medium- and long-run problems. The second section centres on the low level of interest rates – one of the most distinctive features of recent times – and details their explanations and implications. The third section deals with the “unconventional” monetary policies adopted when the usual mechanism of reducing official rates reached the “zero-bound”. Section 4 poses doubts about the persistence of financial fragilities in some advanced and emerging economies. Lastly, section 5 raises the issue of the magnitude and direction of international capital flows.

Figure 1. The recovery since 2009 has been slower than in previous recessions: real GDP in its historical context.



Source: Federal Reserve, Monetary Policy Report, February 2017, available at: https://www.federalreserve.gov/monetarypolicy/files/20170214_mprfullreport.pdf

1.1. * And after the crisis, what? Secular Stagnation or Financial Drag

Larry Summers, the main contemporary contributor to the secular stagnation theory, explains the recent challenges to macroeconomic analysis in terms of four observations:

1) Perhaps the financial crisis from 2008 was surprising (at least for many people), but performance since then has been just as striking if not more so.

2) Expectations about a relatively quick return to previous levels and rates for GDP growth and other macro-aggregates have not been fulfilled. After a drop in global GDP in 2009 (-0.1% at the world level, -3.4% in the advanced economies), the rebound in 2010 (5.4% at the world level, 3.1% for advanced economies) was short-lived. From 2011 to 2016 growth rates have been disappointing, with frequent downward revisions. (Only in 2017 do predictions finally show a more optimistic projection, but with many sociopolitical and financial risks).

3) Monetary policies have been exceptionally expansive, initially in terms of reduction of interest rates until the “zero-lower-bound” was reached in United States, the Eurozone, Japan and other countries. In addition, central banks have engaged in aggressive purchases, giving rise to the so-called unorthodox (unconventional) monetary policies or “quantitative expansions” that have increased the size of their balance sheets to extraordinary magnitudes. For the G7 countries, the increase in assets of central banks has been about US\$ 5 trillion. In spite of this, inflation has not become a major problem; in fact many countries (mainly in Europe) have had problems near to deflation.

4) Fiscal policies have been also very expansive, at least initially.

Secular Stagnation theory attempts to explain these realities in terms of a combination of factors that give rise to a trend towards lower interest rates, resulting from an increased propensity to save and a decrease in demand for investment. As discussed in the following section, this reduction in interest rates is explained by demographic and distributional factors in conjunction with a slower rate of change for productivity and a range of uncertainties, and it is a reduction that precludes the traditional adjustment mechanism via monetary policies. An emphasis on the potential role of fiscal policies is an interesting implication, to be explored at the Unit 2.

There are competing explanations as regards certain financial aspects that, to a large extent, are a “legacy” of the lead-up to the crisis. In particular, the burden of excessive debt deserves special attention. S. Lo and K. Rogoff refer to the “debt overhang” as the main problem to overcome. In a similar approach, Claudio Borio (and some co-authors) speaks about a “financial drag”. A major implication is the priority to recover the health of financial system and the financial situation of business and households. Although these adjustments are necessarily slow, there is nothing intrinsically **secular** about stagnation. And wise financial and monetary policies play a role that is equally or even more important than fiscal policies, which cannot solve a debt problem with more debt!

Activity 1

Read and compare the following three (relatively) short pieces:

Summers, L. (2016), “The Age of Secular Stagnation”, article in Foreign Affairs, available at: <http://larrysummers.com/2016/02/17/the-age-of-secular-stagnation/>

Borio, C. (2017), “Secular stagnation or financial cycle drag?”, Keynote speech, National Association for Business Economics, 33rd Economic Policy Conference, March 2017, available at: <http://www.bis.org/speeches/sp170307.pdf>

Lo, S. and Rogoff, K. (2015), “Secular Stagnation, debt overhang and other rationales for sluggish growth, six years on”, BIS working paper 482, January 2015, available at: <http://www.bis.org/publ/work482.htm>

Discuss:

- the reasons for the slow recovery after the Great Recession;
- each piece of analysis’ implications regarding the measures to be taken to overcome the situation and achieve a solid recovery.

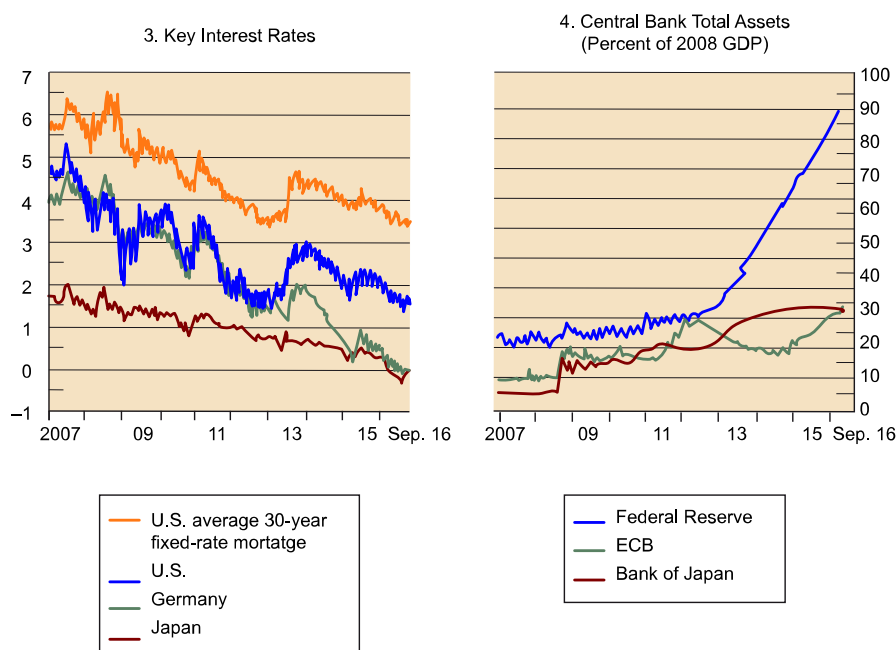
1.2. * Low interest rates: causes and implications

Low interest rates, at historical minima, have been one of the most striking novelties of recent times. Official interest rates used as instruments of monetary policy by central banks have reached levels close to zero or, in some cases, even negative. Real interest rates, determined in theory by the equilibrium

between Savings and Investment decisions – in the modern version of loanable funds theory – also showed a declining trend even before the financial crisis of 2008.

Figure 2 shows, on the left, the evolution of key interest rates for 3 advanced economies and, on the right, the expansion of the asset side of central banks' balances, as a consequence of non-conventional monetary policies adopted as traditional interest rates policies reached – or approached – the *zero lower bound* (ZLB).

Figure 2. Instruments of monetary policy after the crisis: key interest rates and central banks assets.



Source: IMF, World Economic Outlook, October 2016.

This new situation poses an array of interesting questions: Have our economies returned to the “liquidity trap” of which Keynes spoke? Why are interest rates so low? What are the complications for monetary policy? How long will it last? Are these transitory or more permanent features?

Among the reasons highlighted to explain the low level of interest rates, the following are particularly noteworthy:

1) On the side of Savings (an increase in savings tends to depress interest rates):

a) Demographic factors: an increase in segments of the population who are still active but with the prospect of ageing tends to increase saving. In recent years this would have been the situation mainly in some of the advanced economies (and China?).

b) Distributional factors: an increase in the share of national income going to segments of population with a high propensity to save (richer people and capital income have a higher propensity to save and a lower propensity to consume than those with more modest incomes) increases the level of savings associated with a given level of national income or GDP.

c) Global saving glut: the explanation presented by Ben Bernanke (former President of the Federal Reserve) about the rising share in the world economy of countries like China, and some oil exporters, with a high propensity to save).

d) Uncertainties, related to the crisis and its aftermath.

2) On the side of Investment (a contraction in investment tends to lower interest rates):

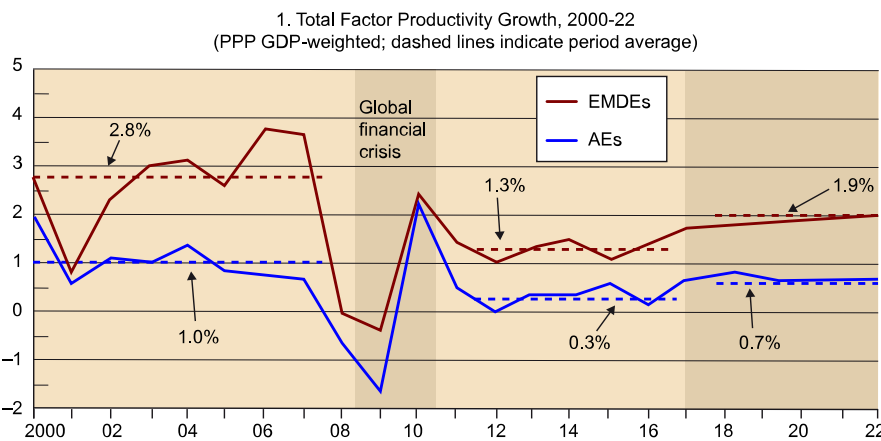
a) (depressed) Expectations: a new case of negative “animal spirits”.

b) A reduction in the (average) price of capital goods: computers (new economy) are, on average, cheaper than blast furnace (“old” economy).

c) Problems with total factor productivity (TFP): after the global financial crisis, as shown in figure 3, total factor productivity has declined, according to some statistics, and this acts as a drag against restarting the investor process.

d) Uncertainties: not only do they increase the incentives to save “for a rainy day”, they are also a drag for investors.

Figure 3. What happens with TFP?



Source: IMF, WEO, April 2017.

Activity 2

Read and discuss the explanations about the contributions of some factors to the low interest rates of recent times:

Rachel, L. and Smith, T. (2015), “Secular drivers of the global real interest rate”, Staff Working paper 571, Bank of England, December 2015, available at: <http://www.bankofengland.co.uk/research/Pages/workingpapers/2015/swp571.aspx>

Problems of Productivity and/or Statistical Inadequacy?

Statistical-technical questions can be asked about the adequacy of the typical statistics used to give an accurate measure of the true pace of innovation and technological progress. Is the New (Fourth?) Industrial Revolution well captured in statistics? A clear discussion of some aspects of this controversy is found in Furceri, D. et al. (2017), “Can Mismeasurement of the Digital Economy Explain the U.S Productivity Slowdown?”; in “IMF Staff Discussion Note. Gone with the Headwinds: Global Productivity”, April 2017, available at: <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2017/04/03/Gone-with-the-Headwinds-Global-Productivity-44758>

A non-technical analysis with implications for monetary policy, based on Cunliffe, J. (2016), "Why are interest rates low?", Speech, Bank of England, November 2016, available at: <http://www.bankofengland.co.uk/publications/Documents/speeches/2016/speech935.pdf>

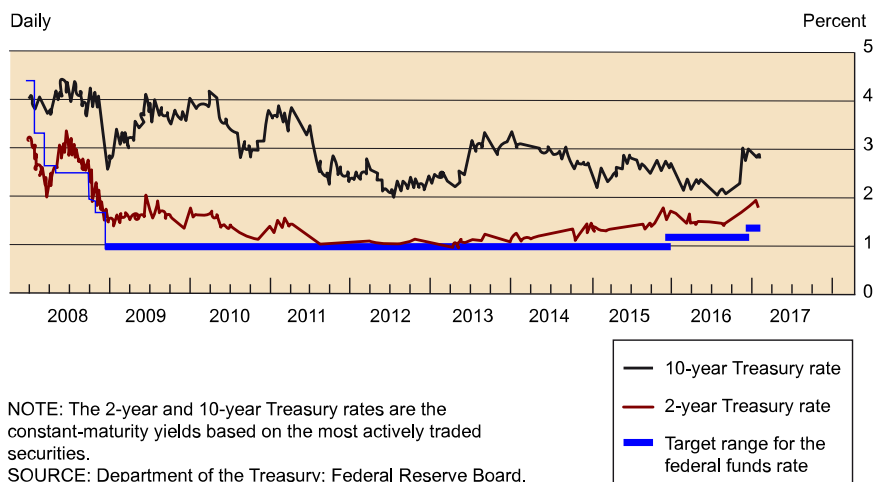
About the notion and declining trend of the natural interest rate: Galesi, A., Nuño, G. and Thomas, C. (2017), "The natural interest rate: concept, determinants and implications for monetary policy", Analytical Articles, Bank of Spain, March 2017, available at: <http://www.bde.es/f/webbde/SES/Secciones/Publicaciones/InformesBoletinesRevistas/ArticulosAnaliticos/2017/T1/files/beaa1701-art7e.pdf>

1.2.1. Are interest rates recovering?

The aforementioned explanations about the declining trend of interest rates include some factors that are transitory and some that are more structural. Have some of these factors recently (end of 2016, 2017) been reversed and are we witnessing a reversal of the trend?

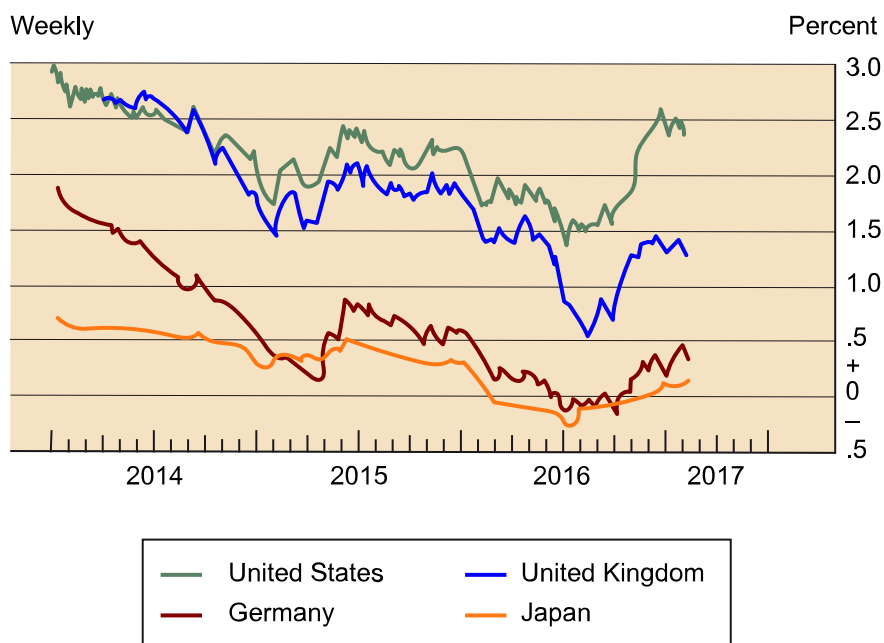
Figures 4 and 5 show the data with which the Federal Reserve highlights this new situation. Is it a USA-specific reversal? Or can a global trend be identified, even for a Eurozone still committed to minimum official interest rates?

Figure 4a. Interest rates: United States



Federal Reserve (2017), Monetary Policy Report, February 2017: https://www.federalreserve.gov/monetarypolicy/files/20170214_mprfullreport.pdf, figure 36 (p.25).

Figure 4b. 10-year nominal benchmark yields in selected advanced economies



Federal Reserve (2017), Monetary Policy Report, February 2017: https://www.federalreserve.gov/monetarypolicy/files/20170214_mprfullreport.pdf, figure 43 (p.29).

Activity 3

Look for data about recent evolution of interest rates – official and market interest rates – and discuss:

- the continuity or reversion of the declining trend in interest rates, their causes and implications;
- is the trend common in the main advanced economies? Are differences emerging and, if this is the case, what are the potential implications?

1.3. New developments in monetary policy

As seen at figure 2 (right), since the Global Financial crisis some important central banks have been “sailing in uncharted waters” in terms of their monetary policies, with non-conventional or unorthodox strategies adopted in order to maintain an expansionary impulse once the zero lower bound (ZLB) in official interest rates was reached (or approached).

1.4. Financial fragilities in advanced and emerging economies?

The April 2017 edition of the Global Financial Stability Report (IMF) states that “financial stability is advancing”, but some problems remain. The 2017 March Interim Economic Outlook (OECD) refers to “financial fragilities” that can contribute to “derail the modest recovery”.

Perhaps the most important fragility refers to the dynamics of credit in China. In an unusually *politically incorrect* way, over the last year the International Monetary Fund has repeatedly presented variants of figure 5. The comparison of the recent trend for the credit/GDP ratio in China resembles past expe-

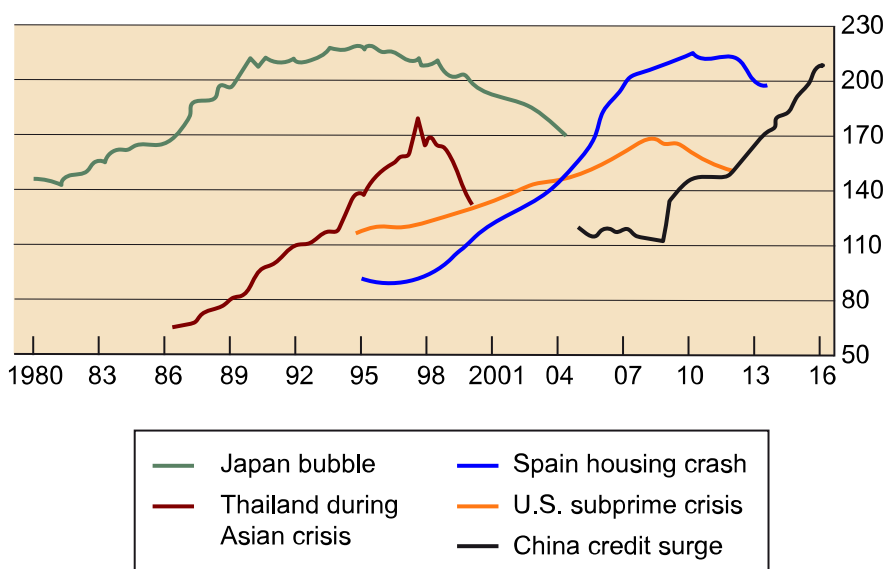
Recommended book

A clear and non-excessively-technical presentation of these new approaches to monetary policy, with special reference to the Eurozone, is: Bank of Spain (2016), “The effects of ECB’s monetary policy in the recent period”, chapter 3 Annual Report 2015, available at: http://www.bde.es/bde/en/secciones/informes/Publicaciones_an/Informe_anual/

periences that came to abrupt conclusions: Japan (1980-1990s); Thailand (and other countries of Asian South East) in the late 1990s; and Spain (and other European countries, but also in some sense the United States) in the years before the Global Financial crisis of 2008.

Figure 5. Is China different, or does its fast credit expansion signal the risk of a financial crisis?

2. Fast Credit Growth and Past Major Crises (Percent of GDP)



Source: IMF, Global Financial Stability Report, April 2017, <http://www.imf.org/en/Publications/GFSR/Issues/2017/03/30/global-financial-stability-report-april-2017>

Activity 4

Based on the April 2017 edition of the Global Financial Stability Report (IMF) and the OECD's Interim Economic Outlook, March 2017, "Will risks derail the modest recovery? Financial vulnerabilities and policy risks", available at <http://www.oecd.org/eco/outlook/Will-risks-derail-the-modest-recovery-OECD-Interim-Economic-Outlook-March-2017.pdf>, discuss whether the recent behaviour of credit and debt indicators in some advanced and emerging economies may signal a return to the problems that give rise to the financial crisis of 2008. Have the lessons from the crisis been learned or (quickly) forgotten?

1.5. International capital flows

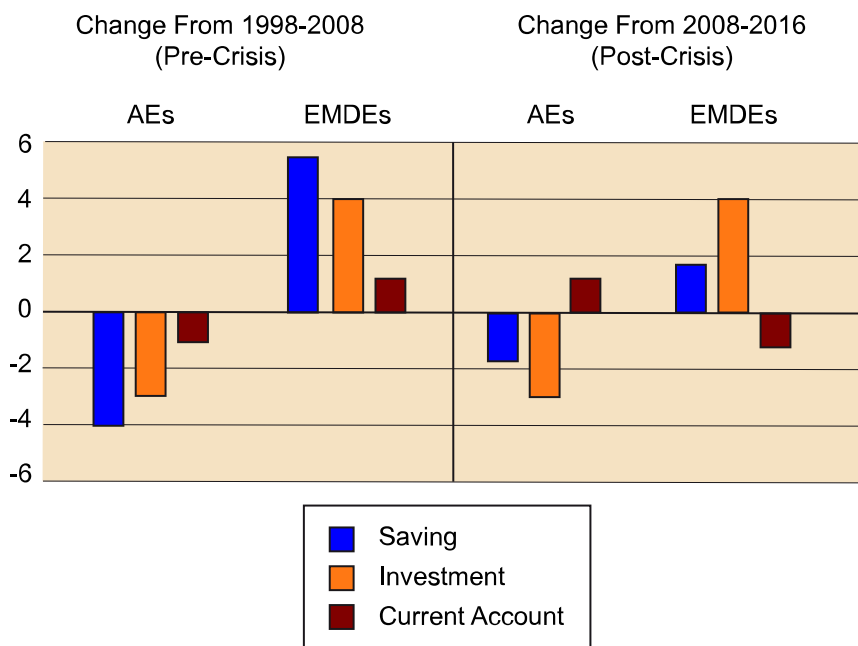
In international financial economics, the "paradox of capital" is the empirical observation that, against the most basic predictions of the neoclassical growth model, capital often flows "uphill", from poorer to richer countries. The neoclassical model is presented in Unit 4, but intuitively, return to capital should be higher in countries with less capital (per worker) endowment than in less developed (poorer) countries, and, in principle, capital should flow from the rich to the poor, *downhill*. The first explanation was presented by Robert Lucas in 1990 and the main argument concerns aspects that reduce risk-adjusted returns for investments in poor countries, such as weaker institutions and a lower level of education. A further explanation is Bernanke's global saving glut argument (mentioned in section 2).

A note by members of research staff from the International Monetary Fund, including the chief economist Maurice Obstfeld together with Emine Bioz and Luis Cubeddu, has compared the trends in the net flow *savings -> investments* between advanced and emerging+developing economies. Figure 6 summarizes the main findings.

During the decade before the crisis, 1998-2008, in advanced economies savings declined more than investment, giving rise to a negative current account and *net borrowing*. In contrast, for emerging and developing economies, investment rose notably but savings made even more: the result was a current account surplus and a net lending. Emerging countries like China ascended to the top of the ranking for net financial flow source countries, while advanced economies such as the United States led the ranking for destinations of foreign financing (with Spain in second place in 2006-2008).

After the crisis, from 2008 to 2016 advanced economies showed a lower savings deficit, less pronounced than that of investment, giving rise to an improvement in the current account. Emerging and developing economies maintained an appreciable level of investment but savings improved by a smaller amount, giving rise to a slight deficit in the current account. Reductions in the net borrowing of the United States and in the net lending of China are the most prominent results (as well as the transition by some Southern European countries such as Spain from a deficit to a surplus in the current account).

Figure 6. Net flows of global saving to investment (data in % global GDP)



Source: Boz, E.; Cubeddu, L. and Obstfeld, M. (2017), "Revisiting the paradox of capital: The Reversal of Uphill Flows", IMF blog, 7 March 2017, available at: <https://blogs.imf.org/2017/03/07/revisiting-the-paradox-of-capital-the-reversal-of-uphill-flows/> at: <http://www.imf.org/en/Publications/WEO/Issues/2017/04/04/world-economic-outlook-april-2017>

Activity 5

1) Explain the trends in international financial flows between advanced and emerging/developing economies detected by the IMF studies and other sources, and identify any explanations and implications.

Suggestion for an additional non-technical approach: European Central Bank, "Recent developments in capital flows to emerging market economies", Economic Bulletin 5/2016, available at: <http://www.ecb.europa.eu/pub/pdf/ecbu/eb201605.en.pdf>

2) Discuss the significance of changes in international reserves and other categories of financial flows.

2. Real economy

After the outbreak of the global financial crisis in 2008, the immediate answer of fiscal policies was neatly expansionary, increasing the level of public deficits: “deficits saved the world”, as said Paul Krugman, a Nobel laureate in Economics.

A few years later a new controversy arose about the need for a quick or a slower reversion to *fiscal consolidation*. A new version of the usual austerity versus expansion debate emerged. Questions about the size of *fiscal multipliers* gained relevance, with some economists defending the low expansionary impact of fiscal policies and the correlative low contractive effect of fiscal consolidation – as supported in Europe by Germany, for example. Other economists, however, defended the more effective role of fiscal policies in supporting economic activity and the dangers of too quick a reversion to fiscal contraction. In 2012-2013 the International Monetary Fund changed its view, with chief economist Olivier Blanchard admitting a previous underestimation of fiscal multipliers and concluding that fiscal consolidation “is a marathon, not a sprint”.

In the second half of the second decade of the 21st century, the emphasis has shifted to structural problems relating to questions such as low growth, productivity trends, the ageing population and other similar topics. As tools not only for demand management but also for supply side questions, the role of fiscal policies has acquired a new emphasis. The OECD spoke about “using fiscal levers to escape the low growth trap” (2016), and the IMF has referred to a “wise use” of public debt (2016) and the role of the “tax system to boost productivity” (2017). The historically low level of interest rates was seen as an opportunity to finance a new push towards efficiency and productivity.

2.1. * Old and new views on fiscal policies

Some of the recent controversies about fiscal policies and related questions can be cast in terms of a duality between an “old view” forged during the *Great Moderation* and a “new view” developed by a pragmatic interpretation of the role and possibilities of fiscal policies.

A short piece by Jason Furman, chairman of the Council of Economic Advisers of the President of the United States from 2013 until the end of the Obama presidency, is a very clear and well summarised comparison of both approaches and their points of divergence. Table 1 is a summary.

Table 1. Old and New Views of Fiscal Policy

Old view	New view
Discretionary fiscal policy is dominated by monetary policy as a stabilization tool because of lags in the application, impact and removal of discretionary fiscal stimulus	Fiscal policy is often beneficial for effective countercyclical policy as a complement to monetary policy
Discretionary fiscal stimulus would be somewhere between completely ineffective or somewhat ineffective with bad side effects (high interest rates and crowding out of private investment)	Discretionary fiscal stimulus can be very effective and in some circumstances can even crowd in private investment
The biggest fiscal policy priority should be the long-run fiscal balance	Fiscal space is larger than generally appreciated
Any fiscal stimulus is very short-run	More sustained stimulus, especially if it is in the form of effectively targeted investments that expand aggregate supply, may be desirable in many contexts
	There may be larger benefits to undertaking coordinated fiscal action across countries

Source: Furman, Jason (2016), "The New View of fiscal policy and its application", Voxeu, November 2, 2016, available at: <http://voxeu.org/article/new-view-fiscal-policy-and-its-application>.

Chapter 1 of the April 2017 issue of the IMF's Fiscal Monitor presents a reworking of existing ideas linking the *new view of fiscal policy* with Richard Musgrave's three classical functions of the public sector, formulated over half a century ago. Under the title "A greater Role for Fiscal Policy", it states that "a new view on fiscal policy is emerging". Available at: <http://www.imf.org/en/Publications/FM/Issues/2017/04/06/fiscal-monitor-april-2017>

The three main dimensions of the greater role for fiscal policy described in the aforementioned chapter are the following:

- Stabilization policies to smooth the economic cycle -> countercyclical
- Allocation policies to foster long-term growth -> growth friendly
- Redistribution policies to promote fairness and inclusiveness -> inclusive

The next 3 sections of this Unit lead to analysis of these dimensions, to a significant extent following the systematic approach of Furman and the IMF (2017).

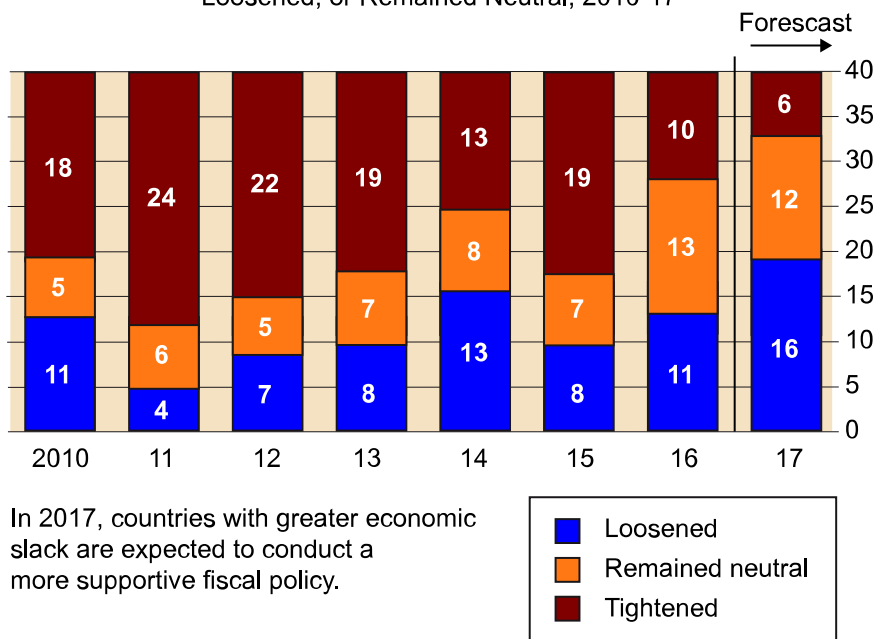
2.2. Doing more with less? A wider role for countercyclical fiscal policies?

Classically, the most controversial aspect of fiscal policies is their ability to act as an effective tool for stabilization policies. The *rediscovery* of Keynesian macroeconomics after the Financial Global Crisis, against the *old view* as summarized by Furman (2016) has opened the way for new approaches (*new view*). Somewhat surprisingly, major orthodox institutions such as the OECD and the IMF are giving nuanced support to a more activist strategy. As stated before, the upward revisions of the size of "fiscal multipliers" provided by Blanchard

– as chief economist of the IMF – were a turning point. The April 2017 issue of the IMF’s Fiscal Monitor is even more explicit in support of fiscal policies, connecting stabilization functions with responsibilities for promoting growth and inclusiveness. Data presented in the same issue of Fiscal Monitor (titled “Achieving More with Less”), summarized in figure 7, are evidence of a more expansive role for fiscal measures in 2016.

Figure 7. A change in Fiscal Stance in 2016-2017?

2. Number of Countries in Which the Fiscal Stance Was Tightened, Loosened, or Remained Neutral, 2010-17



Source: IMF, Fiscal Monitor, April 2017, figure 1.4.

Activity 6

Fiscal policy as a countercyclical tool

Discuss the effectiveness of fiscal policies as a tool for countercyclical economic policy: evaluate data presented in Fiscal Monitor, April 2017, and the corresponding analysis, especially in the section “Fiscal Policy Should be Countercyclical”. Can this effectiveness be enhanced in a context of historically low interest rates?

2.3. Fiscal and structural policies

References to a “growth friendly” fiscal policy – or similar expressions – have become more frequent in recent times. The chapter “A greater Role for Fiscal Policy” in Fiscal Monitor, April 2017, contains a section under this same title.

Fiscal policies are complementary to the so-called *structural policies* that seek improvements in the efficiency of production, or the supply-side of the economy. The following IMF publication addresses this topic.

IMF (2016), “Time for a Supply-Side Boost? Macroeconomic Effects of Labor and Product Market Reforms in Advanced Economies”, chapter 3 World Economic Outlook, April 2016, available at: <http://www.imf.org/en/Publications/WEO/Issues/2016/12/31/Too-Slow-for-Too-Long>

Activity 7

Summarize and discuss the arguments from the two previous references (Fiscal Monitor 2017 and WEO 2016). Explain the interactions between demand-side and supply-side policies. Discuss the conditions required in order for the proposals presented to be effective.

Activity 8

Summarize and discuss the OECD analysis of fiscal policy levers to “escape the low growth”

<http://www.oecd.org/eco/using-fiscal-levers-to-escape-the-low-growth-trap.htm>

<http://www.oecd.org/eco/outlook/general-assessment-of-the-macroeconomic-situation-oecd-economic-outlook-november-2016.pdf>

and the IMF’s Fiscal Monitor, April 2017, chapter 2: Upgrading the Tax System to Boost Productivity

<http://www.imf.org/en/Publications/FM/Issues/2017/04/06/fiscal-monitor-april-2017>

Recommended link

A specific problem we face is the implications of an ageing population. The “Cost of Aging” is a short non-technical summary of this matter, available at:

<http://www.imf.org/external/pubs/ft/fandd/2017/03/lee.htm>

2.4. * Distributional aspects of macroeconomic policies

Citing the preface of David Ricardo’s Principles of Political Economy and Taxation, (1817) this prominent classical economist states:

“to determine the laws which regulate... distribution is the principal problem in Political Economy”.

But, in spite of this venerable tradition, macroeconomic analysis has been often conducted in terms of an “average citizen”, with an emphasis on aggregate data or average rates (GDP, GDP per capita and so on), but giving little or no importance to distributional aspects, which have often appeared outside, or at least on the periphery of the core economic questions. It seems Ricardo has been forgotten!

Increases in many inequality indicators or the polarization of income distribution in recent decades have increased the importance of the need to address these issues. In 2005 and 2007, chapters in the emblematic World Economic Outlook were devoted to inequality. In 2008 the OECD published its “Growing Unequal?” report. The so-called “dividends of globalization” seemed distributed in an unequal – and for some people, unfair – way.

Today things are different. The OECD regularly updates the sections of its website on Inequality and Inclusive Growth. G20 declarations include references to the need for “strong, sustainable, balanced and *inclusive* growth”. From the academic field, papers and books from leading authors such as Thomas Piketty and Branko Milanovic on inequality and income distribution have received

great recognition. It seems the “disconnect between Macroeconomics and the study of economic inequality” (Piketty et alia, 2017) is (partially) being rectified.

The following relevant short pieces are a selective summary of interesting research lines in these areas (more references can be found in Further Reading, at the end of this unit).

- Raghuram Rajan, a former chief-economist at the IMF (and former Governor of the Reserve Bank of India), explains the build-up to the 2008 financial crisis in terms of a credit expansion to “compensate” the stagnation of real wages for broad sectors of population, leading ultimately to excessive fragility.
- Under Rajan’s leadership, IMF research into inequality has worked on the relationship between inequality and growth. The following is a non-technical summary with links to relevant papers: <https://blog-imfdirect.imf.org/2017/02/22/the-imfs-work-on-inequality-bridging-research-and-reality/>
- The ECB’s 2016 Annual Report, released in April 2017, includes a text (box 5, pp. 48-51) on “the distributional impact of monetary policy”, available at: <http://www.ecb.europa.eu/pub/pdf/annrep/ar2016en.pdf?7090bb266c06d6c8857f41220370bfb>
- On the need for a new macroeconomic database: Piketty, T., Saez, E. and Zucman, G. (2017) “Economic growth in the US: A tale of two countries”, VOX, 29 March 2017, available at: <http://voxeu.org/article/economic-growth-us-tale-two-countries>

Activity 9

Macroeconomics and Distribution

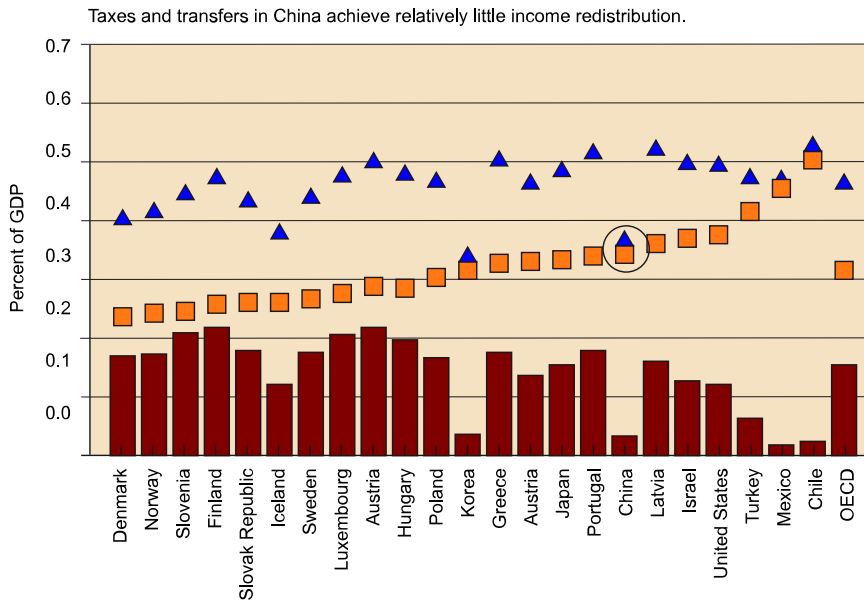
Based on the previous references, summarize and evaluate the impacts of macroeconomic evolution on income distribution over the last two decades – before and after 2008 financial crisis – and explain the main causes and implications.

A traditional aspect of fiscal policies has been their role in income redistribution. How has this role evolved in recent decades? Has globalization hindered its effectiveness at precisely the time that greater inequality has shot up? How have these problems contributed to sociopolitical frictions in across different countries in recent years?

Figure 8 shows a traditional approach to this redistributive role of fiscal policies. Comparisons between market income distribution – before subsidies and taxes – and disposable income – after taxes paid and subsidies received – is shown for different countries, and the magnitude of the redistributive effect is displayed.

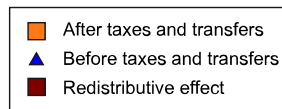
Figure 8. Redistributive effects of fiscal policies

Figure 13.1. Redistribute Effect of Fiscal Policy in Selected Advanced and Emerging Market Economies, 2009 (Gini coefficient)



Sources Ding and He 2016; and Organisation for Economic Co-operation and Development (OECD) Income Distribution Database.

Note: The redistributive effect is the difference in the Gini coefficient before and after taxes and transfers.



Source: IMF (2017), Fiscal Monitor, April 2017, box 1.3.

Activity 10

Summarize and discuss the approach from the “Fiscal Policy Should Promote Inclusion” section of Chapter 1, Fiscal Monitor, April 2017.

2.5. Technological changes: macroeconomic implications

Technological change is a dominant feature of our time. Many if not all economic areas are widely affected. Growth, fiscal revenues and distribution are controversial areas. The impacts on labour markets, employment (and unemployment) and wages are central topics.

A recent (but influential) paper is: Acemoglu, D. and Restrepo, P. (2017), “Robots and jobs: evidence from the US”, March 2017, available at: <https://economics.mit.edu/files/12763>

A non-technical summary from VOX, April 2017, is available at: <http://voxeu.org/article/robots-and-jobs-evidence-us>

Recommended book

A topic recently discussed is the connections between economic polarization (in the income distribution) and political polarization in some electoral or political processes (for example the UK referendum on Brexit). To learn about the application of this idea to the USA’s 2016 Presidential Election, read:

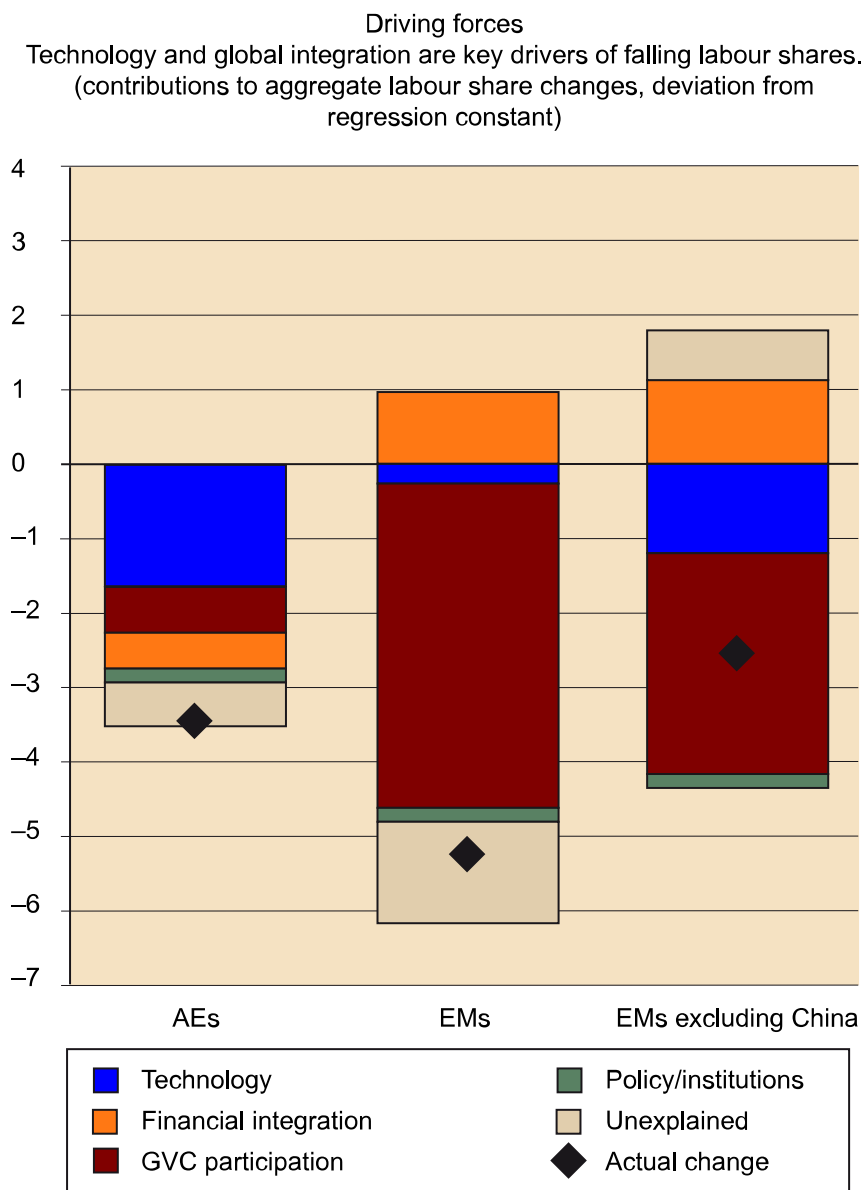
Autor, D. et al. (2016) “Importing Political Polarization?”; and Autor, D. et al. (2017) “A note on the Effect of Rising Trade Exposure on the 2016 Presidential Election”, both available at: <https://economics.mit.edu/faculty/dautor/papers/in-equality>

More general approaches can be found in the three papers from the “Automation and Labour Markets” Symposium (Autor, D.; Mokyr, J. et al.; Pratt, G.), in the Journal of Economic Perspectives, summer 2015, available at: <https://www.aeaweb.org/issues/381>

Based on Chapter 3 of World Economic Outlook, April 2017, discuss the relative roles of technology and certain aspects of globalization in explaining the falling share of labour in national income.

Figure 9 summarizes the main results. The impact of technology is especially significant for advanced economies.

Figure 9. Falling labour shares: the role of technology and globalization



Note: AEs = advanced economies; EMs = emerging markets; GVC = global value chain.

Source: IMF (2017), “Understanding the Downward Trend in Labour Income Shares”, Chapter 3, World Economic Outlook, April 2017, available at: [http://www.imf.org/en/Publications/WEO/Issues/2017/04/04/world-economic-outlook-april-2017#Chapter 3](http://www.imf.org/en/Publications/WEO/Issues/2017/04/04/world-economic-outlook-april-2017#Chapter%203)

Further Reading (Units 1 and 2)

References contained in the main papers and documents quoted – especially in sections 1 and 2 of Unit 1 and in section 1 of Unit 2 – allow readers to expand and deepen their understanding of the contents of Units 1 and 2 with the most relevant literature.

On private investment: IMF (2015), “Private Investment: What’s the Holdup?”, Chapter 4, World Economic Outlook, April 2015, available at:

<http://www.imf.org/en/Publications/WEO/Issues/2016/12/31/Uneven-Growth-Short-and-Long-Term-Factors>

On the role of inequalities in connection to financial fragility, growth and other questions:

Rajan, R. (2010), “Fault Lines: How Hidden Fractures Still Threaten the World Economy”, Princeton University Press, 2010.

The OECD website contains sections devoted to inequality, <http://www.oecd.org/social/inequality.htm>

and to inclusive growth, <http://www.oecd.org/inclusive-growth/>

An IMF document on inequalities:

Dabla-Norris, E. et al. (2015), “Causes and Consequences of Income Inequality: A Global Perspective”, IMF Staff Discussion Note, 2015, available at: <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2016/12/31/Causes-and-Consequences-of-Income-Inequality-A-Global-Perspective-42986>

An application of inclusiveness to trade topics:

IMF-WTO-WB, April 2017, “Making Trade an Engine of Growth for All”

https://www.wto.org/english/news_e/news17_e/wto_imf_report_07042017.pdf

For a more sceptical view, see the column by Rodrik, D. (2017) “Too late to Compensate Free Trade’s Losers”, Project Syndicate, April 11, 2017: <https://www.project-syndicate.org/commentary/free-trade-losers-compensation-too-late-by-dani-rodrik-2017-04>

3. Growth: analysis and empirical studies

Although the evolution of the economy in the short term is the subject of wide analysis and concern, the dynamics in the medium and long term are as important or more important for the countries' well-being. The theory of economic growth seeks to explain the factors that affect trends in the level and rate of change of major economic indicators beyond short-term fluctuations.

3.1. Why is economic growth important?

The great differences in living standards between different societies show the importance of economic growth. Nobel laureate Robert Lucas, after devoting much of his activity to short-term macroeconomics, explained how the differences between the levels of indicators such as GDP per capita or per capita income and their rates of variation was a crucial issue of interest to understand the dynamics and well-being of different countries.

A simple formula helps to understand the importance of seemingly small differences in growth rates. A country that grows by 1% takes about 70 years to double its income level. But if it grows by 2%, it is 35 years. And if they grow at rates close to 7%, as some emerging economies have in recent decades, they double their income every 10 years.

For classical economists, an essential concern was precisely how to achieve what Adam Smith referred to as "The Wealth of Nations". The full title of his 1776 book was "an inquiry into the nature and cause of the Wealth of Nations", a more literary form of expression than the contemporary technical jargon used to refer to the dynamics of economic growth. Factors on what is modernly called the "supply side" – the factors of production and the way in which they are combined – occupied a central place in classical political economy.

Although the birth of Macroeconomics as a specific part of economic analysis has been associated, since the 1930s, with the severity of short-term economic situations with high unemployment rates, which Keynes attributed to problems of aggregate demand, interactions between the aggregate demand and supply dimensions have returned to a central place in macroeconomic models since the 1970s. As seen in the two previous models, concern about supply side issues – productivity, innovation, etc. – are gaining momentum in new approaches to classical demand policies (fiscal policies, for example).

Among the various approaches developed in relation to economic growth, the so-called neoclassical model is key, and is best known by the 1956 work of Robert Solow. The lecture given by Professor Solow in 1987 when he re-

ceived the Nobel Prize of Economics, titled “Growth Theory and After”, provides an interesting summary of the main features of the approaches to economic growth.

Activity 11

Find data about differences in levels and rates of growth on the World Bank’s website:

<http://data.worldbank.org/indicator/NY.GDP.PCAP.CD?view=chart>

With PPP adjustment:

<http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?view=chart>

GDP per capita growth:

<http://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG?view=chart>

Consider the data in the context of basic conceptual framework presented by Paul Romer at <https://paulromer.net/economic-growth/>

3.2. * Some classical insights

In the introduction to *The Wealth of Nations*, Adam Smith describes an earlier version of what now we know as *GDP per capita* as the proportion of the produce (augmented by imports) of “all the necessaries and conveniences of life” and the “number of those who are to consume it”, explaining that

“this proportion must, in every nation, be regulated by two different circumstances: first, the skill, dexterity, and judgement with which its labour is generally applied; and, secondly, by the proportion between the number of those who are employed in useful labour, and that of those who are not so employed”.

In modern language, the first “circumstance” refers to labour productivity and the second to the labour utilization rate. With the total population expressed as N and the population in employment expressed as L , this can be shown as follows:

$$\frac{GDP}{N} = \frac{GDP}{L} \times \frac{L}{N}$$

GDP per capita, GDP/N = Productivity per person employed, GDP/L x employment rate L/N

Smith insists on the central role of these two dimensions:

“whatever be the soil, climate, or extent of territory of any particular nation, the abundance or scantiness of its annual supply must depend upon these two circumstances”.

But, in a pioneering claim about the central role of productivity, Smith also notes this abundance or scantiness “seems to depend more upon the former of those two circumstances than upon the latter”.

Each of these two main concepts can be usefully broken down for a more disaggregated view of the dynamics of *GDP*. The first, productivity per person employed, can be expressed as the product of productivity per hour worked (GDP/H) and hours per worker (H/L).

$$\frac{GDP}{L} = \frac{GDP}{H} \times \frac{H}{L}$$

An interesting question concerns the economic and sociocultural reasons for differences between levels and rates of growth of productivity per worker and productivity per hour.

Labour utilization, L/N , can be broken down as the product of: 1) people in employment (L) as a proportion of Labour Force (LF); 2) labour force as a proportion of the population of working age (PWA); and 3) ratio of PWA as a proportion of the total population, N .

$$\frac{L}{N} = \frac{L}{LF} \times \frac{LF}{PWA} \times \frac{PWA}{N}$$

Combining these two disaggregations, the evolution of GDP per capita can be expressed as:

$$\frac{GDP}{N} = \frac{GDP}{H} \times \frac{H}{L} \times \frac{L}{LF} \times \frac{LF}{PWA} \times \frac{PWA}{N} \quad 1.4$$

(a) (b) (c) (d) (e)

Different variants of the decomposition of growth are typically employed in macroeconomic analysis, for example:

1) The “growth accounting framework” explained in box 4.1 of Growth Prospects and Fiscal Requirements over the Long Term (OECD, 2014), available at: <https://www.oecd.org/economy/Long-term-growth-prospects-and-fiscal-requirements.pdf>

In order to analyse growth prospects, it is very similar to the Smith’s basic decomposition.

2) And also, in part, the analysis of the “transition from short-run to medium- and long-run” in: IMF (2015), “Where Are We Headed? Perspectives on Potential Output”, Chapter 3, World Economic Outlook, April 2015, available at:

<http://www.imf.org/en/Publications/WEO/Issues/2016/12/31/Uneven-Growth-Short-and-Long-Term-Factors>

Activity 12

Smith’s decomposition applied to the Spanish economy

The Bank of Spain published the “Structural Indicators of the Spanish Economy and of the EU”

http://www.bde.es/webbde/es/estadis/infoest/si_1_4e.pdf

with a decomposition of the evolution of GDP per capita into three components: 1) labour productivity per person employed (components a + b); 2) employment rate (components c+d); and 3) population aged 15-64 as a ratio of total population (component e), both in levels and rates of growth from 1970 to the present. It also published an interesting comparison between the Spanish economy and the average for the Euro Area and the whole European Union.

Table 2. GDP per capita and components: Spain/Euro Area (Euro Area = 100)

	1970	1975	1980	1985	1990	1995	2000	2005	2011	2015
GDP per capita	80.3	86.4	77.3	76.2	81.0	84.3	89.0	92.7	87.4	87.8
e = Pob.15-64 / total pop	97.5	97.3	96.3	95.5	96.9	100.8	101.5	103.2	102.7	101.7
c x d = Employment rate	93.4	92.4	81.5	76.6	82.8	81.1	91.8	100.1	90.5	87.7
a x b = Labour productivity	83.8	91.1	94.2	100.4	95.9	100	95.5	92.0	95.7	97.9

Source: Bank of Spain, Structural Indicators of the Spanish Economy and of the EU (November 3, 2016), http://www.bde.es/webbde/es/estadis/infoest/si_1_4e.pdf

Discuss:

- 1) the contributions of each component to Spain's growth;
- 2) compare the roles of employment and labour productivity: explain how the behaviour of labour productivity is either pro-cyclical or anti-cyclical.

3.3. The Harrod and Domar models

The role played by investment is twofold: firstly, it is an ingredient of aggregate demand in Keynesian approaches; and secondly, it is a way to increase productive capacity and, as a result, the potential supply.

Basic equation:

- Saving rate: $s = S/Y$
- Capital/product ratio: $v = K/Y$

The ratio between these two variables is therefore:

$$(s/v) = (S/Y)/(K/Y) = S/K$$

If it is assumed that in the long run savings S are efficiently channelled towards investment I , without the problems that are present in the short term, then:

$$(s/v) = I/K$$

And since I is the accumulation of capital, the (s/v) ratio can be interpreted as the rate of accumulation of capital (a percentage which represents the increase of K over the value of K).

Again, in the long term, the growth rate of the labour factor is assumed to be given by the growth rate of the population, n , if the percentage for the labour force and employment is relatively stable in the long term.

From these assumptions it is possible to formulate the condition for equilibrium between the rate of accumulation of labour and the rate of accumulation of capital:

$$(s/v) = n$$

This is the central equation of the Harrod and Domar formulations.

If we introduce the possibility of technological progress that makes the labour factor more efficient, at a rate we call g , the equilibrium condition can be rewritten as:

$$s/v = n + g$$

The problem with this approach is that the four variables that appear each have their own determinants, in principle seemingly unrelated to each other:

- 1) the savings rate depends on consumer choices about how to distribute their income between consumption and savings;
- 2) the capital / product ratio depends on technology;
- 3) the growth rate of the population, n , is associated with demographic factors; and,
- 4) the rate of improvement of the efficiency or productivity of labour depends, depending on the approaches, on aspects such as innovation or exogenous causes.

It would therefore be a 'coincidence' if that condition were fulfilled unless mechanisms were established to make one of those variables fit the others.

One way of interpreting the various theories of economic growth is precisely in terms of which of the variables involved is the one that assumes the role of 'adjustment variable'. Thus, one way of reformulating the Malthus' approach is to assign population with the role of the adjustment variable. The neoclassical growth model converts the capital / output ratio (or capital / labour associated with it) into the adjustment variable. Recent developments in endogenous technological progress - discussed in Unit 4 - give that role to the variable

g. The savings rate plays the role of adjustment variable in approaches such as the Cambridge saving functions – developed by Kaldor and Pasinetti – that associate the volume of savings with the distribution of income, assuming that the propensity to save from capital income is greater than the propensity to save from wages.

3.4. The aggregate production function

A useful tool in the analysis of economic growth is the aggregate production function, which relates aggregate output, Y , to production factors, principally Labour, L , and Capital, K . In the long term it is also necessary to include a reference to the evolution of technology, denoted as A :

$$Y = AF(K, L)$$

There is a traditional hypothesis about constant returns to scale in the long run: an increase of the same proportion in both factors of production causes an increase of the same proportion in output. For example,

$$AF(tK, tL) = tAF(K, L) = tY$$

A specific useful formula is obtained with $t = 1/L$

$$AF(K/L, 1) = Y/L$$

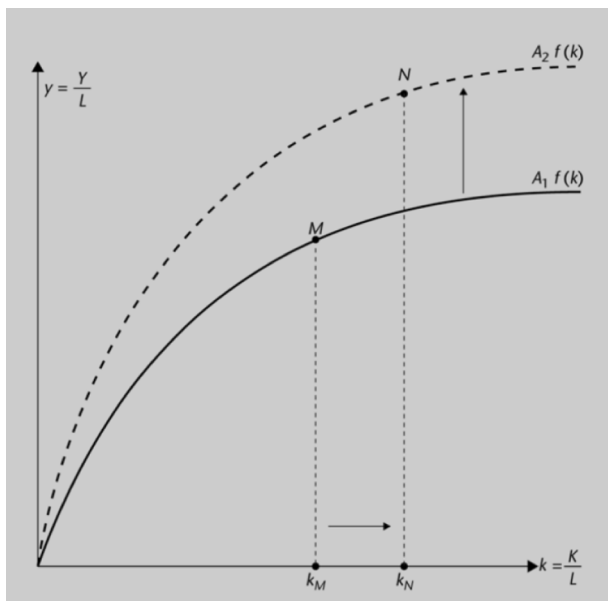
With $y = Y/L$ (output per capita), and $k = K/L$ (capital per capita):

$$y = Af(k)$$

This expression summarizes two main drivers of economic growth: the accumulation of production factors (capital per worker, k) and the efficiency of the production processes, A .

Figure 10 shows two aggregate production functions in terms of the relation between k and y , given a low level of A (A_1) and a higher level (A_2).

Figure 10. Aggregate production function in intensive (per capita) terms



The transition from point M to point N , with an increase in y , can be explained in terms of both:

- 1) an increase in the accumulation of capital per worker along the initial $A_1f(k)$; and
- 2) an improvement in the technology/efficiency, with a shift from $A_1f(k)$ to $A_2f(k)$

A specific production function that can be very useful is the Cobb-Douglas production function:

$$Y = AK^aL^{1-a} \quad 1.5$$

As taught in Microeconomics, if each production factor is paid by its marginal productivity, the parameters a and $(1 - a)$ reflect the fraction of total income accruing to Capital and Labour, respectively. In fact, it was the relative stability in the distribution of income between Capital and Labour – a stylized fact of growth, according to traditional studies of growth economics – that gave rise to the Cobb-Douglas approximation to the Aggregate Production Function.

In intensive (per capita) terms:

$$Y/L = A(K/L)^a \Rightarrow y = Ak^a \quad 1.6$$

An interesting point is that the slope of the production function at a point dy/dk is equivalent to the Marginal Productivity of Capital and, as is usually assumed, each factor is paid according to its marginal productivity, which is also equal to the rental price of capital, r . This implies that as the economy moves to the right along $f(k)$, retribution to capital declines. And if two economies with different values for k are compared, the economy

with higher k has a lower r . Does it mean that advanced economies (higher k) offer less return to capital in comparison to less-developed economies (with low k) and that, in consequence, with capital mobility, capital flows must go “downhill” from advanced to developing economies? Do the facts contradict this simple prediction? This is the starting point of the Lucas’ Paradox introduced in Unit 1.

The aggregate production function is a very useful starting point to study many dimensions of economic growth. Solow’s decomposition of growth is a classical empirical approach, as we will see in the next section.

3.5. * Decomposition of growth: data and theory

An influential study about the growth of the American (United States) economy 1909-1949 was: Robert Solow (1957), “Technical change and the Aggregate Function of Production”.

One of the main conclusions is that

“gross output per man hour doubled over the interval, with 87.5% of the increase attributable to technical change and the remaining 12.5% to increased use of capital”.

This was, in some sense, a surprise, given the emphasis previously given to the “accumulation of production factors” and the *tag* of “residual factor” applied to other causes.

The methodology of the Solow’s analysis has become a point of reference. Based on a basic aggregate production function $Y = AF(K,L)$ and assuming constant returns to scale and a return for each factor equal to its marginal productivity, the following expression is obtained:

Rate of growth $Y =$ rate of growth $A +$ (share K in Y) (rate of growth K)
 $+ ($ share L in Y) (rate of growth in L)

And with g representing the rate of growth, and s_k and s_l the shares of Capital and Labour, respectively:

$$g(Y) = g(A) + s_k g(K) + s_l g(L) \quad 1.7$$

The growth in output is linked to the growth in the factors of production (each weighted by its share in the production costs/returns) plus the growth in the efficiency parameter or Total Factor Productivity, TFP.

This expression is a basic version of what is known as **Solow’s decomposition of economic growth**.

In fact, the evolution of TFP is unobservable. Equation 1.7 can be used in an indirect way in order to quantify the value of the rate of change in TFP according to:

Bibliographic reference

Robert Solow (1957), “Technical change and the Aggregate Function of Production”, *The Review of Economics and Statistics*, 39 (3), August 1957, available at: <https://faculty.georgetown.edu/mh5/class/econ489/Solow-Growth-Accounting.pdf>

$$g(A) = g(Y) - s_k g(K) + s_l g(L)$$

with $s_l = 1 - s_k$, this can be rewritten as:

$$g(A) = g(Y) - s_k g(Y) - (1 - s_k)g(L)$$

Equation 1.7 can also be expressed in “intensive” – per capita – terms. Assuming again $s_l = 1 - s_k$:

$$g(Y/L) = g(Y) - g(L) = g(A) + s_k g(K/L)$$

We find again that economic growth can be expressed in terms of the contribution of technical efficiency – technical progress or similar improvements in the organization of processes – and the contribution of “capital deepening”: an increase in capital per worker.

From this basic approach, some qualifications have been introduced:

- A specific role for “human capital”, H : the level of education, in addition to the number of workers/hours.
- Disaggregation of K , for example, in recent studies, Information and Communication Technology (ICT) and other Capital.

Activity 13

Discuss the application of Solow’s methodology to the long-term trends for, and impact of the crisis on, economic growth and productivity (see data in the appendix of the document and explanations in the main text):

OECD (2015), “The Future of Productivity”; available at:

<https://www.oecd.org/eco/OECD-2015-The-future-of-productivity-book.pdf>

Explain the main differences between countries.

Activity 14

Application: Bank of Spain applies Solow’s decomposition to Spanish economy

A detailed application of the Solow’s original decomposition for estimates of Spain’s potential output is:

Cuadrado, P. & Moral-Benito, E. (2016), “Potential Growth of the Spanish Economy”, Banco de España, Documentos Ocasionales No. 1603, 2016

<http://www.bde.es/f/webbde/SES/Secciones/Publicaciones/PublicacionesSeriadas/DocumentosOcasionales/16/Fich/do1603e.pdf>

A summary of the results:

Table 3. Potential growth of the Spanish economy

	1983-1990	1991-2000	2001-2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Potential growth	2.9	2.8	3.1	1.9	1.1	0.7	0.3	0.0	0.0	0.3	0.5	0.7	0.9	1.0	1.1	1.1
Contributions to potential growth																
Employment	0.0	1.0	1.6	0.8	0.2	-0.1	-0.4	-0.7	-0.7	-0.5	-0.4	-0.3	-0.1	0.0	0.1	0.1
Capital	0.9	1.1	1.6	1.3	1.0	0.8	0.5	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5
TFP	2.0	0.7	-0.1	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5	0.6	0.7	0.6	0.6	0.6	0.6

Rates of change (%)

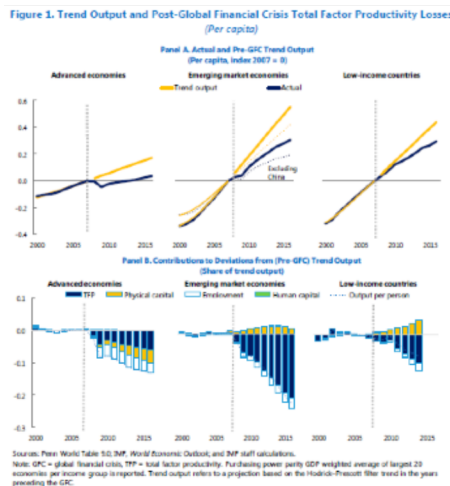
Discuss the evolution of, and prospects for, growth in the Spanish economy, as presented in this paper.

Given the central role of total factor productivity found in the traditional Solow analysis of economic growth, this variable has been the subject of special attention. An interesting recent application is the interaction between the long term and the crisis and its “legacy”.

Activity 15

Figure 11, from Furceri et al. (2017), shows in panel A the actual and pre-crisis trend output for 3 groups of countries, and in panel B the “contributions to deviations from pre-crisis trend output”.

Figure 11.



Source: Furceri et al. (2017), “Gone with Headwinds: Global Productivity”, Staff Discussion Note, IMF, April 2017, available at: <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2017/04/03/Gone-with-the-Headwinds-Global-Productivity-44758>

Explain the role of productivity and other factors in the performance of advanced economies and other countries since the crisis. What are the main implications of the IMF’s analysis?

See also

Further reading: See end of Unit 4.

4. Topics in economic growth

This unit presents the Neoclassical growth model, based on Solow's and Swan's papers, a useful starting point for many questions. The basic formulation is presented, and the implications of changes in savings, population and technology are explored. The role of welfare – related to consumption and not only to GDP – is also introduced. The last section introduces the so-called “new growth” models, with emphasis on the role of ideas, knowledge and innovation.

4.1. * A basic formulation of the neoclassical model

Let's begin assuming a constant technology, with $A = 1$, and a production function $y = f(k)$.

A steady-state configuration is reached when K , L and Y are varying at the same rate and in the same direction, that is they are increasing or decreasing at the same rate at the same time: in this steady state equilibrium the economy maintains the capital/labour ratio, and the production per capita is also stable. How can the economy reach this equilibrium?

In the neoclassical model we must compare:

1) The additions to capital stock – via investments – resulting from the level of income: if a fraction s (rate of saving) of the income is saved and invested, this amount is given by sY , and, in per capita terms, $sy = sf(k)$.

In the long run, a frictionless transfer from savings to investment is assumed. In the short and medium run, as the financial crisis regularly reminds us, and as we saw in unit 1, this automatic and quiet transfer from S to I cannot of course be assumed.

2) The need for capital to maintain the amount of capital/labour to satisfy the requirements of:

a) depreciation of capital, usually presented by a fraction d of the existing capital;

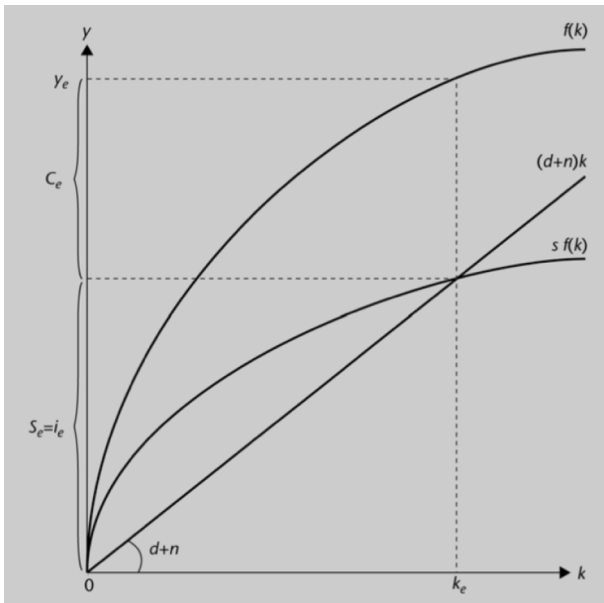
b) provision of new workers, which increase at the rate n , with the same amount of capital as existing workers.

These needs can be expressed as $(d + n)k$.

The equilibrium condition becomes then $sf(k) = (d + n)k$.

Figure 12 shows the two items of comparison:

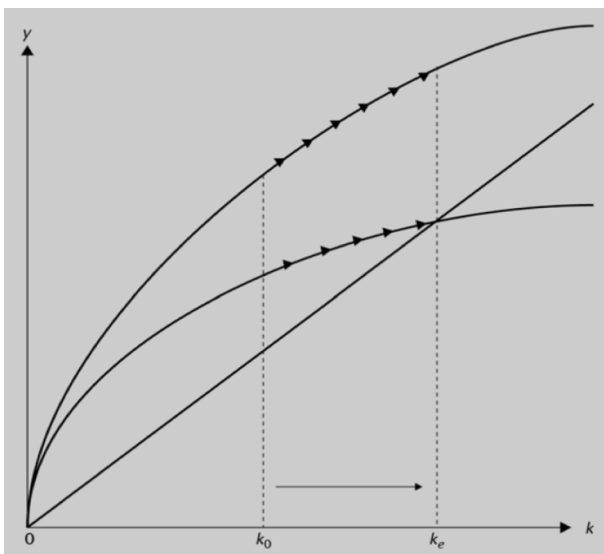
Figure 12. Steady-state growth



At the level of k corresponding to the intersection of $sf(k)$ and $(d+n)k$ the steady state equilibrium is reached: the provision of new capital – via investments – just equals the requirements of a stable value of k .

If the initial situation diverges from the equilibrium, an adjustment is on the way. For example, at the level k_0 in figure 13, the amount of investment $sf(k)$ exceeds the amount needed to maintain k at k_0 , causing an increase in k . The arrows in figure 13 shows the path to reach the equilibrium steady state at k_e .

Figure 13. Transition towards a steady equilibrium



Economic Miracles

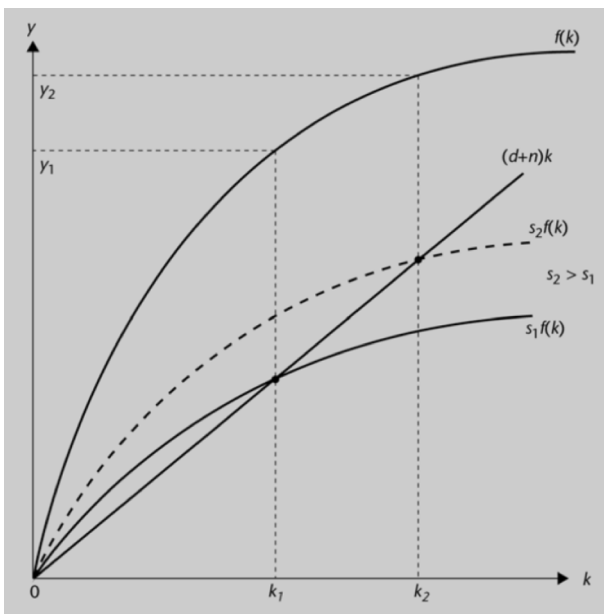
In figure 13, during the transition from k_0 to k_e , the economy grows from the level of output per capita corresponding to k_0 on $f(k)$ to the level corresponding to k_e . Episodes of rapid growth may be associated with initial depressed levels of capital per worker, for example, after a war or other traumatic shocks, or they may also be associated with rapid injections of capital or other mobilizations of resources.

4.2. Impact of changes in the savings rate

Our grandparents would probably tell us that to save is a valuable virtue. But according to the paradox of thrift, explained in basic Keynesian macroeconomic model, savings can be counterproductive in the short run, especially in a depressed economy. What is the role of saving in the neoclassical growth model?

Figure 14 shows the impact of a change in the savings rate: an increase from s_1 to s_2 . The equilibrium moves from k_1 to k_2 , a higher level of the ratio K/L and a corresponding higher level of output per capita Y/L , from y_1 to y_2 .

Figure 14. Effects of a change in the savings rate



In quantitative terms, with a Cobb-Douglas production function $y = k^a$ the steady-state equilibrium condition, $sf(k) = (n + d)k$, becomes:

$$\begin{aligned}
 sk^a &= (d+n)k \Rightarrow k^{1-a} = s/(d+n) \\
 y = k^a &= \left(\frac{s}{d+n}\right)^{\frac{a}{1-a}}
 \end{aligned}
 \tag{1.8}$$

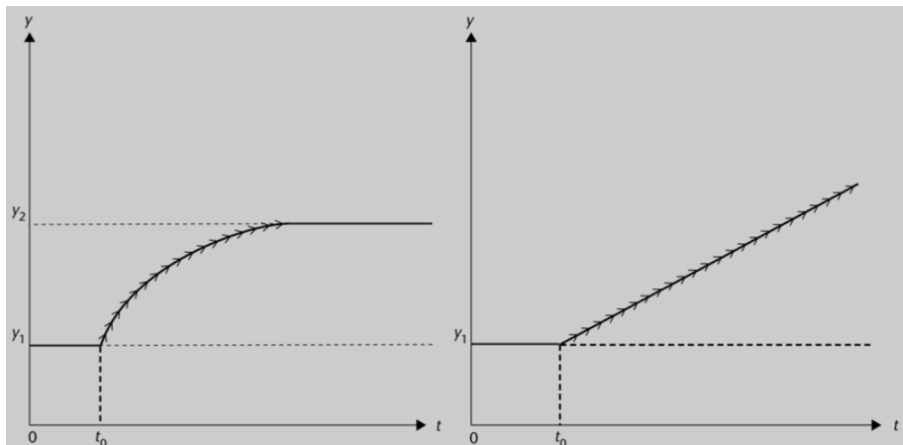
These last expressions show the effects of a change in s on k and y .

In the special case $a = 1/2$, $y = s/(d+n)$ where y varies in proportion to s , the impact really is significant!

The impact of changes in s affects the level of y but not the rate of change of y once a new equilibrium path is achieved. Does this mean that an increase in the savings rate is not a valuable option? An interesting difference in dynamic economics is between a “level effect” and a “rate of growth effect”. Figure 15 shows both cases.

In the left panel a level effect is shown: at time t_0 a change in a relevant variable – for example, the savings rate – occurs and this brings a new equilibrium with a higher level of output per capita, from y_1 to y_2 . In the transition there is of course a positive rate of growth, but the ultimate reward from a higher s is a better *level* of y .

Figure 15. Level effect and rate effect



In the right panel a rate effect is shown: at time t_0 a change occurs that modifies the rate of change – the *rhythm* – of the dependent variable, in this case y . As we will see next, this is this case when technical progress is introduced in the neoclassical model, but not when there is a change in s .

In real life it's sometimes difficult to distinguish between a rate effect and the transition to a level effect, especially in situations in which the transition can be very long lasting.

Activity 16

Correlation between savings rates and rates of growth

Look for data about the savings rates of different countries and their rates of growth (select the relevant time periods) and discuss the degree of correlation between the two variables. What explanations can you find regarding the high or low degree of correlation?

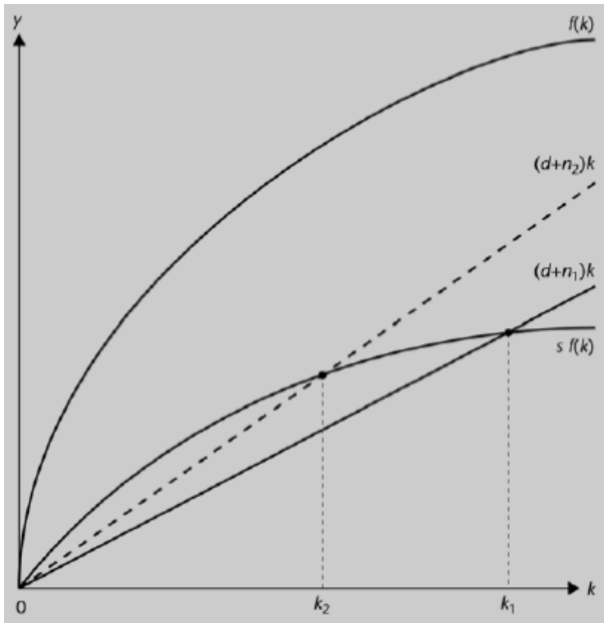
4.3. Population and technological progress

An increase in the rate of population growth, n , has a double effect: firstly, an increase in one of the production factors, and secondly, a greater denominator in variables such as Y/L or K/L . Classical analysis such as the well-known thesis by Robert Malthus, from two centuries ago, postulated the idea of a food race, concluding that periodically population growth will overwhelm production, with great social costs. But other approaches – for example that of Michael Kremer – have shown that most densely populated societies generate a critical mass in order to promote innovations and creativity, with production growing faster than the population.

In the neoclassical model, figure 16 shows the effects of an increase in the rate of population growth. The steady-state rate of growth of Y is increased, but not the rate of growth (zero) of (Y/L) .

Both (Y/L) and (K/L) have lower values at the new steady state: under decreasing returns to each production factor, the denominator is greater than the numerator in each ratio. But in order to maintain the constant values of $\gamma = Y/L$ and $k = K/L$, both K and Y must increase at the same rate than L , n .

Figure 16. Effects of an increase in n



The most interesting results are associated with technological progress. In the neoclassical growth model the easiest way to introduce improvements in technology is the so-called “labour augmenting technical progress”: the efficiency of each worker increases at a rate g making the contribution of L the same “as if” the number of persons/workers had increased by the same rate g . Obviously, the main practical difference is that now the rate of growth of both Y and (Y/L) increases at the same rate, g .

Labour-augmenting technical progress and TFP

The Cobb-Douglas aggregate production function shows the relation between these two concepts of technical improvement. There is an equivalence between a TFP at a rate g (left side of the following expression) and a labour-augmenting improvement at a rate (j/a) , on the right side:

$$A_0 e^{jt} (K_0^{1-a} L^a) = A_0 K_0^{1-a} (L_0 e^{jt/a})^a \quad 1.9$$

A labour-augmenting technical progress of (j/a) is equivalent to a TFP of $(j) < (j/a)$.

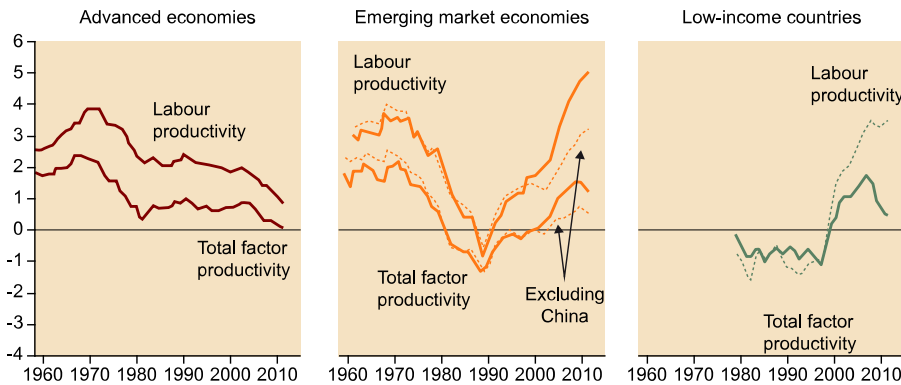
For example, with $a = 0.6$, a labour-augmenting rate of 5% has the same effect as a TFP of 3%.

Activity 17

Use the data on TFP and labour-augmenting indicators contained in Furceri et al. (2017) and analyse them for advanced, emerging and low-income countries. Discuss the evolu-

tion of both indicators and their relation. Explain the stages in this evolution and differences between groups of countries.

Figure 17. A Long-Term View of Total Factor Productivity Growth, 1950-2014



Source: Furceri et al. (2017)

In graphical terms, the easiest way to introduce technical progress is to add a new term to the requirements of capital to keep the capital stock per capita at a constant: in addition to depreciation, the term to be added helps balance the two dimensions of the (increase in) “effective rate” of workers: their number, n , and their productivity, g .

Figure 18. Technical progress

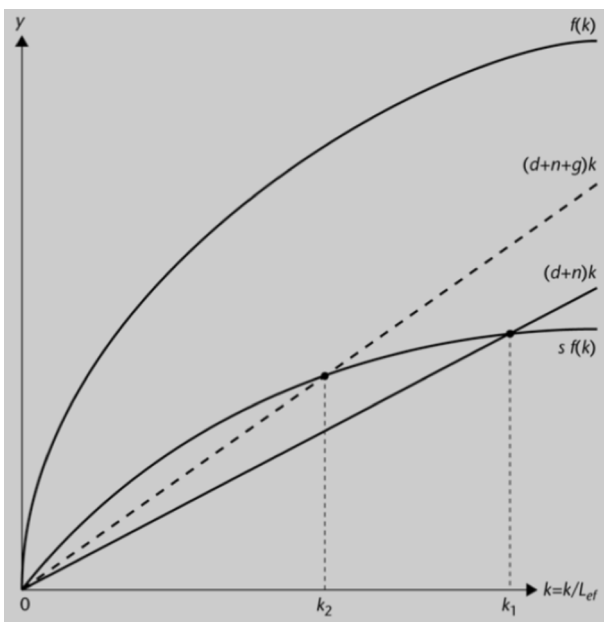


Table 4. Summary of the effects of technical progress on some fundamental variables, under the neoclassical growth model

Variable	Rate of growth
Capital per capita $k = K/L$	g
Production per capita $y = Y/L$	g
Production Y	$n + g$
Capital K	$n + g$

Variable	Rate of growth
Labour L	n

4.4. Growth and welfare: the golden rule

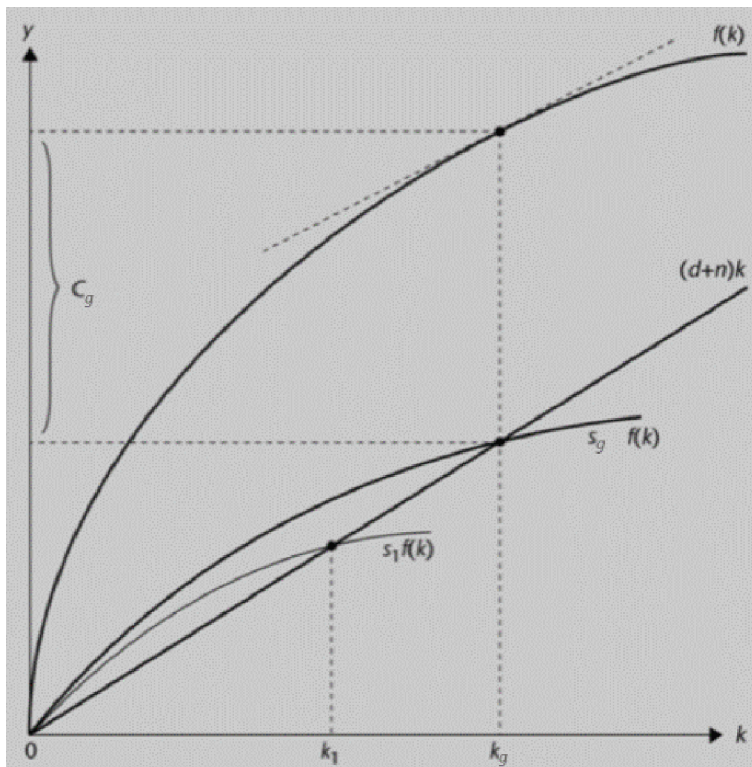
The growth models are centred on the behaviour of GDP per capita or similar indicators. But a useful insight is given by asking about other variables more directly related to the welfare, such as consumption per capita. A society with a high level of Y/L but devoted mainly to investment can leave an suboptimal amount for consumption. But an excessive allocation of resources to consumption can make it difficult to achieve a sustainable level of growth, which is detrimental to future consumption.

How can an optimal growth path be reached in order to maximize the sustainable level of consumption per capita?

The answer to this question is the so-called Golden Rule. Graphically, the amount of consumption per capita is shown by the difference between output per capita and savings per capita: $C/L = c = f(k) - sf(k)$.

Figure 19 represents the values for two savings rates, s_1 and s_2 . How is c maximized?

Figure 19. Golden Rule



Analytically,

$$C/L = Y/L - sY/L = f(k) - sf(k)$$

On a steady-state path (we are looking for a sustainable equilibrium level of consumption per capita), as we have already seen:

$$sf(k) = (d + n)k \quad 1.10$$

Combining the last two equations:

$$c = C/L = f(k) - (d + n)k$$

In order to maximize c the first-order condition is to choose a value of k in order to obtain:

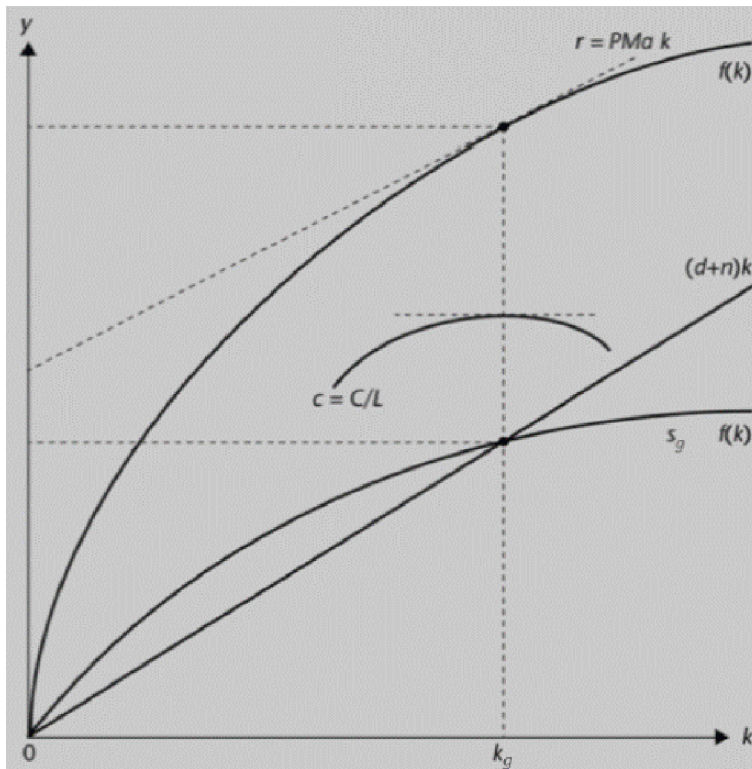
$$dc/dk = f'(k) - (d + n) = 0$$

which implies:

$$f'(k) = d + n \quad 1.11$$

Graphically, as seen in figures 19 and 20, this requires the slopes of the curve $f(k)$ and the straight line $(d + n)k$ to be equalized: in the figure, the level k_g , the ratio K/L represents the Golden Rule. In order to achieve this level of k_g as the level of steady-state equilibrium, the savings rate must be s_g , so that $s_g f(k)$ intersects with $(d + n)k$ at the level k_g .

Figure 20. Optimal consumption under the Golden Rule



As shown in figure 21, a level of k under k_g – corresponding to savings rates less than s_g – means the accumulation of capital is insufficient, and at savings rates above s_g an excessive share of output is devoted to investment, leaving a suboptimal amount for consumption.

And assuming that in a competitive equilibrium the marginal product of capital equals its returns, r :

$$r = f'(k) = d + n$$

This equation together with the previous conditions 1.10 and 1.11 implies:

$$n + d = f'(k) = sf(k)/k = r$$

As $rk/f(k)$ is the share of capital in the value of product, s_k , so:

$$s = rk/f(k) = s_k$$

In a nutshell, the savings rate associated with the Golden Rule must equal the share of capital in the output value. In a Cobb-Douglas aggregate production function with said share of capital, this implies:

$$s = a$$

So for a value of the parameter $a = 0.5$, the Golden Rule requires a savings rate of 50% – only attained *in the real world* by China under some official estimates. For values of the parameter close to $1/3$, the recommended savings rate would be $s = 33\%$, not achieved in most countries.

Activity 18

Discuss alternative policies in order to increase the savings rate to achieve or get closer to the Golden Rule; what economic effects can be expected in the short-run and in the long-run? Can a linear increase in consumption per capita be achieved?

Activity 19

Discuss the effects of the Chinese strategy to reduce the share of GDP devoted to savings in the second decade of the 21st century. What are the effects in terms of growth and composition of GDP?

4.5. * Endogenous technological progress: the role of ideas

The neoclassical model treats technological progress as an exogenous variable. But in modern societies innovation is not (only) a spontaneous and “random” event but the result of deliberate activities that require a high level of resources. In other words, technological progress is the *endogenous* result of tasks like *research+development+innovation*, R+D+i. In addition, innovation and/or the accumulation of knowledge benefits not only the original researchers but, at least on some occasions, a wide range of users of the new ideas. Innovation has a dimension of positive externality that gives rise to arguments in favour of public policies for R+D+i.

Paul Romer (appointed chief economist of the World Bank in 2016) published his seminal papers on “endogenous growth” (in fact, growth with endogenous technical progress) at the end of the 1980s. Since then his models have become an important ingredient in explanations and analyses of economic growth, the role of ideas in the *knowledge society*, and the role of private and public policies to promote innovation.

Some noteworthy features of his formulations are:

1) Knowledge or “ideas” are an important production factor, but in many cases – depending on intellectual property laws – ideas, I , are similar to a “public good”, in the sense that they are “nonrival goods”, not (always) appropriable, and can be used by everybody.

The production function can now be formulated as:

$$Y = AK^aL^{1-a}I^b \quad 1.12$$

Thus this production function has constant returns on the “appropriable or rival factors” but increasing returns on the whole array of other factors, including I .

An important implication is that now factor accumulation can affect not just the level of growth but the rate of growth as well: this “limitation” of constant returns is overcome by the new input!

2) Technical progress can no longer be considered an exogenous “mana from heaven”. In contrast, innovations, discoveries, etc. are usually the result of deliberate activities to expand the frontiers of our knowledge. Sometimes as the result of publicly-funded research, sometimes as the result of private activities aimed at obtaining profitable results. “Endogenous Technological Change” is the title of one of Romer’s seminal papers (Romer, 1990).

The positive impact of knowledge and its dependence on the allocation of resources to R+D activities gives rise to new arguments favouring public support for these activities.

Activity 20

R+D+i policies

Look for data about resources devoted to R+D+i activities in different countries and discuss relationships involving the levels and/or rates of growth of relevant variables, such as Y/L .

Further Reading (units 3 and 4)

Two excellent and complementary surveys about the facts and explanations of economic growth:

Rodrik, Dani (2013), “The Past, Present, and Future of Economic Growth”, Global Citizen Foundation, available at: http://www.sss.ias.edu/files/pdfs/Rodrik/Research/GCF_Rodrik-working-paper-1_-6-24-13.pdf

Charles Jones (2015), “The Facts of Economic Growth”, available at: <http://www.hoover.org/sites/default/files/jones-facts040.pdf>

<https://web.stanford.edu/~chadj/facts-slidesConference.pdf> (presentation)

The core of Unit 4 is the neoclassical model of economic growth, presented in 1956 in two independent papers by Robert Solow and Trevor Swan. Solow’s paper can be found (among many other Internet sites) at:

<http://piketty.pse.ens.fr/fichiers/Solow1956.pdf>

Solow acknowledges the precedent of Harrod and Domar, and Swan the role of Adam Smith.

The 1987 Nobel Prize Lecture given by Solow is an interesting guide to the origins of the theory of economic growth, also featuring an explicit reference to Adam Smith; available at:

http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1987/solow-lecture.html

Adding Human Capital to Solow’s growth model: Mankiw-Romer-Weil (1992)

http://eml.berkeley.edu/~dromer/papers/MRW_QJE1992.pdf

Recommended book

A non-technical summary of these and other recent ideas in economic growth is:

Jones, Ch. and Romer, P. (2010) “The new Kaldor Facts: Ideas, Institutions, Population, and Human Capital”, *American Economic Journal: Macroeconomics*, January 2010. Previous version available at: <http://web.stanford.edu/~chadj/Kaldor200.pdf>.

Two seminal papers introducing the “new growth theory” are:

Paul Romer (1986), “Increasing Returns and Long Run Growth”, *Journal of Political Economy*, 94.5 October 1986, available at: <http://delong.typepad.com/paul-romer-increasing-returns-and-long-run-growth.pdf>

Paul Romer (1990), “Endogenous Technological Change”, *Journal of Political Economy*, 98 (5), available at:

<http://pages.stern.nyu.edu/~promer/Endogenous.pdf>

The Lucas’ paradox is presented in a short paper that is well worth reading:

Lucas, Robert (1990), “Why Doesn’t Capital Flow from Rich to Poor Countries?”, *American Economic Review*, 80 (2), May 1990, available at (many sources, including):

<https://www.econ.nyu.edu/user/debraj/Courses/Readings/LucasParadox.pdf>

On a non-technical level, the IMF’s informative publication *Finance & Development* devotes its March 2017 issue to the *Growth Conundrum*, with some short and informative pieces, available at:

<http://www.imf.org/external/pubs/ft/fandd/2017/03/index.htm>

An interesting example of interactions between short- and long-run aspects of economic evolution is Blanchard et al. (2017), “Short Run Effects of Lower Productivity Growth: a Twist on the Secular Stagnation Hypothesis”, Peterson Institute for International Economics, 2017; available at: <https://piie.com/system/files/documents/pb17-6.pdf>

In-depth reviews of countries by the European Commission under the Macroeconomic Imbalance Procedure, including estimates and projections of (potential) output growth following decomposition based on Solow (typically in table 1.1 of each report), available at:

https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/macroeconomic-imbalance-procedure/depth-reviews_en#2017-country-reports-including-idrs

About the problems of productivity, with a extensive explanation of both long-term and medium-term factors:

Furceri, D. et al. (2017), “Gone with the Headwinds: Global Productivity”, IMF Staff Discussion Note, SDN 17/04, April 2017, available at: <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2017/04/03/Gone-with-the-Headwinds-Global-Productivity-44758>

The challenges of growth for emerging and developing economies, with reference to internal and external factors:

IMF (2017), “Roads Less Travelled: Growth in Emerging Market and Developing Economies in a Complicated External Environment”, chapter 2, *World Economic Outlook*, April 2017, available at: <http://www.imf.org/en/Publications/WEO/Issues/2017/04/04/world-economic-outlook-april-2017>

Some applications of the concepts introduced in Units 3 and 4

Johansson et al. (2012), “Looking at 2060: Long-term global growth prospects”, *OECD Economic Policy Papers*, 03, 2012, available at:

<https://www.oecd.org/eco/outlook/2060%20policy%20paper%20FINAL.pdf>

OECD (2014), “Growth Prospects and Fiscal Requirements over the Long Term”, chapter 4, *Economic Outlook 2014/1*, 2014, available at: <https://www.oecd.org/economy/Long-term-growth-prospects-and-fiscal-requirements.pdf>

Havik et al. (2014), “The Production Function Methodology for Calculating Potential Growth Rates & Output Gaps”, *European Economy, Economic Papers*, No. 535, November 2014, available at:

http://ec.europa.eu/economy_finance/publications/economic_paper/2014/pdf/ecp535_en.pdf

On problems of measurement:

Byrne et al. (2016), "Does the United States have a productivity slowdown or a measurement problem?", *Brookings Papers on Economic Activity*, 2016, available at:

https://www.brookings.edu/wp-content/uploads/2016/03/ByrneEtAl_ProductivityMeasurement_ConferenceDraft.pdf

