BACKGROUND PAPER

BOOSTING PRODUCTIVITY: A FRAMEWORK FOR ANALYSIS AND A CHECKLIST FOR POLICY

SILVIA ALBRIZIO AND GIUSEPPE NICOLETTI

GLOBAL FORUM ON PRODUCTIVITY

REPÚBLICA PORTUGUESA
FINANÇAS

OECD
BETTER POLICIES FOR BETTER LIVES

TABLE OF CONTENTS

Tables

Figures

BOOSTING PRODUCTIVITY: A FRAMEWORK FOR ANALYSIS AND A CHECKLIST FOR POLICY

Silvia Albrizio and Giuseppe Nicoletti

1. Introduction

1. This paper uses the recent work on The Future of Productivity (OECD, 2015a), and subsequent developments of it in the context of the Global Forum on Productivity, to propose a framework to analyse country-specific productivity challenges as well as a checklist of issues to be reviewed when designing productivity-enhancing national policies.

2. A key finding of recent productivity research is that aggregate productivity outcomes are shaped by structural factors that operate at the industry or firm level. These include the degree of heterogeneity in productivity performances across firms (such as proximity to the global or national frontier), the distribution of firm characteristics across the economy (such as size, age, propensity to innovate), the ability of markets to allocate labour and capital efficiently across firms, the extent to which the business environment facilitates on the one hand the growth of the most productive and innovative firms and on the other the diffusion of best practices across the economy, and the smooth functioning of a "creative-destruction" process by which experimentation is encouraged through new entry, as well as exit in case of failure, freeing up resources for the most successful firms.

3. In turn, research has highlighted that these structural factors are significantly affected by public policies via a number of channels. For instance trade, competition, regulatory and innovation policies affect the speed at which knowledge spreads throughout the economy and, together with financial supervision, influence the ability of new entrants and successful firms to grow and increasingly contribute to aggregate productivity; labour market, skills and housing policies affect the ability to allocate workers to jobs that correspond to their competencies; policies that influence the exit of unsuccessful firms (such as insolvency regimes) affect entrepreneurial spirit and the efficient allocation of labour and capital across the economy; most crucially, all these policies affect incentives to take risks and innovate.

4. While the mechanisms and channels that go from policies to aggregate productivity via structural factors are common across countries, the policies and structural factors that shape this relationship differ widely across countries. For instance, there are significant differences in regulatory policies, especially in service sectors, and labour market policies among OECD countries. These differences are even larger and broader in scope, including also in trade and FDI policies, between OECD and non-OECD countries. Partly as a consequence of this as well as reflecting historical developments, economic structures differ widely across countries, for instance in terms of the distribution of firms characteristics, distance from the global and national productivity frontier, speed of catch up, degree of mismatch in labour markets, etc. Therefore, there is ample scope for tailoring policies aimed at boosting productivity in ways that are consistent with initial policy and structural conditions in each country.

5. The new Global Forum on Productivity is a vantage point from which to elaborate such tailored productivity policy advice because it can draw not only from the analytical framework and cross-country information produced by the OECD but also from the country-specific contribution of participants in the Forum, including that of experts from non-OECD countries.

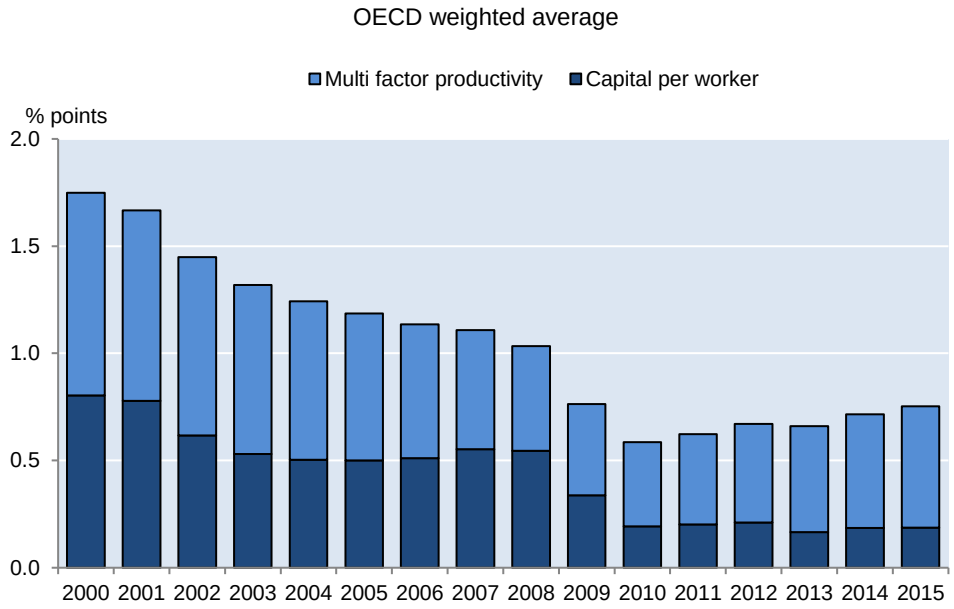
6. This paper is a first step in the elaboration of such a framework, and is intended to be work in progress to be refined and augmented in discussions with Forum participants. It begins with a short section setting out the main channels through which structural characteristics at the industry and, especially, firm level affect aggregate productivity. In the light of this, Section 2 draws a list of important statistics that it would be useful to collect to diagnose productivity issues in a country. Section 3, describes the mapping of policies into these structural determinants of productivity that results from OECD and other empirical research. Finally, Section 4 uses the diagnostic tools and the policy mapping to establish some typical country profiles that could emerge and to describe how, depending on the country profile, different policy areas, policy packages and institutional setups could be given priority in designing productivity-enhancing policies.[1]

2. How aggregate productivity growth is generated: from firm to aggregate productivity outcomes

2.1 Decomposition of labour productivity

7. Productivity is commonly defined as the ratio of output per inputs expressed in volume. Changes in labour productivity (LP), which is the most frequently used measure of productivity,[2] are the outcome of changes in the amount of capital per worker (i.e. capital deepening) and changes in multifactor productivity (MFP) (Figure 1).

Figure 1. Decomposition of trend labour productivity growth



Note: The figure depicts the weighted average of OECD countries. In the calculation of trend productivity, the production function is assumed to be Cobb-Douglas, and multi factor productivity is labour-augmenting. Ollivaud and Turner (2015) and Johansson et al. (2013) provide further details on the OECD method of estimating trend productivity.

1 The framework for the analysis is mostly based on OECD (2015) and Banks (2015).

2 Table 1 in Annex I presents different measures of productivity, the related measurement issues and the data sources.

Source: OECD estimations based on Ollivaud, P., Y. Guillemette and D. Turner (2016), "The Links between Weak Investment and the Slowdown in OECD Productivity and Potential Output Growth", OECD Economics Department Working Papers, forthcoming; OECD Economic Outlook 99 database.

8. Capital per worker rises with investment in both physical capital -- such as machinery, equipment and buildings -- and intangible capital (so-called knowledge based capital, henceforth KBC), in the form of computerised information, innovative property and economic competencies (Corrado et al., 2005; OECD, 2013a). KBC, in particular, plays a key role in enhancing productivity through the link between innovation and reallocation (Andrews and Criscuolo, 2013).

9. Multifactor productivity reflects the efficiency with which all the inputs are used. It is a residual measure, in the sense that MFP growth is GDP growth net of the measured contributions of production inputs under the assumption that these are paid their marginal products. As many of these inputs are not well measured and markets are not necessarily competitive, firm MFP de facto incorporates the effects of different factors ranging from technological progress, organisational innovation, changes in managerial practices, general increases in knowledge, adjustment costs, economies of scale and the rents deriving from market power. At the industry and aggregate-level, MFP also captures the efficiency of resource reallocation.

10. MFP is therefore a function of the way the other inputs are measured. For instance, if labour inputs are not adjusted for human capital and capital inputs do not account for KBC, their effects will be captured by MFP. However, even if all inputs were measured correctly, some of them (notably KBC) are likely to affect MFP through spillovers (OECD, 2015a and 2016a). Disentangling the pure efficiency component of measured MFP from the rent element implied by market imperfections is also challenging, though innovative approaches have recently been proposed for making this possible with firm-level data (de Loecker and Warzynski, 2012) and have been used in analysis provided to the Global Forum (Andrews et al., 2016).

11. When looking at the evolution of productivity over time, productivity can be further decomposed into cycle and trend components. Cyclical components are by definition affected by temporary factors, such as weak demand due to the financial crisis or a period of acute policy uncertainty. MFP measurement is also sensitive to demand factors as it is difficult in practice to measure the capacity utilisation of inputs over the cycle with available data. Although extracting the trend of a time-series is fraught with difficulties and subject to large ex-post revisions, identifying the trend component of productivity is nonetheless important as it can give more insights on the effect of structural factors (investment, allocation of resources, business dynamism) on the current and potential economic growth of the economy. The analysis that follows focuses therefore on trend productivity.[3]

2.2 Economic structure and productivity

Industry composition

12. Bearing in mind the increasingly artificial nature of our industrial classification structure, cross-country differences in observed labour productivity developments partly reflect differences in industry structure for at least three reasons. First, the shift of economic activity from agriculture to manufacturing is usually a major source of productivity growth in developing and emerging countries. Second, the shift from manufacturing to services in industrialised countries can also have a bearing on productivity growth. Third, the shift from low to high-value added goods and services, which occurs in the most advanced countries, can have implications for the ability to measure (and therefore compare across countries) productivity correctly.

3 Empirical results on which this paper is based typically include country and time fixed effects that filter out cyclical effects on productivity growth.

13. For instance, while there is great heterogeneity across services, the low productivity rates that characterize many services combined with the increasing share of services in the total economy, can contribute to explain the decline in aggregate productivity growth. Compared to manufacturing, the service sector is typically less capital intensive and it is less exposed to international competition due to the low or non-tradability of most services. Moreover, services are often characterized by a relatively inefficient resource allocation and by low managerial quality (OECD, 2015a). Therefore, unless such efficiency and quality are enhanced in parallel, the shift to services will tend to put a break on productivity growth. A related issue is the ability to adequately capture developments in productivity of the public sector. This becomes increasingly relevant for productivity analysis as this sector grows in size (e.g. with the level of economic development).

14. Productivity growth in services matters for aggregate productivity not only because the share of services in economic activity has risen over time, but also because services outputs represent an increasing share of intermediate inputs in manufacturing sectors.[4] Thus, weak productivity in services will tend to propagate throughout the economy faster than in the past (via input-output linkages), especially if this weakness originates in the business services industries.

Informality

15. The extent of informality in the economy plays an important role as well. At the macro level, informality negatively affects fiscal sustainability, and consequently reduces public resources that can be directed to investment in those public infrastructures and services that sustain productivity. At the micro-level, the link between informality and productivity is more complex. Informality can represent a life jacket for small firms, which tend to be disproportionately affected by poorly designed regulations (OECD, 2001). However, firms in the informal sector have been found to limit their size to below their optimal efficiency scale to avoid detection (La Porta and Shleifer 2014). Therefore, they often use backward production technologies, partly reflecting their sub-optimal size (Dabla-Norris et al., 2007) and their predominantly inward orientation. Recent OECD research suggests that access to global markets and connecting with the global frontier is crucial for fully benefiting from international productivity spillovers (Andrews et al., 2015), while there is related evidence emphasizing the negative effects of informality on productivity, partially through misallocation of resources (Dougherty and Escobar, 2016).

Measurement

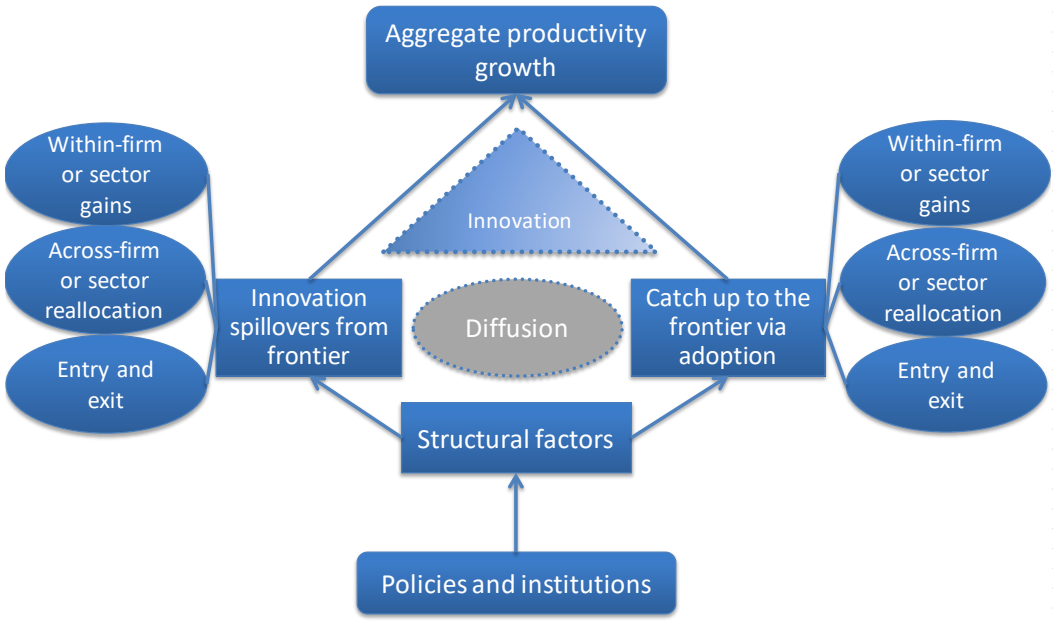
16. The presence of informality clearly makes accurate productivity measurement difficult. But also the shift towards services can exacerbate measurement error as productivity in these sectors is typically more difficult to grasp than in manufacturing. More generally, measurement issues become more serious as economies climb up the value-added ladder towards higher-value added (and high-tech) products that are typically more reliant on enhancements in product variety and quality, which are difficult to capture statistically. Recent research suggests, however, that these measurement issues are unlikely to be an important factor behind the productivity slowdown observed in advanced economies (Byrne et al., 2016; Syverson, 2016; Ahmad and Schreyer, 2016), but mismeasurement is a potential difficulty that needs to be kept in mind.

4 For instance, stalled productivity in the transport sector may influence manufacturing sector's productivity by lengthening the lead time needed to access key inputs and slowing down the delivery of products. Evidence of such upstream-downstream effects is pervasive (see e.g., Bourlès et al, 2010).

2.3 Market structure and productivity: a framework

17. As schematised in Figure 2, aggregate productivity developments ultimately reflect three main structural factors: (i) a multitude of within-firm productivity enhancements, including those contributing to the productivity frontier (e.g. as induced by innovation), (ii) the speed at which these enhancements diffuse to other firms, and (iii) the way in which markets are able to reallocate resources towards the most efficient firms (i.e. between-firm developments).

Figure 2. Simplified framework – Factors and channels affecting aggregate productivity growth



Source: OECD

Producing new innovations

18. Within-firm productivity enhancements are shaped by the ability to innovate, including by reorganizing efficiently available resources, notably through investment in both tangible and intangible capital. Innovation is essential to boost the (global or national) productivity frontier, which is the premise for wider diffusion of productivity gains throughout the economy. Public and basic research plays an important role here due to the well-known market failures in innovation markets, but innovation is closely linked to the ability to experiment, not only via investment in R&D and intellectual property, but also via investment in other forms of knowledge-based capital, such as data, and the implementation of new business models and non-standard organisational and human resources practices.[5]

19. In turn, innovation through experimentation requires ease in market entry, rapid growth of successful firms and exit in case of failure for at least three reasons. First, young firms have a comparative advantage in commercialising radical innovations (Henderson, 1993; Baumol, 2002). Therefore it is fundamental to enable start-up firms to access the adequate resources to enter the market. Second, it is important that young firms either grow rapidly, accessing global markets, or exit but not linger and become

5 Examples of non-standard human resource practices are work teams (Boning et al., 2007) incentive pay mechanisms (Lazear, 2000), and high performance work practices (OECD, 2016b).

small-old firms locking up resources that would be better reallocated to innovative firms. The prospect of rapid growth, if innovation is successful, is in itself a strong incentive for innovation, while obstacles to firm grow are a deterrent. Third, the lingering of unsuccessful incumbents in markets, especially when they can only survive thanks to various kinds of subsidies (including those implied by bank forbearance) and regulatory frameworks that favour incumbents, is especially penalising for aggregate productivity growth as these firms trap labour and capital inputs that could be used more efficiently elsewhere in the economy (Calvino et al. (2016)).

The diffusion of innovations

20. Robust frontier productivity growth is necessary but not sufficient for sustaining aggregate productivity developments. It is crucial that these productivity advancements diffuse into the economy through knowledge spillovers and technology adoption, reducing technological gaps among firms. These *gaps* reflect the distance of each firm to the global productivity frontier level and the evolution of technological gaps over time gives an indication of the speed of knowledge and innovation diffusion in the economy. Typically, improvements in frontier technologies and best practices do not immediately diffuse to all firms, but they are most easily and rapidly adopted by the most productive firms in each country (i.e. national frontier firms) and subsequently by other firms in the economy.

21. Recent research shows that the extent and speed of the diffusion of productivity gains obtained at the frontier varies across countries and appears to have slowed down over the past two decades, especially in the services sector (OECD, 2015; Andrews et al., 2016). To the extent that these gains reflect the creation of new innovations, this may signal differences in the ability to absorb and diffuse such innovations in the economy. The ability to benefit from knowledge spillovers from the frontier or adopt best practices depends in turn on a number of structural factors, including trade interactions with frontier economies and leveraging on the existing stock of KBC (e.g. skills and R&D). Protection of intellectual property rights has a complex influence on the diffusion of knowledge: without IPR protection inventors would lack the incentive to produce new knowledge, but protection itself may hinder the diffusion of new technologies throughout the economy.

Allocating resources efficiently

22. It is the ability of an economy to reallocate resources to the most efficient firms that translates the efficiency gains obtained at the frontier into higher aggregate productivity levels and growth rates. Recent research suggests that the contribution of the efficiency of reallocation to aggregate productivity levels could be sizeable.[6] In a healthy economy the firms that are initially most productive or successfully innovating should be able to attract a larger and increasing share of employment and capital to finance their investment relative to their less productive and stagnating peers. Recent and ongoing research shows that this ability varies widely across countries and can also change over time. For instance, firms that patent often encounter difficulties to attract sufficient labour and capital required to underpin their expansion in some countries (Andrews et al., 2015) and in several countries the elasticity of employment growth and/or investment to initial levels of productivity may have declined over the past twenty years (Foster et al., 2016; Adalet McGowan et al., 2016).[7] As a result, allocative efficiency, as measured by the contribution that efficient resource allocation gives to overall productivity levels differs a lot across countries (Arnold et al. , 2011; Andrews and Cingano, 2014), especially in the services sector.

6 For instance Andrews and Cingano (2014) estimate a positive contribution of efficient allocation by between 30 and 40% in the average country included in their sample .

7 For instance, Garcia-Santa et al. (2015) found that capital misallocation in Spain lowered productivity growth by around 0.3% per annum and 1.5% per annum, respectively.

23. Efficient allocation is the result of letting the most efficient firms grow rapidly and the unsuccessful firms leave (i.e. the up or out firm dynamics). A worrying phenomenon that deserves to be monitored in this context is the possible increase in the share of so-called "zombie firms" in some economies (e.g. the UK, Italy and Korea) over the past two decades, and especially since the Great Recession (Bank of England, 2013; Bank of Korea, 2013), which echoes similar developments observed in Japan in the past (Caballero et al., 2008; Peek and Rosengren, 2005). Such firms typically have low productivity levels and growth rates, and represent a drag on aggregate productivity developments both directly and indirectly by trapping resources that could fuel the growth of healthy firms. Cross-country evidence of such phenomenon is currently being collected through OECD research.

24. One other important dimension of resource allocation is that of skills. Efficient reallocation requires the ability to optimally combine technological, organisational and human capital in production processes. For instance Bloom et al. (2016), show that one of the main factors explaining the substantial differences in productivity among firms and countries consists of variations in management practices. Therefore, ensuring that the most effective managers are responsible for a larger share of the economy's resources would significantly boost aggregate productivity.

25. More generally, matching worker' skills to jobs plays a key role. Recent OECD research suggests that the degree of skills mismatch differs widely across countries (OECD, 2015a) and is largely due to the inability of labour markets to ensure the necessary reallocation of labour from low to high productivity (and well-managed) firms (Adalet McGowan and Andrews, 2015a). The potential productivity gains from reducing such mismatch are estimated to be large.

3. Diagnosing productivity issues

26. The framework and the evidence discussed above, point to a number of key indicators that ought to be looked at for uncovering productivity weaknesses and their proximate causes. Table 1 presents some of these indicators. A first set of aggregate indicators serves to identify trends in aggregate productivity and its proximate determinants (aggregate MFP and capital deepening) consistent with a growth accounting approach as well as framework conditions that are likely to affect aggregate productivity (such as the nature and quality of financial and other infrastructures, and the characteristics of institutional settings aimed at promoting productivity-enhancing policies). A second set of indicators is organised along the three core firm-level channels of aggregate productivity enhancements: the production of new firm-specific innovations, the diffusion of best practices to other firms and the reallocation of resources to support growth of the most efficient firms.

Table 1. Key structural indicators for productivity diagnostics

Category	Sub-category	*Indicators*
Aggregate trends	*Labour productivity*	Per hour/per worker, levels/growth, trend and cyclical components.
	MFP	index, contribution to labour productivity growth, trend and cyclical components.
	Capital deepening	Gross and net investment rates and capital stocks, capital per worker, contribution to labour productivity growth.
	Investment (KBC,ICT)	Share in GFCF, contribution to labour productivity growth.
Framework conditions	*Business environment*	Financial market development, venture capital, congestion, informality, trial length and costs of judicial procedures, complexity of administrative procedures.
	Productivity-enhancing institutions	Independent governance, transparent processes, solid research capacity, economy-wide reference framework, and linkages to policy-making mechanisms within government.
Firm-level channels		
I. Knowledge creation and innovation	*Overall innovation*	Productivity growth at the global frontier.
	R&D, digital technologies and other KBC investment	Private investment and stocks of R&D, public investment in basic research, investment in IPR, data and software, uptake of digital technologies.
	Skills	PISA and PIAAC scores, average years of education, managerial skills, organisational capital.
II. Knowledge and innovation diffusion	*Productivity distribution and gaps*	Productivity distributions across firms (kernels), distance of national productivity frontier to global frontier, distance of non-frontier productivity to national frontier, speed of catch up to frontier.
	Innovation diffusion	International cooperation on inventions (patenting), science-industry cooperation, R&D cooperation.
	Business dynamics	Start-up ratios, age of global and national frontier firms, share of small and old firms, share of "zombie" firms, participation in GVCs, trade intensity with frontier firms, international ownership (multinational group).
III. Efficiency of reallocation	*Labour and capital allocation*	Contribution of allocative efficiency to aggregate productivity levels (Olley and Pakes), responsiveness of reallocation (of labour and capital) to initial productivity levels (Foster and Haltiwanger 2016; Hsieh and Klenow 2009).
	Matching jobs to skills	Skills mismatch, share of under-skilled or over-skilled workers, productivity gains to be obtained from reducing mismatch or improving managerial skills.

27. This list is not intended to be an exhaustive diagnostic toolbox but rather a starting point for an evolving collection of relevant indicators that will be amended and enriched as new data become available and feedback from the Forum's experts is collected. New empirical results from both OECD, GFP and national research efforts are expected to fill in areas that currently have limited coverage: for instance, this includes ongoing work on (i) the characteristics, causes and consequences of the apparent slowdown in knowledge and innovation diffusion, (ii) trends in the efficiency of capital allocation, (iii) linkages between GVCs and productivity, and (iv) institutional settings for productivity-enhancing policies.

28. The suggested indicators can be examined over time in one country (to see whether they tend to improve or worsen), across countries (to see how each country compares to the others) or in both dimensions. When data availability permits, some of the indicators could be considered for manufacturing and services separately, or at a finer industry level and then aggregated into macro-sectors.

29. The metrics range from aggregate to firm-level dimension. Aggregate indicators are well-suited to highlight overall trends but obviously cannot identify the underlying structural phenomena. As explained in the previous section, micro-level indicators can unveil the structural phenomena that underlie the overall

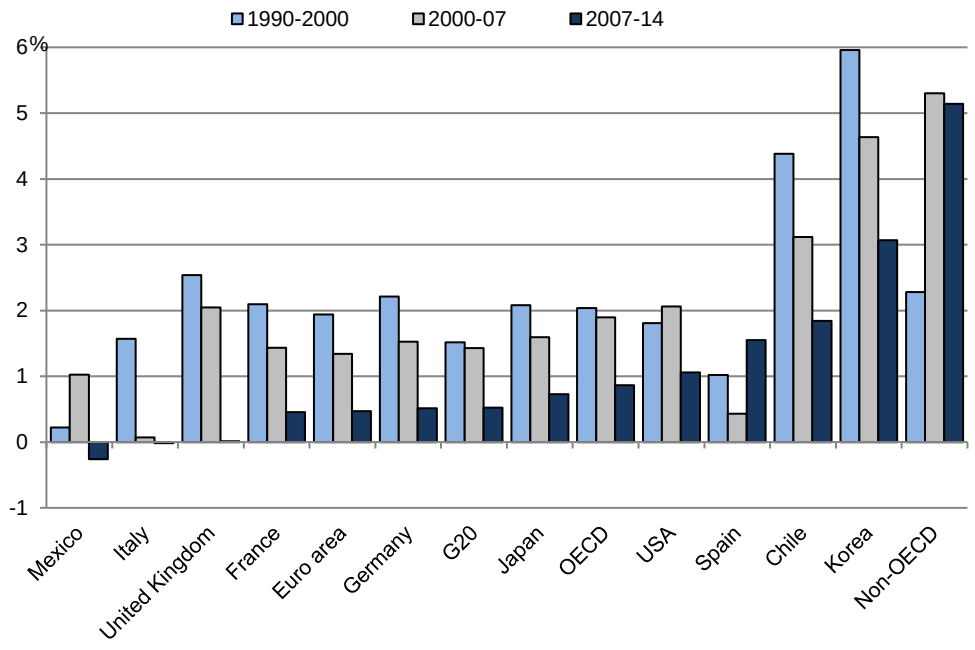
trends, possibly helping to anticipate potential issues that are not yet visible at the aggregate level. Also, similar developments in aggregate indicators across countries may be driven by different underlying micro phenomena, in such context only a firm-level perspective would allow to uncover this evidence and to respond with tailored policy interventions.

3.1 Key structural indicators

Aggregate trends: productivity and investment

30. The first category focuses on ***aggregate (macro or sectoral) developments in productivity and its drivers, capital deepening and MFP***. These indicators allow comparing each country to the others, and give insights on whether country productivity developments are country-specific or part of a generalized global trend, and whether they are originated by structural factors or cyclical factors. For instance, Figure 3, provides evidence of the ongoing productivity slowdown in both developed and emerging economies, which often precedes the financial and economic crisis, suggesting a long-lasting structural problem. As Figure 1 suggests, this phenomenon is the outcome of both weak investment, especially after the crisis, and an earlier declining contribution of MFP to productivity growth (OECD, 2016a).

Figure 3. Labour productivity slowdown



Note: OECD, Euro area, G20 and non-OECD are aggregated using GDP-PPP weights. OECD includes all OECD countries except Estonia. Euro area includes all euro area countries except Estonia. G20 includes all G20 countries except South Africa. Non-OECD is Argentina, Brazil, China, Colombia, India, Indonesia, Latvia, Lithuania, Russia and Saudi Arabia. Data for several countries begin between 1991 and 1995, not in 1990. Labour productivity for non-OECD countries is measured per worker, not per hour worked.

Source: OECD estimations using OECD National Accounts database; OECD Productivity database; International Labour Organisation database.

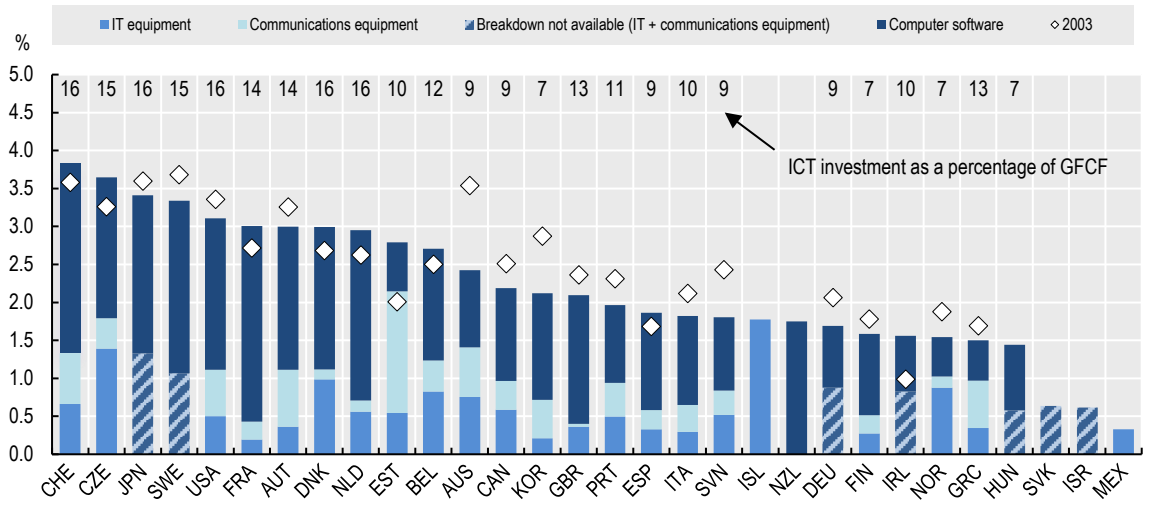
31. The ***asset composition of investment*** (ICT, non-ICT, KBC, non-KBC) is relevant for productivity outcomes first because investment is one vehicle for technology transfer and adoption and, second, because spillovers of ICT investment on MFP are typically stronger than those of other kinds of investment (Andrews et al., 2014). A weakness or a slowdown in ICT investment can therefore negatively affect MFP and labour productivity growth. Over 2001-13, ICT investment in the OECD area dropped from 3.4% to 2.7% of GDP, as part of an overall slowdown in investment in fixed capital. This decrease was accompanied by a shift in

the composition of investment, with a declining share of IT and communication equipment and an increase in software (OECD, 2015a). [8]

32. ICT has had considerable impacts on productivity growth over the past decades, in particular in some OECD countries, but typically only when investment in ICT was combined with investments in complementary assets, such as human capital, organisational changes and process innovations, i.e. knowledge-based assets (OECD, 2004). In order to extract the maximum benefit from ICT, firms typically need to adopt ICT as part of a "system" of mutually reinforcing organisational changes (Brynjolfsson et al., 1997), which will be easier to accommodate in firms with better organisational capital. Indeed, Bloom et al., (2012) attributed at least one-half of the United States-"Europe"15 difference in labour productivity growth between 1995 and 2004 to superior management practices, which significantly raised the productivity of ICT capital in the United States. The findings are also confirmed in a study of firm level MFP growth for a broader sample of OECD (Andrews and Criscuolo. 2013). Moreover, ICT-related changes in firms are typically part of a process of search and experimentation, where some firms succeed and grow and others fail and disappear. Countries with a business environment that enables this process of creative destruction may be better able to seize benefits from ICT – and KBC – than countries where such changes are more difficult and slow to occur.

Figure 4. ICT investment, by asset, 2013

As a percentage of GDP



Source: OECD, based on OECD Annual National Accounts (SNA) Database; Eurostat, EU-KLEMS Database and national sources, July 2015.

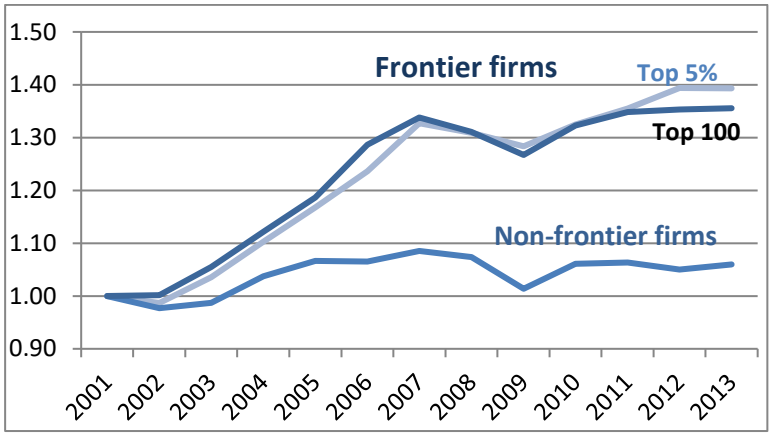
Knowledge creation and innovation

33. The second category looks at evidence and sources of creation of new knowledge and innovation, which is the main driver of aggregate productivity growth. ***Productivity growth of firms at the global frontier*** is an imperfect but interesting indicator of how fast productivity is improved globally. A slowdown of growth at the global frontier can be a source of concern if it is protracted over time. For instance, Figure 5 suggests that global frontier growth has remained strong over the past two decades though some signs of slowdown have emerged after the Great Recession.

8 The shift in the composition of ICT investment may reflect a range of factors, including price effects and growing outsourcing of ICT services (Corrado and van Ark, 2016).

Figure 5. Frontier and non-frontier growth

Manufacturing and business services, excluding the financial sector



Note: 2001 = 1 (log points), average across 24 OECD countries and 22 manufacturing and 27 market services industries. Global frontier has two definitions here (see two series on figures). Global frontier is defined as the 100 most productive firms within each industry and is defined as the 5% most productive firms within each industry, by each year.

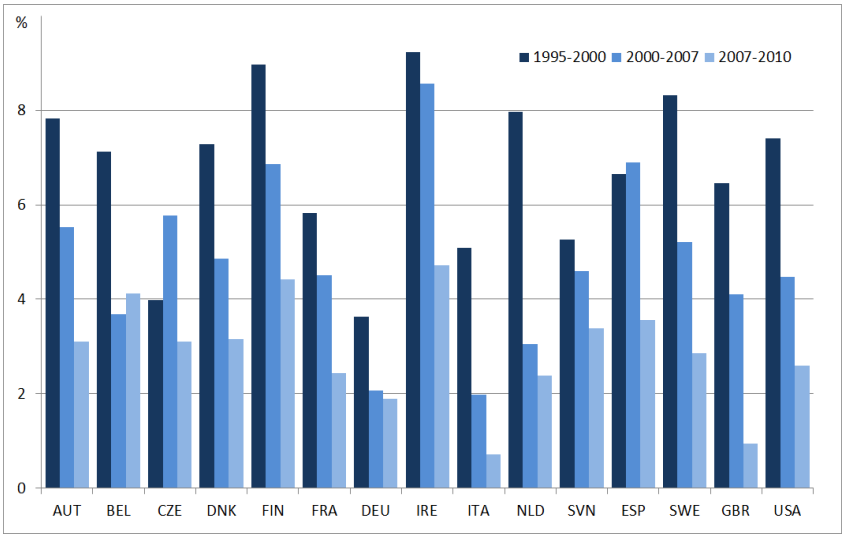
Source: OECD preliminary results based on Andrews, D., C. Criscuolo and P. Gal (2016)

Data Source: Orbis database of Bureau van Dijk.

34. ***Investment in KBC*** is a synthetic aggregate indicator of a country's effort to build up intangible capital that supports growth, e.g. via investment in R&D and intellectual property, computerised information, including data, and economic competencies (including organisational capital, managerial and other skills). Aggregate evidence (Figure 6) suggests that the rate of KBC investment has been slowing in many OECD countries over the recent past (OECD, 2015a). KBC does not only contribute to productivity growth directly (e.g. via innovation) but also indirectly because it is non-rival in nature and reinforces the capacity of countries to absorb frontier knowledge and innovations.

Figure 6. Investment in KBC

Annual average growth; 1995-2010



Source: Corrado et al., (2012).

35. More micro-based evidence concerning investment in organisational capital (Table 2) and managerial skills (Figure 7) shows that these important components of KBC vary a lot across countries.

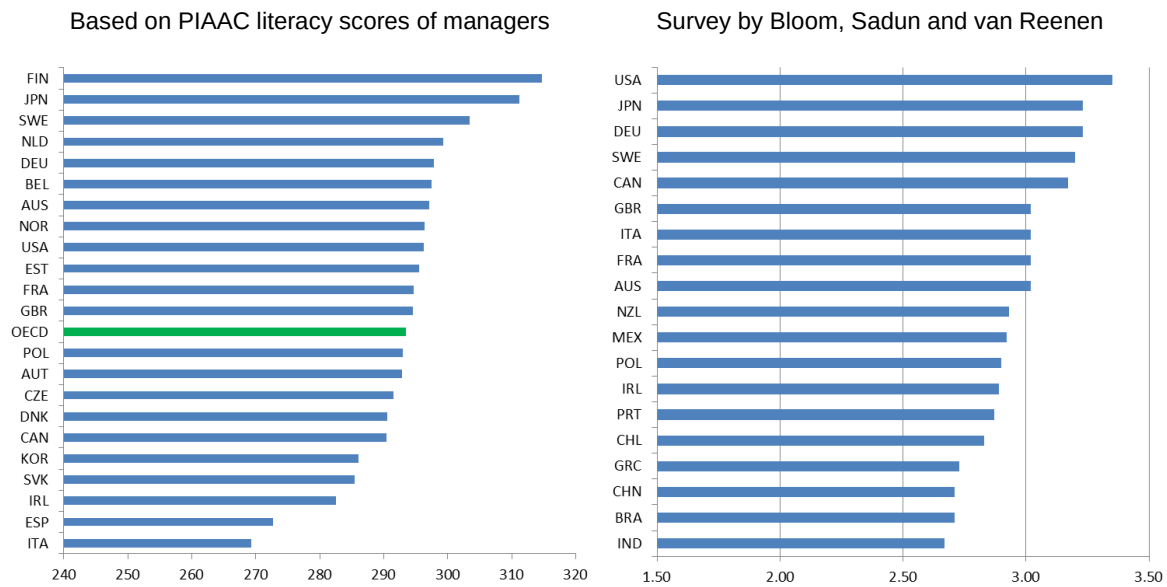
Table 2. Investment in organisational capital in the public and private sectors, 2011-12

As a percentage of value added in each sector

	Private			Public		
	Total OC	Managers	Non-managers	Total OC	Managers	Non-managers
Belgium	1.79	1.19	0.61	1.69	0.56	1.13
Italy	1.43	0.38	1.05	1.74	0.43	1.31
Czech Republic	1.3	0.54	0.77	1.87	0.84	1.03
Korea	1.56	0.29	1.27	1.89	0.52	1.36
Denmark	1.59	0.55	1.04	2.43	0.66	1.78
Slovak Republic	1.19	0.63	0.57	2.65	0.61	2.04
Austria	1.96	0.83	1.13	2.86	0.54	2.32
Spain	1.27	0.77	0.49	3.04	0.39	2.64
Estonia	1.96	1.08	0.88	3.06	1.27	1.79
Germany	1.88	0.98	0.89	3.23	0.93	2.29
Netherlands	3.56	1.25	2.31	3.31	0.73	2.58
Sweden	1.07	0.98	0.09	3.6	0.93	2.67
Japan	2.43	1.3	1.13	3.61	1.45	2.15
United States	2.31	1.77	0.54	3.62	1.33	2.29
Poland	1.6	0.88	0.72	4.77	1.2	3.57
Norway	2.08	1	1.08	5.26	1.03	4.23
France	1.78	1.17	0.61	5.43	1.08	4.35
Ireland	1.82	0.93	0.89	5.67	0.9	4.77
Canada	2.41	1.58	0.83	7.24	2	5.24
United Kingdom	2.51	1.68	0.83	8.62	0.55	8.07

Source: Le Mouel, M. and M. Squicciarini (2015), "Cross-Country Estimates of Employment and Investment in Organisational Capital: A Task-Based Methodology Using Piaac Data", OECD Science, Technology and Industry Working Papers, 2015/08, OECD Publishing, Paris. Data source: OECD calculations based on Programme for International Assessment of Adult Competencies (PIAAC) Database; OECD, Structural Analysis (STAN) Database, http://oe.cd/stan and national sources, June 2015.

Figure 7. Managerial quality



Sources: Adalet McGowan and Andrews (2015a), Bloom et al. (2013)

Knowledge and innovation diffusion

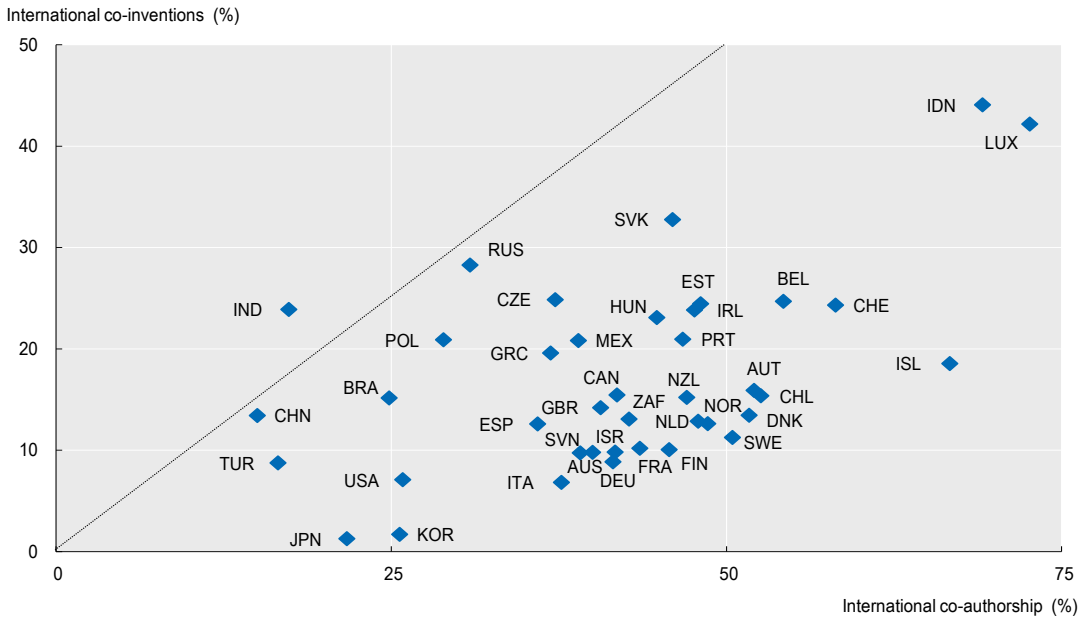
36. The third category collects indicators that can be used to gauge the extent and speed of diffusion of new and existing knowledge and innovations in the economy. The ***distribution of productivity*** levels and growth rates across the economy and the associated ***gaps between high and low-productivity firms*** are key diagnostics to detect the source of weaknesses in aggregate productivity developments.

37. For instance, the characteristics of the productivity distribution across firms (kernel) are useful to check anomalies (across country or over time), such as the persistence of long tails of low productive firms. The distance between the national and global productivity frontiers is useful to position countries in the productivity spectrum and to gauge the ability of an economy to absorb advanced technologies and best practices. In turn, the distance between the national or global productivity frontiers and the productivity frontier of the median or average firm in the economy is a rough indicator of the ability to diffuse those technologies and best practices across the economy. Developments in these gaps over time signal whether a country is increasing or lessening its ability to absorb and diffuse the knowledge that is needed to sustain productivity. For instance, Figure 5 suggests that the ability of the average firm to benefit from productivity gains obtained at the frontier has been declining over time globally, a phenomenon that if confirmed at the country level could help explain the productivity slowdown observed in many OECD economies.

38. The ability to absorb knowledge and innovation from abroad and within the economy is also influenced by the degree of cooperation on research and innovation. OECD evidence suggests that more intensive collaboration between firms and universities – as proxied by the share of higher education R&D financed by industry – is associated with more diffusion of foreign advanced technologies (OECD, 2015a) and may also facilitate the mobility of skills. Accordingly, the productivity gap between national and global frontier firms tends to be lower in countries where there is more intensive R&D collaboration (Andrews, Criscuolo and Gal, 2015). Such cooperation also extends beyond the country and OECD data finds large differences between countries in their degree of international cooperation on science and innovation (Figure 8).

Figure 8. International collaboration in science and innovation, 2003-12

Co-authorship and co-invention as a percentage of scientific publications and IP5 patent families



Source: OECD, STI Micro-data Lab: Intellectual Property Database, http://oe.cd/ipstats, June 2015; OECD and SCImago Research Group (CSIC), Compendium of Bibliometric Science Indicators 2014, http://oe.cd/scientometrics. See chapter notes.

39. The ability to absorb and spread out knowledge is also influenced by factors that are related to ***business dynamism***. For instance, the ageing of national frontier firms, a persistently high share of small and old firms, and declining start-up ratios (Table 3) may raise an alarm bell as these outcomes may reflect rising barriers to entry and experimentation and a lower propensity to implement the radical innovations that are usually introduced by young and dynamic firms. This is confirmed by new data from the DYNEMP project to be published shortly.

Table 3. Start-up rates

Manufacturing and services

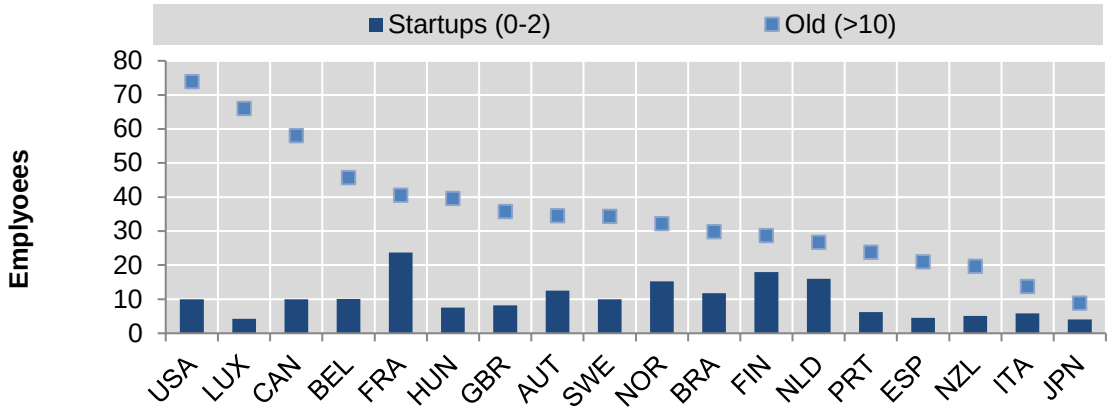
	2001-2003	2004-2006	2007-2009
Austria	22.7	18.4	17.3
Belgium	16.3	18.4	16.2
Brazil	44.2	40.3	34
Canada	19	17.7	15.2
Spain	27.9	28.6	25.9
Finland	8.7	9.4	10.3
France	25.8	21.7	
Great Britain	21.3	22.1	24.2
Hungary	33.2	21.2	18.2
Italy	14.6	12.5	10.1
Japan	5.2	6.6	
Luxemburg	22.6	21.3	19.6
Netherlands	19.2	19.7	25.7
Norway	15.6	14.8	11.7
New Zeeland	21.7	20.5	16.2
Portugal		18.4	18.8
Sweden	17.6	17.2	17.7
United States	21.9	21.3	18
OECD Average	21	19.5	18.7

Sources: C. Criscuolo, P. N. Gal and C. Menon (2014a).

Data Source: DynEmp

40. Factors that affect business dynamism include firm connectedness to global frontier firms via trade and GVCs, insufficient investment in different kinds of KBC, an inefficient allocation of skills and obstacles to the growth of young and dynamic firms (Figure 9 reports the cross-country average size of start-up and old firms in the manufacturing sector). For instance, high productivity gaps between global and frontier firms may be explained by undersized national frontier firms, as in the case of Italy, where these differences reflect barriers to up-scaling after firm entry (OECD, 2015a).

Figure 9. Average size of start-up and old firms in the manufacturing sector across countries



Source: Sources: Source: C. Criscuolo, P. N. Gal and C. Menon (2014a)..

Data Source: DynEmp.

Efficiency of reallocation

41. Efficient resource allocation is therefore a key determinant of the ability to generate new knowledge and ensure the absorption and diffusion of existing cutting-edge in the economy. ***Efficient reallocation*** would require that highly productive firms are able to attract the workers and capital they need to grow. Evidence for the US and preliminary evidence for other countries suggests that there are cross-country differences in the ability of highly productive firms to do so and that reallocation efficiency has tended to decline in some countries over the past two decades.[9]

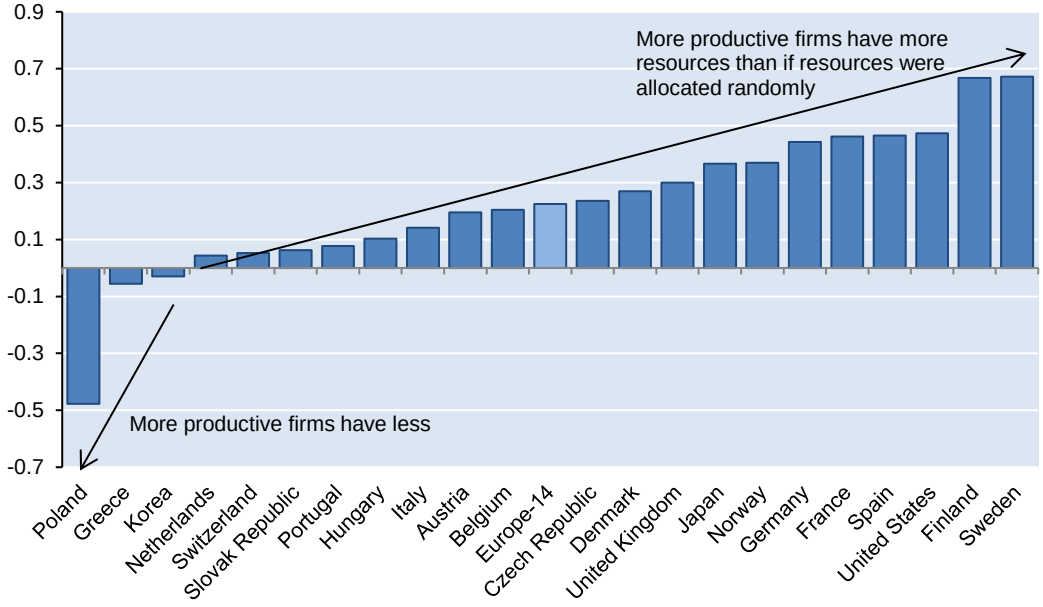
42. A clear sign of capital misallocation is a high and increasing share of firms that persist in activity even though they are not viable (so-called "zombie" firms) as, perhaps due to bank forbearance, credit is channelled to unproductive firms that would otherwise exit the market unlocking resources for more efficient and innovative firms. Indeed, business liquidations in the United Kingdom and Japan have been low in the aftermath of the Great Recession compared to the size of the output shock and relative to the previous recession episode (OECD, 2015b and 2015c).

43. Inefficient reallocation results in a lower contribution of the efficient allocation of resources to overall productivity, as captured by the Olley-Pakes measure of allocative efficiency, which quantifies the extent to which firms with higher efficiency have a larger market and employment share (Figure 10).

9 Evidence from the United States suggests that the pace of resource reallocation during the crisis picked up relative to normal times, but it was less productivity-enhancing than during previous recessionary episodes when the financial system was less impaired (Foster et al., 2014). In the United Kingdom, there is some evidence that the pace of productivity-enhancing reallocation has slowed (OECD, 2015a). The same evidence was found for Italy and Spain in ongoing (and as yet unpublished) research at the OECD.

Figure 10. Contribution of allocation of employment across firms to manufacturing labour productivity

Log points; manufacturing sector in selected OECD countries in 2005



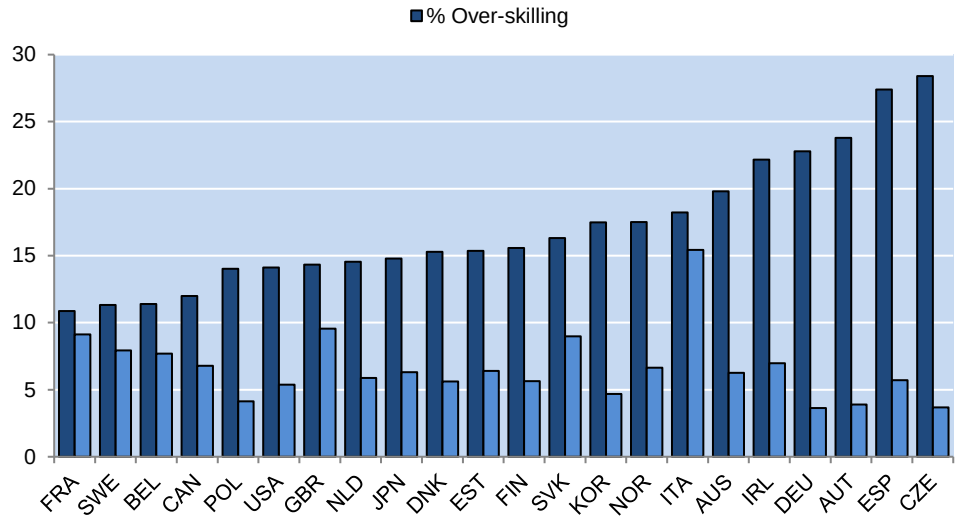
Notes: the estimates show the extent to which the firms with higher than average labour productivity have larger employment shares. In most countries, the covariance between productivity and employment share is positive, suggesting that the actual allocation of employment boosts manufacturing labour productivity, compared to a situation where resources were allocated randomly across firms (this metric would equal zero if labour was allocated randomly). For example, manufacturing labour productivity in the United States is boosted by around 50% due to the rational allocation of resources. Europe-14 includes: Austria, Belgium, Czech Republic, France, Greece, Germany, Hungary, Italy, Netherlands, Portugal, Poland, Spain, Slovak Republic and Switzerland, and is obtained by aggregating the respective allocative efficiency indicators by each countries share in manufacturing sector employment.

Source: Andrews and Cingano (2014).

44. Indicators of ***labour market matching***, such as overall skills mismatch, and share of under-skilled and over-skilled workers (Figure 11), measure the extent of mismatch between workers' job and skills. Skills mismatch may be due or aggravated by barriers in workers' regional and international mobility. A high share of over-skilled workers is statistically associated with low allocative efficiency, and it may reflect that more productive firms find it more difficult to attract skilled labour and gain market shares at the expense of less productive firms. A high share of under-skilled workers is not only associated with lower allocative efficiency but also with lower within-firm productivity, potentially due to low managerial quality. Recent OECD research has estimated the productivity gains that can be obtained from reducing mismatch or improving managerial skills (Adalet McGowan and Andrews, 2015a).

45. High levels of skills mismatch are also associated to wage inequality. A better labour allocation may contribute to reduce the job insecurity, earnings volatility, and wage inequality by lifting wages in the bottom part of the distribution (OECD, 2016c). For instance, a 10% decline in the dispersion of skills use in the Netherlands would reduce wage inequality by 1.1% (OECD, 2015e). However, job reallocation entails workers displacement and it may have short-term costs for the individual concerned and local communities. This is particularly relevant for workers who are less mobile or less able to adapt to new job requirements could face insecurity, earnings volatility and unemployment, weakening the potential benefits of reallocation. Therefore, labour market policies should facilitate this transition and ensure that workers are re-allocated to firms and activities where they are best able to exploit their skills (OECD, 2016c).

Figure 11. Skill mismatch, 2011-12



Note: The figure shows the percentage of workers who are either over- or under- skilled and the simulated gains to allocative efficiency rom reducing skill mismatch in each country to the best practice level of mismatch. The figures are based on OECD calculations using OECD, Survey of Adult Skills (2012).

Source: Adalet McGowan, M. and D. Andrews (2015b).

Framework conditions

46. Other structural factors characterizing the ***business environment*** also play an important role for aggregate productivity developments, especially in emerging and less developed economies. For instance, skills shortage and low market capitalization may decrease the capacity of firm to access the necessary resources (human capital and finance) in order to adopt existing technologies or develop new ones. Well-developed network sectors are fundamental for the efficiency of production processes of the rest of the economy. For instance, frequent congestion episodes of the metropolitan transport system increase workers commuting time. Under-provision of public transports emerges when cars became indispensable, suggesting co-ordination failure for the provision of mass infrastructure and service. Finally, in terms of judicial efficiency, relatively short and effective trials and low associated costs, foster investment by reducing business failure costs and the associated perceived risk by entrepreneurs.

47. The setup of ***institutions that promote productivity-enhancing policies*** is also important. This setup generally depends on historical, political and cultural factors that are largely independent from productivity outcomes and therefore can be considered to be part of the framework conditions that have an influence on productivity outcomes.

48. There is a strong case for establishing public institutions that not only help governments identify the right policies, but that can also counter one-sided political pressure against reform and help educate the public about what is at stake. Indeed, policies that promote productivity can be difficult for governments to devise and even more difficult for them to successfully implement, given uneven political pressures and fragmented administrative structures (OECD, 2010). In order to meet this challenge, institutional arrangements need to exhibit design features that include independent governance, transparent processes, solid research capacity, a frame of reference focused on improving economy-wide outcomes and linkages to

policy-making mechanisms within government (Banks, 2015). These criteria are not absolute, as they may be met to varying degrees and in various ways, and they can be difficult to quantify.

49. Independency and transparency ensure that the institution's research findings and policy recommendations are not influenced by pressure from political groups and lobbies. Independence can be inferred from the way senior appointments are made, from the source of funding and the way the decision process is designed. Public hearings, annual reports, public availability of the research findings and ex-post evaluation results can guarantee a certain degree of transparency.

50. A solid research capacity is crucial to uncover a country's productivity issues and propose adequate solutions. This capacity entails a problem-specific approach (evidence-based research, cost-benefit analysis, impact assessment, ex-post evaluation, etc), coupled with the ability to take economy-wide effects into account, which is a necessary feature that can be formalized in the institution's mandate.

51. Finally, the effectiveness of any institution will depend on its relationship to other relevant institutions, how its agenda is determined and the extent to which its work is integrated into decision-making processes.

4. Policies for improving productivity

52. The list of key indicators in Table 1 provides guidance on diagnosing the structural sources of aggregate productivity weakness. Drawing on a body of research conducted at the OECD and elsewhere, this section focuses on the policies that are needed for addressing this weakness by improving the structural drivers of productivity, including the design of effective institutional setups for promoting and implementing such productivity-enhancing policy packages.

53. The proposed policy toolbox is not intended to be exhaustive, but just a first illustrative step towards a more complete list to be established in collaboration with participants in the Global Forum. [10]

4.1 A policy taxonomy

54. Table 4 summarises the channels through which policies shape aggregate productivity following the simplified framework presented in Section I and Table 1: the effects of policies on productivity can operate via the creation of knowledge and innovation, their diffusion or the efficiency of resource reallocation. Ideally, this approach allows relating policies to structural factors that are relevant for productivity through the channels identified by empirical research. For instance, if a country has a falling ratio of start-ups, this can be an indication of declining experimentation and innovation rates ahead, which can be addressed with competition and innovation policies and reforms aimed at facilitating entry and exit (e.g. lower administrative burdens, better access to seed capital or more effective insolvency procedures).

55. Often, there is no one-to-one mapping between policies and structural factors, as many policies are ultimately relevant for productivity by improving at the same time knowledge creation, knowledge diffusion and resource allocation. Moreover, as highlighted in the table, policies targeted at the different channels are most effective when they are coupled with adequate framework policy settings (encompassing product and labour market reforms as well as the strengthening of rule of law) in a comprehensive policy package. For instance, fostering innovation is impossible without a well-designed intellectual property rights (IPR) regime but this should be coupled with pro-competition policies and an efficient judicial system.

10 One relevant feature that should be considered in future developments of this framework is the existence of structural differences between developed and developing countries. Such heterogeneity should consequently be mirrored in the policy response.

Table 4. Synoptic table on the channels through which policies shape aggregate productivity

The Future of Productivity, OECD 2015.

Firm-level channels to be activated	Relevant policies	Channels	Outcomes	*Relevance to performance of various firms:* Global frontier (GF)	National frontier (NF)	The laggards
1. The production and creation of knowledge and innovation	Innovation policies (e.g. basic research, R&D fiscal incentives, IPR), policies for other forms of KBC (e.g. data)	Promoting an efficient balance between applied and basic research.	Pushing the global technological frontier via more radical innovation and knowledge absorption from the science base.	★★	★	
	International co-ordination of innovation policy	Compensating firms for market failures in the provision of innovative effort.		★★	★	
	Framework policies (e.g. PMR, EPL, anti-trust and competition policy, Insolvency regimes, Judicial Efficiency, Financial markets, Openness)	Competitive pressures and creative destruction.	More experimentation. Innovative entrants bring new ideas and pressure incumbents to innovate.	★★	★	
			Enhanced market size to raise the returns to innovation.	★	★	
		Efficient resource allocation (see 3).	Entry into global markets enables interactions with the GF	★	★★	
			Lower skill mismatch, which increases the effective pool of skills to supply innovation	★	★★	
2. Knowledge and innovation diffusion	Framework policies (especially PMR)	Competitive pressures	Greater market discipline incentivises technology adoption		★★	★★
			Presence of complementary KBC assets to facilitate technological diffusion		★★	★
	IPR protection Basic research, policies for other forms of KBC (e.g. data, ICT) R&D fiscal incentives and other public support for innovation	Compensating firms for market failures in the provision of innovative effort.	Knowledge externalities from public research leads to more applied innovation in the private sector		★★	
					★	★
	R&D collaboration between firms and universities, international science & technology cooperation	Knowledge transfer and spillovers	Allows new entrants, experimenting at small scale, to access research facilities.		★	★★
3. Efficient resource reallocation	Framework policies (especially PMR, competition and anti-trust, EPL, ALMPs, Insolvency, Financial markets)	Channelling scarce resources to the most productive and innovative firms; exit/downsizing of inefficient firms.	Higher returns to commercialisation and implementation of new ideas, leading to more experimentation (see 1)	★★	★	★
			Lower the cost of business failure and exit to encourage risk-taking and experimentation (see 1)	★★	★	★
			Facilitates up-scaling and entry into global markets (see 1)	★	★★	★
			Lower skill mismatch (particularly over-skilling), which increases the effective pool of skills to supply innovation (see 1)	★	★★	★
	Housing policies					

Source: OECD (2015a)

56. Expanding from Table 4, the following policies would seem to be most relevant for the three channels identified in previous sections:

57. **Policies for knowledge creation**: A range of different policies matter for process, marketing and organizational innovations. Targeted policies include:

- Global coherence and transparency of intellectual property rights (IPR) regimes. Ex ante returns on investment in innovation should be ensured without favouring incumbents. Balancing these factors may require a review of existing IPR regimes to match technological developments in certain industries.

- Policies directed to facilitate cross-border, cross-field collaboration, and university-private sector collaboration, to promote a balance between basic and applied research and to address market failures in the provision of innovative effort.

- Public investment in higher education and basic research, which drives fundamental advances in knowledge and supports private R&D.

- R&D fiscal incentives and direct support designed so as to ensure a level playing field for new entrants and incumbents.[11]

- Policies facilitating other forms of investment in KBC, e.g. data and ICT.

58. More generally, business investment in physical and knowledge based capital is crucially affected by expectations. Future developments of demand, prices and policy affect firm investment decisions. Therefore, to foster investment:

- Monetary and fiscal policies should be designed in a coherent manner and supported by structural reforms in order to facilitate the necessary reallocation of resources. In turn structural reforms need to be matched by monetary and fiscal policies that make the reallocation of resources as smooth as possible.

- Policy uncertainty should be reduced, avoiding retroactive policy revisions, and providing firms with a medium-long term policy horizon.

- Public investment should be channelled to catalyse private investment.

59. Additionally, other framework policies that contribute to reduce the risks connected with experimentation, and ultimately foster innovation, include:

- Bankruptcy regimes that do not punish experimentation failures by forcing early liquidation or penalising future ability to restart a business.

- Policies to develop capital markets and markets for seed and early stage finance, to provide start-ups with the necessary access to finance.

- Product market reforms and pro-competition policies that reduce barriers to new entrants and increase rivalry among firms.

11 R&D tax credits require particular attention at the implementation stage. The standard design of such policy excludes many young firms that usually make losses in the early years of an R&D project. For the young firms to benefit from the program, the R&D tax credit should contain provisions for immediate cash refunds for R&D expenditure or allow such firms to carry associated losses forward to deduct against future tax burdens.

60. **Policies for knowledge diffusion:** Some of the policies that are relevant for knowledge creation also positively affect knowledge diffusion, such as public investment in basic research and fiscal incentives for R&D investment, which help generate the knowledge base necessary to absorb cutting-edge technologies and best practices, or general pro-competition policies. However, additional channel-specific policies may be identified, such as:

- Injecting competition and facilitate the establishment of new business models (e.g. platform-based) in services to incentivise the adoption of better technologies and managerial practices.
- Incentives for closer collaboration between firms and universities to allow smaller firms to access resources (human capital, labs & machineries, knowledge) that they could not afford otherwise.
- Trade policy reform and trade and investment agreements to foster international linkages, connectedness to global frontier firms and facilitate firms' global activities, for instance by reducing restrictions on FDI.

61. Other framework policies can contribute to create a business environment conducive to knowledge diffusion through:

- Education policies that generate and maintain the skills that are complementary to new technologies.

- Implementing metropolitan planning and housing policies that allow cities to attract and catalyse synergies across skills (for instance, by reducing congestion and commuting times and making housing more accessible).

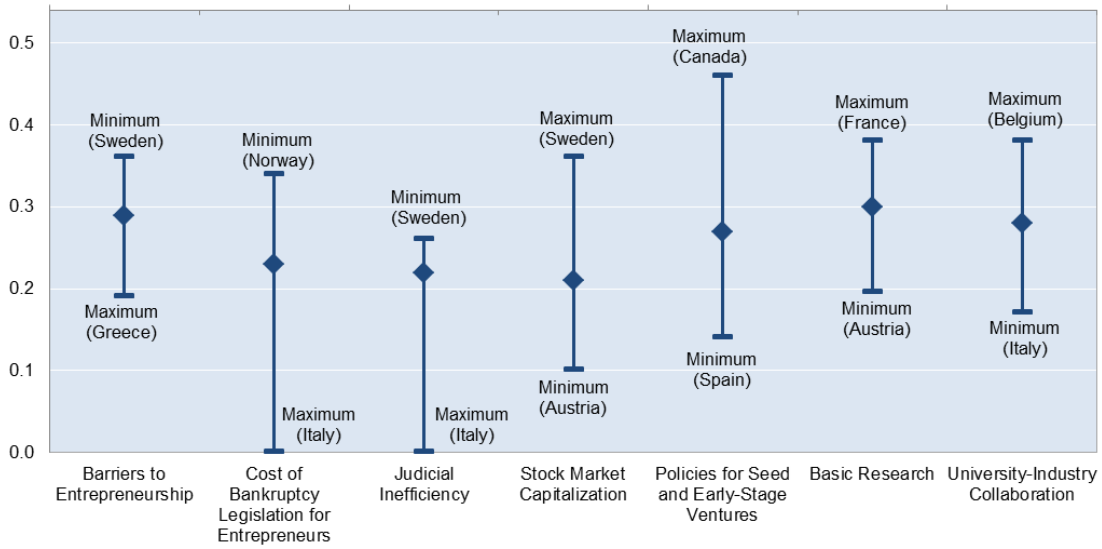
- Strengthening the efficiency of judicial systems (e.g. by reducing the cost and length of trials), thereby encourage investment, business inter-linkages and foster firm growth. Associated with anti-corruption actions, enforcement of the rule of law and fiscal reform, an efficient judicial system can also help to reduce informality.

- Ensuring adequate public investment (or leveraging private investment) in maintenance and creation of key infrastructures (for instance, in domestic and intra-regional transport and communication networks, notably broadband networks).

62. Based on OECD research, Figure 12 shows how productivity gains from frontier knowledge spillovers depend on policy settings. For instance, a country with relatively low level of basic research, such as Austria, would double the gains by stepping up spending on basic research to the level of France.

Figure 12. Public policies and learning from the global frontier

Estimated frontier spillovers (% per annum) associated with 2% point increase in MFP growth at the global frontier.



Notes: The chart shows how the sensitivity of MFP growth to changes in the frontier leader growth varies with different levels of framework and innovation policy variables. The diamond refers to the estimated frontier spillover effect associated with a 2% MFP growth at the frontier around the average level of the policy. The label "Minimum" (Maximum) indicates the country with the lowest (highest) value for the given policy indicator in a given reference year.

Source: Saia, Andrews and Albrizio (2015).

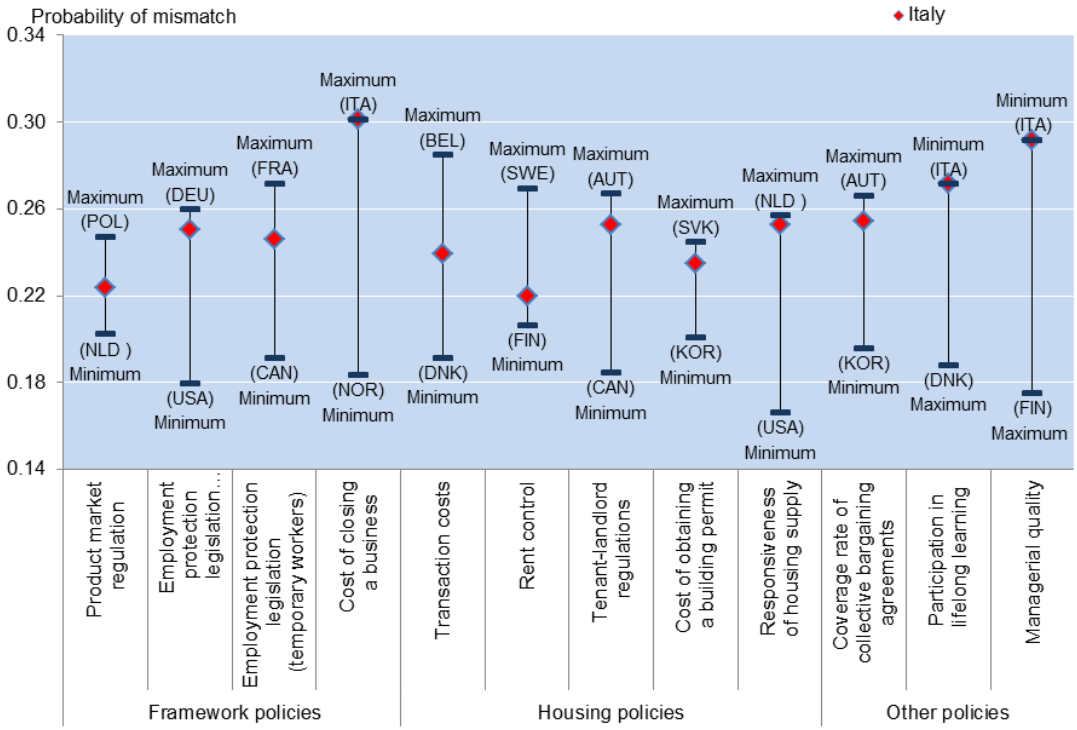
63. **<u>Policies for an efficient reallocation of resources:</u>**

64. Most of the policies that foster knowledge diffusion are also relevant for improving the efficiency of reallocation. Additional ones that would foster efficient reallocation of capital and/or labour, including by reducing skill mismatch, are:

- Improving the efficiency of bankruptcy legislation can reduce the likelihood that valuable resources are trapped in inefficient firms.
- Reforming housing policies to support residential and job mobility by reducing moving costs (notably the transaction costs affecting the buying and selling of dwellings and other regulations stifling housing markets).
- Lowering hiring and firing costs, by reducing the stringency of employment protection legislation.
- Promote adult learning to empower workers with the knowledge and competencies that allow them to keep up with technological progress.

65. By way of illustration, Figure 13 describes how reforming different policies can reduce the probability of skill mismatch in Italy, based on OECD research (Adalet McGowan and Andrews, 2015b). By reforming framework, housing and other policies, governments may improve the matching in the labour market and eventually the allocation of skills in the economy.

Figure 13. Policy reforms can help reduce skill mismatches – the case of Italy



Notes: The dot is the probability to have mismatch evaluated at the policy value for the relevant country (Italy) and individual characteristics, which include age, marital and migrant status, gender, level of education, firm size, contract type, a dummy for working full-time and working in the private sector. The distance between the Min/Max and the country value is the change in the probability of skill mismatch associated with the respective policy change.

Source: Adalet McGowan, M and D. Andrews (2015b).

4.2 Setting institutions right

66. Productivity-enhancing institutions support governments in the identification and implementation of the right policies to address productivity challenges. In the context of recent OECD Economic Surveys and in the taxonomy proposed by Banks (2015) for the GFP, relevant institutional forms have been discussed. While many of their features are country-specific, and are designed to address specific institutional failures and/or strengths, some general observations concerning the pros and cons of different settings can be made.

67. Key features are summarized in Table 5, using "subjective" star ratings. Importantly, while only a few institutional forms would appear to satisfy the criteria to a high degree, in combination they may play a more significant complementary role, depending on the extent to which government relies on them for designing and enforcing productivity policies.

Table 5. An institutional 'scorecard' for promoting productivity-enhancing policies

Type of institution	Policy linkages	Legal mandate	Skills	Independence	Transparency
Standing inquiry body	★★★	★★★	★★★	★★★	★★★
Ad hoc taskforce	★★★	★★★	★★★	★★	★★
Advisory council	★★★	★★	★★★	★	★★
Central Bank research unit	★★	★★	★★★	★★★	★
Departmental bureau	★★★	★	★★★	★	★
Competition authority	★★	★★	★★	★★★	★
Publicly funded think tank	★★	★★	★★★	★	★★

Source: Adapted from Banks (2015).

68. Not all of these organisations were designed to strengthen policy-making with respect to productivity, although some institutions were expressly designed for this purpose. These include advisory councils, *ad hoc* taskforces and, less commonly, bodies with standing research and inquiry functions. The extent of their respective contributions has depended on a range of factors, including the detail of their governance and operations, the tasks they have been assigned and how well governments have handled their reports.

69. While there is unlikely to be a 'one design fits all' solution, there would seem to be scope for most governments to build or strengthen institutional capability that suits their circumstances and meets the broad requirements outlined here:

- One option, for example, is to extend or adapt the role of an existing institution that already has some desirable features, such as an independent tariff tribunal, audit body or economic regulator (as in Australia) or advisory council (as in Mexico).

- Another is to begin by appointing a special taskforce to conduct an arm's length review of the policy landscape, with a view to identifying more specific priorities for early action or in-depth review (as in Denmark or Norway).

- A third option is to create an institution with legislative foundations and remit, but to make these subject to a 'sunset clause' after a specified period (say three to five years). Within this period, the body could be commissioned to undertake a broad review and more detailed investigations in areas identified as priorities. A 'hybrid' model of this kind could bring the added advantages of a standing body, without posing some of the perceived political risks for government. Moreover, an independent review of the institution's operations and impact prior to the end of its term could be used by the government of the day to determine whether to renew its mandate for a further period (or indefinitely, as in Australia and New Zealand).

70. There is accordingly also considerable potential for governments to learn from each other about the relative merits of different institutional approaches, and for existing institutions themselves to build capability by drawing on the experience of others. The GFP is well placed to facilitate such mutual engagement and learning, which could ultimately see governments becoming better equipped to secure the pro-productivity policies that are crucial to sustained improvements in living standards.[12]

12 The example of Mexico is an illustrative one, where the OECD has made recommendations in the context of Economic Surveys that helped to form the initial setup of the National Productivity Council, and supported the clarification of its legal mandate and substantive agenda. This included work on estimating the potential impact of structural reforms (OECD, 2013b, 2015d; Dougherty, 2015).

5. Tailoring policies to issues

71. Using the above analysis, broad country profiles can be drawn, each corresponding to a different diagnosis concerning productivity pitfalls.[13] In turn, different diagnoses may call for specific policy packages. Whilst decelerating productivity is currently observed globally, countries often differ with respect to some of the structural dimensions presented in Table 1, such as productivity levels, speed of catch-up, business dynamics, etc. This subsection presents three different country profiles corresponding to typical productivity diagnoses and sketches the policy therapies that are needed to address them effectively.

5.1 Illustrative country profiles

72. The first country profile is that of an industrialised country with an average OECD aggregate productivity level experiencing a productivity slowdown (as it could be the case, for instance, of Italy and Japan). This country has a sizeable gap between median and frontier productivity levels and various structural indicators signal significant problems in capital and labour allocation (i.e. a high share of zombie firms, a high share of old and small firms, a high rate of skill mismatch). These structural factors suggest that there is a problem of knowledge diffusion, originating from a lack of business dynamism, and that there is substantial room for improvements in resource allocation. In terms of productivity-enhancing institutions, the country has the institutional capacity required to address productivity-related issues, both in terms of human capital and public sector development. However, this capacity is not channelled into a co-ordinated and efficient effort, either because the mandate of the institutions that should promote productivity-enhancing policies is not well defined, or because there is a co-ordination failure between the governmental bodies involved.

73. The second country profile consists of an advanced country whose aggregate productivity is close to the global frontier but is also experiencing a productivity slowdown, such as in United States and Sweden. This country has a smaller gap between frontier and median productivity, and an efficient allocation of resources, as reflected in low rates of skill mismatch, high managerial capacity, and a strong contribution of allocative efficiency to the aggregate productivity level. However, the country is characterized by declining investment (especially ICT and KBC components) and business dynamism (e.g. with falling business start-up rates). These diagnostics generate concerns about the future pace of experimentation, innovation and growth. From an institutional perspective, this country is lacking a productivity-focused public engagement, but it can count on significant private productivity-enhancing initiatives (think tanks, etc.).

74. Finally, the last country profile is that of a country whose aggregate productivity level is far from the global frontier and where, notwithstanding the fast productivity catch-up experienced in the past, high productivity growth has slowed perhaps due to a typical middle-income trap. Examples would be Mexico, Chile and Costa Rica. Substantial gaps exist between a few high-productivity firms and a fat tail of low-productivity ones. The country has neither adequate public infrastructure (low and inefficient public investment in transport, telecommunications and education) nor well-developed urban planning, which leads to high congestion costs. Skills shortages, informality and corruption negatively affect firms' growth and investment (both in physical capital and KBC). Limited trade integration into global value chains hinders the adoption of frontier technologies and new business models, reducing the market opportunities for domestic firms and nurturing the productivity gaps. Finally, this country has neither a dedicated institution to promote productivity nor the resources readily available to address these challenges.

13 To define such profiles, the indicators have to be compared against a benchmark which can consists of the OECD or the sample averages (depending on data availability), or of average scores of the top performers countries. This choice may be dictated not only by data availability constraints, but also by the distribution of the indicators across countries.

5.2 Policy packages

75. Based on the policy influences discussed in Section 3, each country profile can be related to specific policy weaknesses and, therefore, to a tailored set of policy improvements that are necessary to boost productivity.

Profile I

76. From the first profile analysed, three different issues emerge: weak knowledge diffusion, inefficient resource allocation and institutional coordination failure.

77. In order to address the problem of diffusion, the policy effort should be targeted to foster the speed of catch-up of laggard firms and encourage business dynamism. This may require strengthening competitive pressures and reforming regulations in services markets to boost investment in knowledge based capital and ICT. It may also require facilitating access of smaller-sized dynamic firms to the resources they need to adopt new technologies, for instance by fostering university-industry R&D collaboration, and stepping up efforts to upgrade average skill levels in the population via education reforms. Another way to reactivate the diffusion channels and give a significant push to domestic productivity, may come from policies that increase the connectedness to global market, for instance through the participation in high-level trade agreements and the reduction of restrictions on inward foreign investment.

78. Addressing inefficiencies in resource allocation requires a wide package of reforms in labour and product markets, including finance and housing. These may include for instance easing hiring and firing rules, revamping lifelong learning and training programmes, facilitating the restructuring of banks' balance sheets and reviewing insolvency regimes and bankruptcy laws. Reallocation friendly policies are clearly desirable but should be flanked by adequate policy measures (e.g. well-designed ALMPs) to insure workers against labour market risk and make such reforms politically possible in the first place (See Andrews and Saia (2016)).

79. Assuming that existing public bodies have the capacity to address productivity challenges, improving the ability to channel this capacity effectively could require a clear mandate that accurate nests the productivity-dedicated institution(s) within the existing legislative framework, which could help overcoming coordination problems. Also strengthening the independence and transparency of the bodies involved could contribute to build consensus with legislatures and the public for the necessary policy reforms.

Profile II

80. The second profile suggests a declining ability to create new knowledge by a frontier country, likely related to a lower rate of experimentation (decreasing investment in R&D and KBC, falling start-up rates, aging frontier firms). Decreasing business dynamism and a weakening of the creative-destruction process may be related to insufficient competition in certain services that are important for business development, excessive incumbent power in certain key dynamic markets and may also mirror a degradation of public infrastructure.

81. A package combining innovation-targeted policies and reforms of framework conditions may reactivate the experimentation machine. This may require reviewing the IPR regime to enhance efficiency and transparency (for instance reducing the length of the patenting process) and preventing its strategic use by incumbents. It could also require reviewing fiscal incentives to innovation to level the playing field between incumbents and new entrants. Removing remaining barriers to competition in services markets could also contribute to restore incentives for investment in KBC and ICT. In general, when looking at policy barriers and distortions, the focus should be broaden in order to include also state and local level regulations. Finally, public investment in the maintenance of infrastructure could

be necessary since many types of infrastructure complement business activity and such deterioration negatively affects aggregate productivity.

82. On the institutional side, while a multi-stakeholder involvement in the productivity dialogue is an asset, focused public engagement in the development and implementation of productivity-enhancing policies is fundamental to channel private initiatives and increase their impact on policy design.

Profile III

83. The third profile reflects the situation faced by many emerging economies. The lack of appropriate infrastructure and weak institutions can hold back an economy that otherwise would have sufficient human and natural resources to quickly catch-up with the frontier. An appropriate set of productivity-enhancing reforms for this country would include stimulating public and private investment and improving broad framework policies.

84. Investment in infrastructures would ensure adequate conditions for business developments in terms of transport, telecommunications, and access to electricity, etc. Investment in education is key to foster social mobility and generate the skill capacity required to participate as an active player in global markets.

85. Framework policies, such as a stronger judicial system and rule of law would reduce corruption and informality, favouring the reallocation of resources to the most productive firms. Reducing the complexity of administrative procedures for business and simplifying sector-specific regulations, would help the integration into global value chains and would indirectly contribute to reduce informality. Strengthening the competition framework (e.g. by sanctioning cartels) would encourage entry of new firms and generate stronger incentives for managerial performance.

86. In terms of productivity-enhancing institutions, both investment in capacity building and a clear understanding of the country productivity challenges and opportunities are at the core of an effective productivity strategy. This understanding may involve the creation of one or more dedicated institutions depending on the country institutional setting and characteristics.

Table 6. Priority policy packages for different country profiles

	Profile I	Profile II	Profile III
Policies	*Weak knowledge **diffusion**, inefficient resource **allocation** and institutional **coordination failure** between the institutions involved in promoting productivity-enhancing policies*	*Declining ability to create **new knowledge** by a frontier country. Absence of a productivity-focused **public engagement** but significant private productivity-enhancing initiatives*	*Large productivity gap and **decreasing ability to catch-up** due to lack of appropriate infrastructure and weak institutions. **Absence of a dedicated institution to promote productivity***
Service sector regulation reforms	★	★	
Collaboration on science and innovation	★	★	
Trade and FDI policies	★		★
Product market reforms	★	★	★
Labour market reforms	★		
Insolvency regimes and bankruptcy laws reforms	★		
Innovation policies	★	★	
Fiscal incentives		★	
Public investment in infrastructure	★	★	★
Education policies:			
Higher education	★		
Primary and secondary education			★
Judicial system reforms	★		★
Pro-competition reforms	★	★	★
Rule of Law			★
Set-up of productivity-enhancing institutions			
Strengthen independency and transparency	★		
Provide a clear mandate	★		
Create a focused public engagement in a collaborative dialogue with the existent private initiatives		★	
Investment in capacity building, creation of one or more dedicated institutions			★

REFERENCES

Adalet McGowan, M and D. Andrews (2015a), "Labour market mismatch and labour productivity: evidence from PIAAC data", *OECD Economics Department Working Papers*, No. 1209, OECD Publishing, Paris.

Adalet McGowan, M. and D. Andrews (2015b), "Skill Mismatch and Public Policy in OECD Countries", *OECD Economics Department Working Papers*, No. 1210. OECD Publishing, Paris.

Adalet McGowan, M. and D. Andrews (2017), "Productivity and Policies: Dynamic Resource Allocation in OECD Countries", *OECD Economics Department Working Papers*, forthcoming, OECD Publishing, Paris.

Ahmad, N. and P. Schreyer (2016), "Are GDP and Productivity Measures Up to the Challenges of the Digital Economy?", *International Productivity Monitor*, No. 30.

Andrews, D. and A. de Serres (2012), "Intangible Assets, Resource Allocation and Growth: A Framework for Analysis", *OECD Economics Department Working Papers*, No. 989, OECD Publishing, Paris.

Andrews, D. and A. Saia (2016), "Coping with Creative Destruction: Reducing the Costs of Firms Exit.", *OECD Economics Department Working Papers*, forthcoming, OECD Publishing, Paris.

Andrews, D. and B. Westmore (2014), "Managerial Capital and Business R&D as Enablers of Productivity Convergence", *OECD Economics Department Working Papers*, No. 1137, OECD Publishing, Paris.

Andrews, D. and F. Cingano (2014), "Public Policy and Resource Allocation: Evidence from firms in OECD countries", *Economic Policy*, Issue 74 , April.

Andrews,D. and C. Criscuolo (2013), "Knowledge-Based Capital, Innovation and Resource Allocation", *OECD Economics Department Working Papers*, No. 1046, OECD Publishing, Paris.

Andrews, D., C. Criscuolo, P. Gal (2015), "Frontier firms, technology diffusion and public policy: Micro evidence from OECD countries", *OECD Productivity Working Papers*, N°2, OECD Publishing, Paris.

Andrews, D., C.Criscuolo and P. N. Gal (2016), "The Global Productivity Slowdown, Technology, Divergence and Public Policy: A Firm Level Perspective", forthcoming, OECD Publishing, Paris.

Andrews,D., C. Criscuolo and C. Menon (2014), "Do Resources Flow to Patenting Firms?: Cross-Country Evidence from Firm Level Data", *OECD Economics Department Working Papers*, No. 1127, OECD Publishing, Paris.

Arnold, J., S. Stefano and G.Nicoletti (2011). "Regulation, resource reallocation and productivity growth," *EIB Papers 4/2011*, European Investment Bank, Economics Department.

Bank of England (2013), *Inflation Report*, London, August.

Bank of Korea (2013), *Financial Stability Report*, Seoul.

Banks, G. (2015), "Institutions to Promote Pro-Productivity Policies Logic and Lessons", *OECD Productivity Working Papers*, N°1, OECD Publishing, Paris.

Baumol, W.J. (2002), *The Free-Market Innovation Machine: Analyzing the Growth Miracle of Capitalism*, Princeton University Press.

Bloom, N., R. Sadun and J. Van Reenen (2012), "Americans Do IT Better: US Multinationals and the Productivity Miracle*", American Economic Review* 102(1): 167–201.

Bloom, N., R. Sadun, and J. Van Reenen (2013), "Management as a Technology", *LSE mimeo*.

Bloom, N.A., R. Lemos, R. Sadun, D. Scur, J. Van Reenen (2016), "International Data on Measuring Management Practices", *American Economic Review*, Vol. 106, Issue 5, Pages 152-156.

Boning, B., C. Ichniowski and K.Shaw (2007), "Opportunity Counts: Teams and the Effectiveness of Production Incentives," *Journal of Labor Economics* 25(4), 613-650.

Bourlès, R, G. Cette, J. Lopez, J. Mairesse, G. Nicoletti (2013), "Do Product Market Regulations In Upstream Sectors Curb Productivity Growth? Panel Data Evidence for OECD Countries", *The Review of Economics and Statistics*, Vol. 95, No. 5.

Brynjolfsson, E., A. Renshaw and V. Marshall Alstyne (1997), "The Matrix of Change: A Tool for Business Process Reengineering", *Sloan Management Review*, pp. 37-54.

Byrne D.M., Fernald J.G. and Reinsdorf M.B. (2016), "Does the United States have a productivity slowdown or a measurement problem?," *Brookings Papers on Economic Activity*.

Caballero, R. J., T.Hoshi and A.K. Kashyap. 2008. "Zombie Lending and Depressed Restructuring in Japan," *American Economic Review*, 98(5): 1943-77.

Calvino, F., C. Criscuolo and C. Menon (2016), "No Country for Young Firms?: Start-up Dynamics and National Policies", *OECD Science, Technology and Industry Policy Papers*, No. 29, OECD Publishing, Paris.

Conway, P. and G. Zheng (2014), "Trade Over Distance for New Zealand Firms: Measurement and Implications", *New Zealand Productivity Commission Working Paper*, No. 5.

Corrado C., C. Hulten and D. Sichel (2005), "Measuring Capital and Technology: An Expanded Framework", in "Measuring Capital in the New Economy", C. Corrado, J. Haltiwanger, and D. Sichel, eds., *Studies in Income and Wealth*, Vol. 65, Chicago: The University of Chicago Press.

Corrado, C., and B. van Ark (2016), "The Internet and productivity", Chapter 6 in *Handbook on the Economics of the Internet,* pp 120-145 from Edward Elgar Publishing

Dabla-Norris, E., M. Gradstein and G. Inchauste (2007), "What Causes Firms to Hide Output? The Determinants of Informality", *Journal of Development Economics*.

De Loecker, Jan and Frederic Warzynski. 2012. "Markups and Firm-Level Export Status." American Economic Review, 102(6): 2437-71.

de Serres, A., N. Yashiro, H. Boulhol (2014), "An International Perspective on the New Zealand Productivity Paradox", *New Zealand Productivity Commission Working Papers*, Vol. 2014/01.

Dougherty, S. (2015), “Boosting Growth and Reducing Informality in Mexico”, *OECD Economics Department Working Papers*, No. 1188, OECD Publishing, Paris.

Dougherty, S. and O. Escobar (2016), "Could Mexico become the new ‘China’? Policy drivers of competitiveness and productivity", *OECD Productivity Working Papers*, No 4, OECD Publishing, Paris.

Dougherty, S., R. Herd, He P. (2007), “Has a private sector emerged in China's industry? Evidence from a quarter of a million Chinese firms”, *China Economic Review*, Vol. 18, No. 3. (OECD ECO WP 471)

Foster, L., C. Grim and J. Haltiwanger (2016), “Reallocation in the Great Recession: Cleansing or Not?”, *Journal of Labour Economics*, Vol. 34.

Gal, P. (2013), “Measuring Total Factor Productivity at the Firm Level using OECD-ORBIS”, *OECD Economics Department Working Papers*, No. 1049, OECD, Paris.

García-Santana, M., E. Moral-Benito, J. Pijoan-Mas and R. Ramos “Growing like Spain: 1995-2007, *CEPR Discussion Paper* 11144.

Giacomelli, Silvia and Menon, Carlo, “Firm Size and Judicial Efficiency: Evidence from the Neighbour's Court “(January 30, 2013), *Bank of Italy Temi di Discussione* (Working Paper) No. 898.

Henderson, R. (1993), “Underinvestment and Incompetence as Responses to Radical Innovation: Evidence from the Photolithographic Alignment Equipment Industry”, *RAND Journal of Economics*, 24(2), pp. 248–270.

Hsieh, C-T. (2015), “Policies for Productivity Growth”, *OECD Productivity Working Papers*, N°3, OECD Publishing, Paris.

Hsieh, C-T., P.J. Klenow (2009), “Misallocation and Manufacturing TFP in China and India”, *The Quarterly Journal of Economics*, Vol. CXXIV, Issue 4.

Johansson, Å., Y. Guillemette, F. Murtin, D. Turner, G. Nicoletti, C. de la Maisonneuve, P. Bagnoli, G. Bousquet and F. Spinelli (2013), “Long-Term Growth Scenarios”, *OECD Economics Department Working Papers*, No. 1000, OECD Publishing, Paris.

La Porta, Rafael and Andrei Shleifer, (2014), "Informality and Development", *Journal of Economic Perspectives*, 28(3): 109-26.

Le Mouel, M. and M. Squicciarini (2015), “Cross-Country Estimates of Employment and Investment in Organisational Capital: A Task-Based Methodology Using Piaac Data”, *OECD Science, Technology and Industry Working Papers*, 2015/08, OECD Publishing, Paris.

Lazear, E.P. (2000), “Pay and Productivity”, *The American Economic Review*, Vol. 90, No. 5 (Dec., 2000), pp. 1346-1361.

OECD (2003), *The Sources of Economic Growth in OECD Countries*, OECD Publishing, Paris.

OECD (2005), *Economic Policy Reforms: Going for Growth*, OECD Publishing, Paris.

OECD (2010), *Making Reform Happen: Lessons from OECD Countries*, OECD Publications, Paris.

OECD (2013a), *Supporting Investment in Knowledge Capital, Growth and Innovation*, OECD Publishing, Paris.

OECD (2013b), *Economic Survey of Mexico*, OECD Publications, Paris.

OECD (2015a), *The Future of Productivity*, OECD Publishing, Paris.

OECD (2015b), *OECD Economic Survey: United Kingdom*, OECD, Paris.

OECD (2015c), *OECD Economic Survey: Japan*, *OECD*, Paris.

OECD (2015d), *OECD Economic Survey: Mexico*, OECD, Paris.

OECD (2015e), Employment Outlook 2015, OECD Publishing, Paris.

OECD (2016a), *OECD Compendium of Productivity Indicators 2016*, OECD Publishing, Paris.

OECD (2016b), *United States Economic Survey*, OECD, Paris, forthcoming.

OECD (2016c), *The Productivity-Inclusiveness Nexus*, OECD, Paris, OECD Publishing, Paris.

Ollivaud, P. and D. Turner (2015), "The Effect of the Global Financial Crisis on OECD Potential Output", *OECD Journal: Economic Studies*, Vol. 2014, OECD Publishing, Paris

Ollivaud, P., Y. Guillemette and D. Turner (2016), "The Links between Weak Investment and the Slowdown in OECD Productivity and Potential Output Growth", *OECD Economics Department Working Papers*, forthcoming, OECD Publishing, Paris.

Peek, J. and E.S. Rosengren, 2005, "Unnatural Selection: Perverse Incentives and the Allocation of Credit in Japan", *American Economic Review* 95, 1144-1166.

Renda, A. (2016), "Pro-productivity institutions: Selected national experiences", Draft paper prepared for the 2016 Conference of the OECD Global Forum on Productivity, Lisbon, Portugal.

Saia, A., D. Andrews and S. Albrizio (2015), "Productivity Spillovers from the Global Frontier and Public Policy: Industry-Level Evidence", *OECD Economics Department Working Papers*, No. 1238, OECD Publishing, Paris.

Syverson C., "Challenges to Mismeasurement Explanations for the U.S. Productivity Slowdown", *National Bureau of Economic Research Working Paper*, No. 21974.

ANNEX I

Table A.1 Measures of Productivity

Measure of productivity	Definition	Concept	Measurement issues	Sources
Labour Productivity	**Aggregate level:** Output volume (real GDP) per hour worked. **Industry and Firm-level:** Real value added per number of employees or hours worked.	It captures the efficiency in using labour inputs. This measure ca be broken down in public and private labour productivity (excluding production by governments and non-profits). This differentiation is difficult in case of heavy state ownership across the economy.	Ideally productivity measures should be based on volumes, but due to data unavailability these are derived by looking a nominal measure, which, by definition, include a price component. To adjust these nominal figures (GDP, value added), usually a single price deflator is used, which generates a measurement error. For aggregate data this measurement error is not particularly significant, however, constant PPP conversion is necessary when comparing productivity levels. On the contrary, this issue is relevant for firm-level data and it gets larger when there are rapid changes in the mix of available products and where they are sold. When countries have significant cross border flows of workers and property income, the gross national income (GNI) may better reflect the income of the country and the output. Another potential source of misspecification lies in the way labour inputs are defined. Ideally labour should account for both the hours worked and the skill composition of the labour force. This becomes a problem especially at firm level where data on human capital does not exist on an extensive basis. Moreover, in some cases, a measurement difference of working hours between countries makes it necessary to consider headcount employment. However, quantification of labour inputs using number of employees fails to account for part-time jobs, self-employment and quality of labour.	**cross-country aggregate level:** OECD Productivity Statistics database, Long-Term productivity Database (BdF). Calculation using data from ADB and EO databases. For larger country samples: PENN World Table or World Bank WDI database **cross-country industry level:** OECD PDBI, STAN, KLEMS, OECD MULTIPROD (aggregated firm data). **cross-country firm level:** OECD ORBIS, OECD MULTIPROD, Calculation from Worldscope

Capital productivity	Ratio of output volume (real GDP) to volume of capital inputs (capital services). In the case of firms and industries, output is proxied by real value added.	It measure how efficiently capital is used to produce output.	Capital stock, which measures the flow of capital services to production, is an aggregation of fixed capital formation (investment) over time. It includes both ICT (computer software, databases, hardware, telecommunication equipment) and non-ICT (non-residential construction, transport equipment, other machineries, R&D, other intellectual property rights). The accurate measurement of capital stock and definition of accounting standards is a work in progress also due to the challenges associated with rapid technological change.	**cross-country aggregate level:** OECD Productivity Statistics database, Long-Term productivity Database (BdF) **cross-country industry level:** OECD PDBI, KLEMS, **cross-country firm level::** OECD ORBIS Productivity Database, OECD MULTIPROD, Calculation from Worldscope
Multifactor productivity	Residual measure - the part of growth that is not explained by growth I labour and capital inputs. In the case of firms and industries, output is proxied by real value added.	Overall efficiency with which labour and capital are used together	Being a residual measure, MFP captures the contribution of other inputs not included in the growth accounting: adjustment costs, changes in capacity utilization, economies of scale, effects from imperfect competition, natural resources, managerial skills, etc. Residual should be purged from the effect of human capital as the stock of human capital adjusted for quality is very problematic. Some MFP measures, such as KLEMS, account for services, materials, energy. Recent OECD work (Cárdenas Rodriguez et al. forthcoming) calculates the productivity adjusted for the use of natural capital (14 subsoil assets) and pollution (8 types of air emissions). The measurement issues of capital and labour described above, may equally cause misspecification of MFP measures. Moreover for cross-country comparison purposes output and the capital stock need to be adjusted for PPPs.	**cross-country aggregate level:** OECD Productivity Statistics database, Long-Term productivity Database (BdF), calculation from OECD ADB/EO; PENN World Table; WB WDI, OECD Environmentally adjusted multifactor productivity database (forthcoming) **cross-country Industry level:** OECD PDBI, KLEMS, OECD MULTIPROD (aggregated firm data), OECD STAN **cross-country firm level:** OECD ORBIS Productivity Database, Calculation from Worldscope

Source: OECD

www.oecd.org/global-forum-productivity/Lisbon2016