

# Keeping pace with technological change: The role of capabilities and dynamism

CONFERENCE OF THE GLOBAL  
FORUM ON PRODUCTIVITY



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GLOBAL  
FORUM ON  
PRODUCTIVITY



## About the Global Forum on Productivity

The Global Forum on Productivity (GFP) was launched by the OECD in 2015 to foster international co-operation between public bodies with responsibility for promoting productivity-enhancing policies. The GFP is a platform where participants convene to exchange information, discuss research findings and best practices in policy, and undertake joint analysis related to productivity. The work programme of the GFP is guided by a Steering Committee of countries and supported by the work of the OECD Secretariat.

## Contact

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## SUMMARY OF THE 4<sup>th</sup> ANNUAL CONFERENCE OF THE GLOBAL FORUM ON PRODUCTIVITY 20-21 JUNE 2019, SYDNEY, AUSTRALIA

*The OECD Global Forum on Productivity (GFP), the Australian Treasury and the Department of Industry, Innovation and Science co-organized the 4<sup>th</sup> Annual Conference of the GFP on “Keeping pace with technological change: The role of capabilities and dynamism” which took place in Sydney on 20-21 June 2019. The Conference gathered 188 participants from 31 countries (Argentina, Australia, Belgium, Brazil, Canada, Costa Rica, Denmark, Finland, Germany, Hungary, India, Indonesia, Ireland, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Turkey, the United Arab Emirates, the United Kingdom and the United States) and 1 regional organisation (European Union). Feedback from participants and the organizers in Australia was very positive.*

### **Introduction**

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**Heather Smith** (Secretary, Australian Department of Industry, Innovation and Science) opened by saying that Australian policymakers are keen to know about how to realize the promise of digital technologies for rising living standards. Relating to ongoing work at the Department of Industry, Innovation and Science, Dr Smith elaborated on some of the challenges for realizing this potential, including the decline in business dynamism and the disruption economic change can cause for some groups. She then called for a more multifaceted approach to innovation and policies around it: instead of just focusing on promoting the animal spirits underlying economic growth, governments should aim for inclusive growth, for instance through education and re-training. More generally, she called for being more open to fresh ideas and proposals for help policies better adapt to a rapidly changing environment.

**Meghan Quinn** (Deputy Secretary, Australian Treasury) remarked in her opening speech how, in a period in which Australia faced important headwinds, strong productivity growth would be crucial for rising living standards and yet – as intangibles grew more important – understanding its drivers would have become more elusive. To meet this challenge, research at the Treasury turned to analysing more fine grained data that allow looking “beneath the surface”. She then listed a number of relevant issues that emerged from this research, such as the growing gap between global and Australian frontier firms, stagnating laggard firms, and a general decline in dynamism of firms and workers coupled with a less efficient reallocation of resources across firms. More structural reforms would be needed to address these issues. Such reforms may be disruptive, as Meghan emphasized, and policies would be needed to address the transitional costs they may impose on some workers.

**Dirk Pilat** (Deputy-Director, OECD) provided a brief introduction to the GFP. The growing need for a better international dialogue on drivers of productivity and productivity-enhancing policies have lead to its founding in Mexico in 2015. Its aim was to bring together policy makers and experts, and to advance the discussion by providing additional research focused on issues that were key to the debate. Dirk went on to list a few aspects that had been learned from the GFP since its beginning, such as the need to go beyond aggregate statistics and distinguish frontier and laggard firms to understand productivity developments, the widespread nature of the rise in industry concentration, and the role of productivity boards for improving policies. Lastly, with its new project ‘The Human Side of Productivity’ the GFP would continue to push the research agenda by looking into firms. Acknowledging that this work would not have been possible without its members, Dirk thanked current and past GFP members and invited more countries to join.

## Setting the Stage: Day 1

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**Chad Syverson** (Professor, University of Chicago) presented joint work with Erik Brynjolfsson and Daniel Rock on the 'Productivity J-Curve', which explored the role of intangibles for productivity measurement. He started his discussion by setting out recent advances in Artificial Intelligence (AI), focusing on machine learning in particular. He then outlined a paradox motivating the present paper: Despite these technological advancements, productivity growth was disappointing in many OECD countries. He explained that this 'paradox' was indeed a recurrent pattern for general purpose technologies (GPTs), groundbreaking technologies that are pervasive, improve over time and stimulate complementary innovations. For example, for GPTs electricity and information technology productivity growth accelerated only several decades after their introduction.

In the rest of his presentation, he pursued an explanation for this pattern that would be complementary to existing explanations holding that costly complementary investments in intangibles would slow down diffusion: The relatively slow productivity growth following the introduction of GPTs and the subsequent surge in productivity could at least partly reflect *changes* in the mismeasurement of productivity. The intuition for this hypothesis would be based on the relative contribution of missing outputs or inputs for measured productivity. Intangible capital was often built up by directing resources towards activities not producing measured output, thus underreporting output. However, intangible capital would also be used for production, thus underreporting input. Measured productivity would be too low if more output than input was missed and vice versa. He continued to provide a model formalizing this intuition for productivity growth rates, concluding from the model that mismeasurement over time was driven by the difference in growth rates for investments in intangibles and the total stock of intangible capital. The diffusion of GPTs would imply a recurrent pattern: Because investments in intangibles would be most important in the early phase of GPT implementation, mismeasurement would change over time in line with an acceleration in observed productivity – the 'Productivity J-Curve'.

Finally, he proposed an approach for applying this model to existing technologies, using information on firms' market valuations to estimate the amount of complementary investments in intangibles associated with capital investments. Applying this approach to various types of capital associated with GPTs, he concluded that there was some evidence that recent productivity growth would actually be higher than observed. However, he noted that accounting for mismeasurement would correct productivity growth rates upwards in earlier decades even more than in recent years, so the mismeasurement of investments in intangibles captured by the J-Curve could *not* explain the widespread decline in productivity growth since 2004. Instead, it would imply that the true productivity slowdown was *even more pronounced*. Focusing on AI, Chad Syverson concluded that this technology may be at the beginning of a new J-curve, but investment in previous years was too small to have a sizeable effect on productivity growth yet.

## Session 1: Technological Change

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**Diego Comin** (Dartmouth College) presented a model that explains the persistently slow growth of productivity in recent years. The key mechanism is based on low R&D spending during the global financial crisis (or the Great Recession, GR), which not only depresses innovation at the frontier but also the adoption of existing innovations by lagging countries and firms. This channel was empirically supported by evidence on the pro-cyclical nature of technology adoption, including that adoption lags are longer during downturns. Besides capturing key turning points in productivity, the model also sheds light on inflation dynamics during the recent period. In particular, inflation was higher than expected during the GR, and

then lower than expected during the cyclical upturn phase, both of which are in line with productivity being endogenously determined. The modelling approach was a good illustration of how combining the short-run relationships – e.g. between the output gap and inflation – to those that pertain to the long run – endogenous growth elements – can yield new insights which have strong empirical relevance.

**Eric Bartelsman** (Vrije Universiteit Amsterdam) offered a fresh look, with sometimes a provocative twist, at policy approaches to address the current slow productivity environment as well as the growing societal challenges related to the spread of recent innovations (artificial intelligence, robotics, etc.). Among one of them is the mutualisation of the gains from ‘winner-takes-most’ type technologies, for instance by allocating a fraction of the income stream from innovations to a wider group of people that contributed to the creation of the innovation (e.g. professors or the university from where the innovator took classes). He also emphasised the need to regulate online platforms and come up with ways that make granular ‘big-data’ sufficiently anonymised so that it can safely be made available for public purposes, a concept of “secure but open” data (e.g. for better regulating traffic in a city). Finally he cautioned against policy to make rushed decisions and instead urged to rely on more detailed and better identified evidence drawing on rich cross-country micro data sources. Without a good understanding of the impact of ongoing innovations it is much harder to devise policies that guide and regulate them appropriately.

**Mark Cully** (Department of Industry, Innovation and Science in Australia) adopted the approach of using granular micro data to better understand macroeconomic productivity challenges in Australia during his discussion of the session. While the country has not seen any recessions for 28 years, productivity and R&D spending are weak, which could be potential headwinds for sustainable growth going forward. He highlighted recent findings using recently assembled Australian microdata (Business Longitudinal Analysis Data Environment, BLADE) from several underlying sources on the role of R&D, exporting and management capacities in driving productivity differences across businesses.

The general discussion touched on the role of demand in driving productivity (Diego Comin responded acknowledging it is indeed key to drive companies’ incentives to invest); on the role of adequate competition in fostering business incentives; on the idea of entrenchment of established incumbents is sometimes due to overly strict regulation (e.g. taxi market) to which technology is providing a response (e.g. UBER). The important distinction between “AI as an imitating tool” and “AI as a discovery tool” also came up and the implications these types of AI uses present for policy. Finally, the role of cross-border trade was discussed, in particular in relation with ‘winner-takes-most’ type technologies, which present extra challenges for smaller countries: If borders are not fully open for trading goods and services, it implies limited scalability of small-country products and services. In addition, in their smaller sized economy, the probability of big inventions to occur is also smaller, presenting another source of challenge for smaller economies in fragmented trade environments.

## *Session 2: Changing Patterns of Mkt Power and Contestability (14h00 – 15h00)*

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**Chiara Criscuolo** (OECD) drew from micro data assembled at the OECD to illustrate a number of developments that raise concern in the recent experience of OECD countries – such as rising concentration and markups (especially at the productivity frontier), declining business dynamism, increasing productivity dispersion (with a pull from the top due to winner-take-most phenomena and a slowing rate of catch-up by laggards). She then related these developments to both structural factors (such as digitalisation and a rising role of intangible investments) and policies. OECD research shows that many of these developments are most acute in sectors that are highly digitalised, intensive in intangible assets and open to trade, suggesting that the rapidly changing technology environment combined with globalisation supports fast

gains in market shares and rising markups of successful incumbent firms and creates challenges for knowledge diffusion to (and growth of) other firms, partly due to the strong complementarities between these technologies and intangibles. These structural drivers of market developments generate in turn a number of challenges for policy including updating and adapting antitrust, supporting technology adoption and intangible investment in laggard firms, reviewing intellectual property rights.

**Jonathan Asker** (UCLA) discussed the concept of market power, the available evidence and the policy issues it may raise, especially in the antitrust area. He noted that a number of stylised facts of the US economy over the past two decades – such as rising markups and concentration, a falling labour share, increasing productivity dispersion, stagnating prices and declining entry rates -- are consistent with rising market power but also with other concurrent explanations related to supply and demand shocks (such as changes in production technologies and globalisation). While market power implies rising markups, increasing concentration and a falling labour share, the reverse is not true. Therefore, until analysis establishes a stronger causal link between the stylised facts and market power, as opposed to other supply/demand factors, policies need to remain cautious. Nonetheless, policy-makers could safely put a spotlight and eventually implement changes in a number of areas, including merger control (focusing on the rise of passive institutional investors and the common ownership issues they raise as well as the treatment of mergers that fall below the threshold of antitrust), the renewed industrial policy drive resulting from the interaction between globalisation and mercantilism (e.g. the Franco-German Manifesto), the regulation of platforms and issues related to antitrust exemptions, state-aid and regulatory capture. More generally, a looming issue is whether antitrust should be targeting efficiency only or also the distribution of political power and economic gains across segments of society.

**Chris Edmond** (University of Melbourne) agreed that the evidence pointing to rising market power was a potential source of concern, but also showed using results from a DSGE model that both the interpretation of the evidence and the policy action required were far from obvious. He stressed that welfare losses from high markups have three sources: aggregate (lower employment, investment and output), allocative (distortions in the allocation of resources that affect productivity) and lower entry (due to lower activity and barriers). Those more costly for welfare are the aggregate ones that are not easy to address with policy, the misallocation and, especially, the entry channels account for very small changes in markups. Thus, focusing on policies that address entry problems is not necessarily a panacea. As rising concentration could signal better allocative efficiency, addressing concentration issues could also lead to additional distortions.

The following discussion highlighted the additional competition policy issues raised by the diffusion of no compete agreements and occupational licensing, with many agreeing to the importance of reviewing the rationale and potential negative side effects of the latter. Another important area where more evidence was called for were the repercussions from rising common ownership by institutional investors. Finally, asked on how he would prioritize policy action in the competition policy area, John Asker stressed the need for reviewing the treatment of small mergers (deemed an easy task) and address occupational licensing arrangements and mercantilist views (deemed more difficult tasks).

### *Session 3: Declining Market Dynamism*

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**Steve Davis** (University of Chicago) presented new findings on the role of housing markets in driving entrepreneurial activity across localities in the US. The mechanism works primarily through the wealth and credit channels from house prices as private homes are often used as collateral assets when starting a new business or when expanding young firms. Moreover, through local banks' balance sheets, house prices could also affect lending supply. To isolate and test for these channels, the paper drew on a combination of several detailed micro data sets on workers, businesses, local housing markets and lending activity and so on and relied on state of the art instrumental variable techniques. When quantifying aggregate, nationwide effects, the paper found that between 60% of the decline in young firm activity (relative to other firms) during the Great Recession was due to the housing price collapse. Finally, one interesting and so far underappreciated fact that the paper uncovered is that young, more entrepreneurial firms tend to hire younger and less educated workers than other businesses.

**Dan Andrews** (Australian Treasury) in his discussion highlighted recent results by the Australian Treasury – using freshly assembled microdata – that confirm many aspects of the US results presented by Steve Davis, with slowing business dynamism, the role of housing market conditions driving regional differences; and the disproportionate role of young firms in creating jobs for younger workers. He highlighted a potential link between lower firm entry rates and lower job-to-job mobility with worse prospects for wage increases. Finally, he emphasised that Australia is in the process of building up its microdata capacity to better inform policy decisions in this area, and the papers such as those of Steve Davis serve as inspiring applications about what types of analyses and policy analyses can be carried out.

In the following general discussion, the fact that we are missing out on young firms was presented as mechanism for a potential hysteresis effect: downturns in housing markets led to persistent scars on jobs and businesses through depressing entrepreneurial spirit and new firm creation. Further, Steve Davis clarified that his presentation is not meant to explain the long-term downward trend in job creation (declining business dynamism) stretching over several decades, but instead it provides an explanation in the movements around that trend over business cycles. Finally, he emphasised that beyond focusing on productivity improvements, keeping people socially engaged as employees is also a key function of businesses, and that is why job creation should be such an important policy focus too.

### *Policy Panel: Which policies can foster dynamism?*

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**Dirk Pilat** (Deputy Director, STI) opened the discussion by asking panel members what happens in their respective countries regarding business dynamism. We know that market entry and exit are important to boost productivity and employment, and governments have made it easier to start new businesses, yet we still witness a decline in business entry rates. Possible explanations include population ageing, technology and globalisation. Could new policies reverse this trend?

**Michael Brennan** (Chair, Australia Productivity Commission) agreed that business dynamism is important to channel resources from old to young firms and from frontier to laggard firms. However, various administrative measures hinder this flow of resources: for example, occupational licensing is damaging in the United States, and stamp duty charged on housing transactions hamper the mobility of workers. In Australia, zoning regulations remain restrictive and prevent reaping up the benefits of agglomeration economies, although some states like Victoria have started to simplify these regulations. On the other hand, policies to improve public transportation systems and investment in infrastructure can help

the flow of resources in large cities. Picking up from a previous session, Mr. Brennan also thought that giving consumers the right to control their data would spur dynamism.

**Pierre Therrien** (Innovation, Science and Economic Development Canada) noted that it takes on average 8 years for a new entrant to become competitive. Hence, it is important to help young firms scale up and become challengers of incumbents. For young firms that create intangible assets, access to financing is difficult in Canada, because these assets cannot be collateralized. Mr. Therrien gave the example of Nortel, which went bankrupt, although it held patents worth 4.5 billion dollars. He also noted that women and indigenous people are a potential source of business dynamism, but they are under-represented in the labour force.

**Stefan Profit** (German Federal Ministry of Economic Affairs and Energy) agreed that business dynamism has declined, though this is not necessarily a source of concern. He noted that medium-size firms are very productive in Germany, even though there is little entry and exit in this segment. Even though there is not much dynamism between firms, there might be a lot of dynamism within the firms thanks to good management of resources, including human resources. What sort of dynamism do we want to achieve?

**Mary Veronica Tovšak Pleterski** (European Commission) noted that problems of access to finance have traditionally hindered business dynamism in Europe. While the United States has attracted 50% of global venture capital flows, the EU has attracted only 11%. A more unified EU market for finance would help, but regulatory barriers still hamper cross border financial flows. Under VentureEU, the EU is providing cornerstone investments to startups, and pilot projects seek to help them to scale up. Another rising challenge facing businesses is the shortage of skills, especially digital skills.

During the follow-up discussion, panellists agreed that, as administrative barriers have fallen, new barriers may have become more important, including lobbying. The lack of human capital was also seen as a growing impediment by panellists, especially in mid-level skills, which do not necessarily require an academic degree, but instead involve good technical and vocational education, which is hard to come by, including due to the lack of good trainers. In the EU, support has been made available to facilitate the reskilling and up-scaling of workers.

Panellists also agreed that programmes to stimulate venture capital are important to help firms grow up, as well as well-designed R&D tax credits, which should not discourage fast-growing firms. Encouraging small and large firms to cooperate among themselves and with research institutes helps to stimulate the diffusion of innovation in Germany. Regulatory sandboxes can also facilitate experimentation. With other similar initiatives, Germany's Ministry of Economy has published an industrial policy plan to increase the share of manufacturing.

Panellists also agreed that government intervention to foster business dynamism should be evaluated regularly, especially financial support to companies, with the use of firm-level data. New datasets made recently available, such as in Australia, will help a lot to make new policy evaluations.

### *Dinner speech*

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**Gary Banks** (Professor, Melbourne Institute & Centre for Independent Studies) took the opportunity of his dinner speech to reflect on Australia's experience during the 'Reform Era' in the 80s and 90s, drawing lessons for the successful implementation of ongoing reform efforts.

Recapitulating the history of the 'Reform Era', he started by recounting the dismal state of Australia's economy between the 50s and 80s, when restrictive and anticompetitive policies kept productivity low and – referring to the conference's title – Australia "lacked both capabilities and dynamism". This period of low performance was followed by policies aimed at boosting productivity, including the opening up to trade and deregulation, which resulted in a surge in productivity, low unemployment and substantial real wage gains shared across the income distribution. Asking about the "Secret Sauce" making these improvements possible, Gary Banks listed several factors: A broad acceptance of the reform efforts; effective communication, aimed at groups that were most affected; basing policies on established evidence; allowing sufficient time for the implementation of policies, also tolerating repeated attempts; the presence of a 'burning platform', in Australia's case the perception of a severe economic crisis; lastly, leadership in terms of political and institutional actors who were committed to the reform efforts. Gary Banks then continued to the present time by contrasting current reform efforts with the lessons learned during the 'Reform Era'. Noting that these lessons had been all but forgotten, he claimed that recent reform efforts often resulted in presenting "underprepared policies to an unprepared public". He concluded that to further boost productivity in Australia, policy makers should remind themselves of these lessons and focus their efforts on some key policy areas, which he identified as industrial relations, taxation, energy and carbon.

### *Setting the Stage: Day 2*

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**Eric Brynjolfsson** (Professor at MIT, by video link) made a keynote speech « *What can Machine Learning Do and what does it mean for the economy?* ». His main argument was «artificial intelligence (AI) is making large changes in the nature of jobs. He categorised AI as the type of general purpose technology (GPT) that induces very large transformations. Previous GPTs include the steam engine, electricity and the electric motor, which all induced drastic changes in the technological environment. What makes GPTs especially important is that they induce complementary innovations, which transform the technological field. At present, AI can solve only narrow tasks, but its performance is improving fast. For instance, image recognition algorithms are now better than humans at recognizing images; speech recognition applications are improving fast and are almost as good as humans at recognizing voice. While firms are investing in intangible assets related to artificial intelligence, the short-term impact on productivity might be negative, but eventually this will have a significant economic impact, change the nature of work and boost productivity – following a J-curve process.

Deep-learning techniques can establish medical diagnostic using supervised learning techniques, which is transforming the field of healthcare. The use of automated translation had led to an increase of exports using eBay by 11%. In Australia's mining sector, some large equipments are already operated without humans. Large technological revolutions take time: it took almost 30 years for electricity to significantly impact productivity statistics, and the irruption of emails in office work did not displace paper for a long time. While it will take to appear in productivity statistics, artificial intelligence and machine learning will eventually be transformative.

While AI will not eliminate many jobs, it will transform most of them, with few remaining immune. For instance, a typical radiologist now undertake 27 distinct tasks, though only one of them (interpreting images) will be affected by machine-learning algorithms. Radiologists still do many other tasks, which cannot be automated because they require soft skills. Machine learning will not perform all tasks and accomplish a full occupation, but it will assist humans in their profession. This will affect both low-paid jobs (cashiers) and highly-paid jobs (airline pilots), so a detailed analysis has been carried out by the *MIT Initiative on the Digital Economy* to map the impact by industries, regions and firms. Their exposure to Machine Learning varies a lot, so large transformations should be expected. In the automobile industry, driverless cars and truck will induce very large changes, which are not yet reflected in stock prices.

In his discussion of the paper, **Kevin Fox** (University of New South Wales) underscored the prevalent skepticism about the benefits of Artificial Intelligence, which has not spurred productivity for the time being. However, AI has spurred technological anxiety: people are afraid about technological disruption, the arrival of robots, and the future of work. The protests of taxi drivers against Uber is reminiscent of the Luddite riots against textile machinery: they see their costly investment in taxi licenses being devalued by the introduction of new technologies. Kevin Fox thought that these fears are exaggerated: like Erik Brynjolfsson, he thought that jobs will not be taken away, even though certain tasks will be done by machines. Quoting Elon Musk, he said that « human are underrated » and can accomplish many tasks that not within the reach of machines. Even though many jobs will be transformed, technology will create more jobs than it will eliminate.

In the general discussion that followed, participants agreed that many new jobs will be created in the future with tasks that cannot be performed by machines, both low pay occupations (cashiers, taxi drivers) and high pay (financial advisors, coaches). A revamping of education will be necessary to prepare people to these new career paths and help the transition to new technologies. Governments will have an important role to reform education, and they should avoid doing mistakes during this difficult transition.

The audience expressed concerns about the social impact of AI transformation: the current system of merit-based career paths, based on a pyramid where workers at the bottom have the opportunity to make it to the top, is at risk. Instead of pyramids, the social structure of companies will be organised as columns, with fewer opportunities to enter at lower levels and then progress. For instance, machines can already scan documents more rapidly than humans, with fewer legal assistants making their way up, so law firms are becoming like columns rather than pyramids. To preserve shared prosperity, we will need to invent new organisations where people will have the opportunity to reskill and climb to the top.

#### ***Session 4: Human Capabilities Part A***

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**Michela Giorcelli** (Assistant Professor, UCLA and NBER) presented work from two papers that used historical evidence to examine the effect management has on productivity, thus demonstrating how economic history can provide complementary evidence on the causal link between management practices and productivity. The papers exploited historical contingencies in programs offering management training to Italian and US firms during the 40's and 50's that randomly affected the amount of training firms received. This variation allowed teasing out the 'causal' effect of management by comparing firms that did and did not receive training - the random assignment assuring that firms receiving training were otherwise not systematically different from those who did not. In the first paper, this variation came from unexpected budget cuts in the program leading to the random exclusion of some firms; in the second paper, this variation resulted from random shortages in the supply of instructors, which meant that some firms received only partial or no training. Findings from both papers confirmed that training in management practices had significant and persistent effects on productivity. The second paper dived further into the mechanisms of management training: Training in human resource management was particularly important as it increased the payoff from training in other areas such as factory operations and inventory and sales management; training was also most profitable when targeted to managers most important for its implementation, e.g. training in human resource management to middle managers and in inventory and sales management to top managers was most effective. The conclusion was that policies offering training in management practices can raise productivity, but that policy makers should be mindful of "what" training was delivered and "to whom" it was delivered.

**Alonso Alfaro Ureña** (Economist, Banco Central de Costa Rica and Universidad de Costa Rica) presented joint work with Isabela Manelici and José P. Vásquez on the effect for domestic firms of becoming a supplier to multinational enterprises (MNEs). Using a rich dataset on firm-to-firm transactions in Costa Rica, the authors conducted a careful analysis to assess the link between firm performance and supplying MNEs. For instance, to assure that any positive link between supplying MNEs and performance reflected domestic firms becoming more productive from supplying, rather than better firms being more likely to start supplying MNEs, they adopted an event-analysis approach, comparing how performance changed for firms who recently started supplying to MNEs with the performance of firms who did not (yet) supply MNEs. They also conducted robustness analyses comparing firms who applied for government mediation to supply MNEs and who marginally succeeded or failed – and who thus should be very similar except that only successful firms started supplying MNEs. Results overall confirmed that becoming a supplier to MNEs increases firm performance in terms of sales and productivity. Complementing the analysis with survey results, the authors finally showed that these improvements reflected a host of changes occurring at supplying firms, including the adoption of management practices and knowledge transfers about new technologies, skill-upgrading of the firm’s workforce and changes to the product range and quality.

**Giuseppe Nicoletti** (Head of Division, OECD) summarized both papers in his discussion as “econometrics at its best”, providing careful analysis on issues at the heart of the conference’s topic – the importance of complementary, intangible investments to reap the full benefits of technology adoption –, while also providing examples of how policies could support investments in such intangibles. After reviewing the empirical analyses of both papers and raising some open questions, Giuseppe related the papers to complementary findings from recent OECD work. Using coarser data but offering a broader, cross-country perspective this work confirmed the importance of complementary investments, showing for instance that the adoption of digital technologies correlated with the use of managerial practices, or that the gains from technology adoption differed with skill-shortages and the firm’s relative performance. Recent OECD work also confirmed the importance of supplying linkages for knowledge transfer and productivity catch-up, showing for instance that more intensive forward and backward GVC participation substantially increased productivity and innovation. Giuseppe Nicoletti concluded by discussing policy implications from these findings, arguing that the challenge for policy makers would be to find novel ways to support the transfer of knowledge in an increasingly multipolar world characterized by rivalry and lack of cooperation.

The general discussion expanded on policy recommendations to increase investments in intangibles, and in particular to increase the use of advanced management practices. While it was generally acknowledged that management quality could be improved by raising the skills of managers, the speakers concluded that many firms lacked awareness of the benefits of management practices, especially laggard firms, and that an important task of policy makers would be to raise this awareness. Further issues concerned spillover effects from management training and the use of public procurement to promote firms based on their growth potential.

### ***Session 5: Human Capabilities Part B***

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**Johanna Posch** (Associate, Analysis Group) presented joint work with Tito Boeri, Andrea Ichino, and Enrico Moretti examining the functioning of labour markets in the presence of regional differences in labour productivity. In particular, the paper contrasted labour market outcomes in Germany and Italy to understand how wage setting at the national level can affect the allocation of workers to jobs, and thus efficiency: While both countries displayed regional productivity differences, nominal wages in Italy were set at the national level and therefore did not take account of productivity differences between the North

and South, whereas wage setting in Germany increasingly reflected the fact that the West was more productive than the East. When prices cannot adjust, employment does: Italy exhibited no link between productivity and nominal wages, but employment in the North was much higher; consequentially house prices rose in the North and fell in the South, leading to opposite changes in real wages. As she argued, workers in the South were kept from migrating to the more productive North because, once employed, they enjoyed higher real wages in the South. None of this was observed in Germany, which also experienced regional productivity differences but allowed wages to adjust. Overall, as demonstrated by a counterfactual analysis, Italy suffered from lower employment levels and lower labour income.

**Steffen Viete** (Economist, ZEW) presented work on how organizational changes induced by digital technologies can affect labour market outcomes, focusing on the effect of trust-based work (TWB) on the gender wage gap. He explained how TWB – whose prevalence in Germany increased from about 15 to 25 percent of all firms between 2004 and 2012 – effectively increased the worker’s autonomy to decide when and where to work. Such increased autonomy could particularly benefit women, who still were disproportionately affected by non-work obligations such as child-rearing: By allowing to better accommodate conflicting demands from such social obligations and work requirements, TWB could act to decrease the gender wage gap. To test this hypothesis, the paper adopted a difference-in-difference approach, comparing within-firm wage differentials between observationally equivalent firms before and after the introduction of TWB. As more skilled women may also select into firms offering TWB, the paper additionally restricted the analysis to workers who were employed at their firms before the adoption of TWB. Overall, results indicated that the adoption of TWB decreased the gender wage gap by raising wages for women, leaving wage and employment levels for men unaffected. Delving deeper into the mechanism for the reduction in wage differentials, the paper established that the adoption of TWB was associated with women reallocating to jobs with higher skill demands.

**Dan Mawson** (Senior Economic Adviser, UK Department for Business, Energy & Industrial Strategy) placed the previous papers in a broader context: A common implicit assumption among policy makers would be that labour markets are about matching jobs – seen as bundles of tasks – to workers with different skills. Thus, their prime function would be to assure high employment levels. Dan argued instead that jobs were more than just bundles of tasks, that labour markets would be involved in a complex matching process, and that therefore the simplified view would miss important links between productivity and labour market outcomes. The previous papers provided examples for such links: Johanna’s paper had shown that wage setting can have wider ramifications, affecting the allocation of jobs to tasks through its effect on house prices. Providing evidence for widespread differences in real wages even in the UK after accounting for house prices, Dan emphasized the importance of transport and housing policies for labour market outcomes. Next, Steffen’s paper showed how manifold the job characteristics would be that firms could use to attract workers and increase productivity – as demonstrated by the fact that TWB reallocated women to more productive jobs. Finally, Dan asked why such arrangements were not more common, and, citing a lack of awareness due to data limitation as a plausible cause, he presented a case study using UK vacancy data to overcome such limitations and understand better the characteristics of jobs and workers needed for new technologies.

The discussion that followed focused mostly on clarifying technical questions about the papers. It also raised concerns about possible downsides of increased work flexibility, which could offer potential benefits but also risks for worker well-being. The discussion also touched on the role of the informal sector in the presence of labour market rigidities.

In opening the session, **David Gruen** (Australian Department of Prime Minister) announced that Australia was in the process of setting up a database on linked employer-employee. Following up, **Peter Gal** (OECD) illustrated the ongoing GFP project on the Human Side of Productivity, which is based on cross-country on linked employer-employee data (LEED). The project aims at “opening the black box of the firm” to focus on the human capabilities that make productivity improvements possible, such as the average and diversity of skills, occupations, gender and age. It is being made possible by the active cooperation of GFP member countries using a Distributed Micro Data approach in which harmonised programming code is sent to contacts in capitals that are accredited to access LEED and, after running the code, send back microaggregate data to the OECD for cross-country comparisons and empirical analysis. Examples of preliminary results highlighting differences in skill, occupational, gender and age composition along the firm productivity distribution were shown, focusing on Denmark and Portugal.

**Andrew Charlton** (Alpha Beta, Australia) emphasised the potential relevance for economic analysis of various sources of administrative data, including those coming from public administrations (such as tax and health) and the private sector (e.g. from use of the cloud). Examples of the latter are accounting data from companies like XERO, providing business accounting services on the cloud (which includes information on balance sheets, employees, transactions with counterparties, ICT use and payments delays); Dun and Bradstreet, providing information about commercial credit and business reports (including income, balance sheets and expenditures); Digitalglobe, providing satellite imagery and data on local GDP (including infrastructure, etc.). These data sources have the advantage of being of immediate access, high frequency, detailed and accurate. However their use present obvious obstacles related to privacy, representativeness, etc. Ideally, researchers would wish to merge and customize administrative and private data but the institutional incentives for doing so on a centralised basis are largely missing. Therefore a federated and decentralised approach would seem more promising.

**Ottavio Ricchi** (Ministero dell’Economia e delle Finanze, Italy) described the availability of LEED in Italy. Most of the data is assembled in the ASIA-LEED database that draws information from a large set of administrative sources providing a huge coverage of workers. The data matches information originating from the statistical offices of different public administrations linked among them by anonymised data. The dataset records the employer-employee relationship at each point in time but have a longitudinal structure that allows tracking worker flows across industries, demographic groups and geographically. It provides information about worker characteristics, the nature of jobs, the type of contract and social transfers and also contains limited information about firms (industry, size, location). There are plans to link the data with business registers to extend the firm information. However, currently there is a mismatch between the representativeness of workers and firms covered by the data. The data has been used ex ante policy evaluation (e.g. the costs of citizen’s income and minimum wages) and ex post policy evaluation (the effects of tax rebates on consumption behaviour). It has also be used as an input into dynamic modelling exercises (e.g. the adequacy of the pension system), tax-benefit micro-simulation modelling.

**Emmanuel Dhyne** (National Bank of Belgium) pointed to three main sources of data for constructing LEED in Belgium. The first is the NBB data warehouse that contains a lot of information on the totality of Belgian firms and their mutual transactions over the past decade, including their internal organisation and ownership. This dataset can be matched with employer-employee data from the Belgian statistical office, although for a smaller representative cross-section of firms. The other option is to match the NBB data with the cross-road databank of the Social Security administration, which covers the whole population of firms and individuals over the past two decades (from both Social Security and administrative sources). Access

to this database is restricted to Belgian researchers (either on site to all the data or off site to anonymised data) for a limited period and is provided for specific pre-approved projects, with the possibility to merge the data with other sources as well. These NBB and employer-employee sources can be combined for specific projects requiring detail at the firm level. For instance, the NBB is currently engaged in a project combining the data warehouse with the cross-road databank to look at the passthrough of import shocks in the domestic network of firms with a focus on the influence of outsourcing and the fragmentation of production. Preliminary results from this project show that there is an immediate effect of import shocks on wages and a delayed effect on employment; among suppliers, the shock is absorbed mostly by the manufacturing sector.

**Lynda Sanderson** (Ministry for Business, Innovation and Employment, New Zealand) illustrated the Longitudinal Data Base (LBD), which makes it possible to track all firms and workers over the past two decades by merging multiple data sources. The LBD is part of a greater plan to create an integrated database that would describe most dimensions of New Zealand workers and firms over time. Data access has recently been made easier by law (2012 Stab Act) for bona fide research implemented in public institutions by researchers with appropriate skills and experience. However, core LBD data (e.g. tax data) remains restricted to government (including university) researchers and accessible only on site. The data has been already widely used to perform research on a wide range of topics by a small set of researchers, including prominently the internationalisation of the New Zealand economy, which is a key but polarised policy issue. Areas covered include for instance learning by exporting and FDI spillovers, where the LBD can throw light on the micro-mechanisms underlying macro outcomes. Findings are helpful for policy design but do not offer silver bullets: they provide insights not solutions.

The subsequent discussion focused on three areas: the implications of informality for the reliability of LEED; the possible role of private administrative data; and the willingness of countries to participate in the GFP Human Side of Productivity project. On informality, **Ottavio Ricchi** noted that while this is not a problem on the employee side (where it is accounted for) it could present challenges on the firm side, for which the data is not always representative. On private data, the problem of incentives to disclose was raised and some wondered also whether the availability of such data could pose an existential problem for statistical institutes. **Andrew Charlton** argued that confidentiality issues could be overcome and these data should be seen as an opportunity for complementing existing databases rather than as a threat. An example discussed was the use of data from the Xero database to investigate issues concerning public procurement (delays in payments), laggards and market power. On participation in GFP projects the response was cautious: most participants expressed interest in joining the project but warned about the length of administrative procedures to access the required detailed micro-data as a potential obstacle.

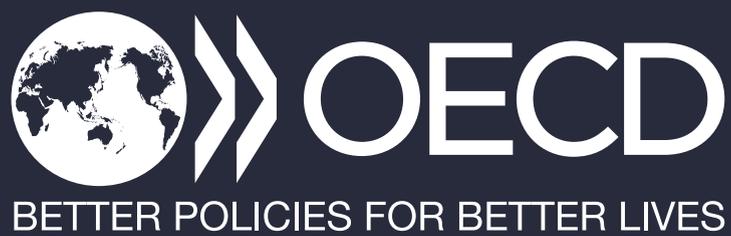
### *Wrap-Up session and way forward*

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**Alain De Serres** (OECD) thanked all the participants and the local organisers, on behalf of the OECD, for the success of the event. He also kindly acknowledged the work of the OECD GFP team. He discussed what his main takeaways were in terms of resolving the productivity paradox. He relied heavily on the talk of Chad Syverson about the importance of implementation lags of the latest technologies which can temporarily lead to slower productivity growth. Also, he drew on the mechanism in Diego Comin's model which gave a cyclical explanation - through depressed R&D spending - to disappointing productivity developments. On the positive side, both channels offer ground for optimism as technologies do get adopted and implemented eventually in larger and larger segments of the economy, plus the relatively strong aggregate demand should also lead to more investment in innovation and adoption.

**Marie Bourke** (Ireland Department of Business, Enterprise and Innovation) highlighted the key takeaways that were particularly relevant for her country, Ireland. She found the work on the benefits of being part of multinational supply chains (presented by Alonso Alfaro Ureña) particularly interesting. She also mentioned the trust-based work schemes (by Steffen Viete) in Germany as a setup that can provide interesting lessons. She praised the initial preliminary results and the direction of the work of the GFP project “Human Side of Productivity” (presented by Peter Gal). Finally, she emphasised the lessons learned on role of management practices (presented by Michela Giorcelli).

**Christoph Menzel** (German Ministry of Economic Affairs and Energy) also provided a summary from his perspective, saying that to him as well the productivity puzzle seems less mysterious, after listening to the arguments related to adoption lags and the necessary complementary investments (in managerial and worker skills and organisational changes). He then focused particularly on issues related to market concentration and the role of ‘new’ industrial policy, in particular on the still open questions, such as the drivers of rising mark-ups, especially in digitally intensive sectors, and the role of policies to ensure a global level playing field in these sectors. Doing so, he set the scene for further work and events into this area – and accordingly, he closed his remarks by inviting everyone to next year’s annual GFP conference, which he and his colleagues will be hosting in Berlin on 14-15 May in 2020 and whose title will be “*Market Dynamics, Competition and the Role of Industrial Policy*”.



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