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EDITOR'S INTRODUCTION TO THE SPECIAL ISSUE OF THE REVIEW OF INCOME AND WEALTH ON "PRODUCTIVITY MEASUREMENT, DRIVERS AND TRENDS" IARIW-UNSW SPECIAL CONFERENCE, SYDNEY, 26–27 NOVEMBER 2013

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This special issue of the Review of Income and Wealth contains selected papers from the IARIW-UNSW Special Conference on "Productivity Measurement, Drivers and Trends," which was held in Sydney, 26–27 November 2013. Hosted by the Centre for Applied Economic Research at the University of New South Wales (UNSW), in addition to support from the IARIW, this conference received financial support from the UNSW Business School, the Australian Bureau of Statistics, the Productivity Commission and the Australian Research Council (LP0884095). All support is gratefully acknowledged.

The concept of the Conference was to bring together leading researchers from academia, industry and government to discuss progress and remaining challenges in understanding productivity. The opening address was given by Dr Philip Lowe, Deputy Governor of the Reserve Bank of Australia, on the topic of "Productivity and Infrastructure." The text, webcast and audio recording of this wide ranging and informative speech, can be accessed through the website of the Reserve Bank, at http://www.rba.gov.au/speeches/2013/sp-dg-261113.html.

The dinner speaker was UNSW President and Vice Chancellor, Professor Fred Hilmer, who spoke on "The Red Tape Challenge—from Meat Axe to Scalpels," providing an entertaining and somewhat disturbing analysis of the productivity losses incurred through bureaucratic excesses. A key message was that increased clarity in definition of "red tape" and more targeted approaches are needed to deal with the "worst productivity and innovation-destroying effects of red tape." The paper is available through the IARIW website: http://iariw.org/papers/2013/HilmerPaper.pdf.

Note: I would like to acknowledge the contributions of the co-chair of the Conference organizing committee, Andrew Sharpe, as well as the program committee of Erwin Diewert, Paul Schreyer, Dennis Fixler, and Barbara Fraumeni. Thanks to the regular editors of the Review, Conchita D'Ambrosio, Robert Hill and Prasada Rao, for their trust and support. Thanks also to the referees for their fine work which enabled this issue to come to fruition. Finally, a special thanks to my assistants in the Centre for Applied Economic Research, Carmit Schwartz and Oded Shrier, for their superlative unfailing support.

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Reflecting the diversity of papers presented at the Conference, the papers in this Special Issue cover a broad range of issues, drawing out key contemporary research areas related to productivity.

The first paper, by Brandt, Schreyer and Zipperer examines "Productivity Measurement with Natural Capital." This paper proposes a framework that introduces natural capital as an input in productivity measurement. The authors use aggregate economy data from the OECD Productivity Database, augmented with natural capital data from the World Bank. Clearly, and as is empirically demonstrated by the authors, the impact on productivity growth of accounting for natural capital depends on the rate of change of extraction relative to the rate of change of other inputs; if there is a relative increase in the rate of natural resource extraction then traditional MFP growth measures will overestimate productivity growth. However, the authors show empirically that it is not *necessarily* the case that the traditional MFP growth measure overestimates productivity growth in countries with resource booms, as resource booms can be accompanied by investment booms originating in the resource sector, causing other inputs to grow even faster. This further illustrates the importance of actually accounting for the natural capital in productivity analysis rather than assuming the result. An additional benefit of the extended framework is that the contribution of natural capital to economic growth becomes explicit, informing policy makers of the implications of depletion of non-renewable resources for future prospects of economic growth.

The next paper examines another class of inputs that have traditionally been ignored in many productivity studies: intangibles. In their paper "Spillovers from R&D and Other Intangible Investment: Evidence from UK Industries," Goodridge, Haskel, and Wallis note that while many agree that evidence exists consistent with spillovers from R&D, there is less clear evidence of spillovers from a broader range of intangibles. Considering such inputs as software, design and training, they use investment data for these wider intangibles for a panel of seven UK industries 1992–2007. A key finding is statistically significant correlations between Total Factor Productivity (TFP) growth and knowledge stock growth in (a) external R&D and (b) total intangibles (excluding R&D). A range of robustness analyses are conducted, with the results being found to be highly persistent. However, the authors note an important caveat to their findings; while they find correlations with either broadly defined non-R&D intangibles, or aggregate economic competency intangibles, they have not been able to find significant correlations within each component. As they conclude, future work on wider and longer datasets might help shed light on this issue, but in the meantime this paper certainly advances understanding of these important issues.

The paper by Niebel, O'Mahony, and Saam on "The Contribution of Intangible Assets to Sectoral Productivity Growth in the EU" continues on the similar theme of advancing the understanding of the role of investment in intangibles. They use new data on intangible investment at the level of 1-digit industries of 10 European Union countries, constructed as a sectoral breakdown of the INTAN-Invest database, which contains measures of intangible investment at the level of the aggregate business sector. Employing both growth accounting and econometric estimation techniques, they examine the contribution of intangibles to

productivity growth, finding interesting differences across sectors (the growth accounting contribution of intangibles to labor productivity growth is generally highest in manufacturing and finance) and differences in estimated output elasticities from previous research (considerably below values found by studies using aggregate data). While significant advances in measuring intangibles has facilitated the literature to which this paper contributes, in concluding the authors note the importance of improving measurement, specifically of prices and service lives, in order to be more confident of the robustness of the results.

The fourth paper is by Cette, Lopez, and Mairesse on "Upstream Product Market Regulations, ICT, R&D and Productivity." Citing the fact that much firm-level research provides evidence for the idea that competitive pressure enhances innovation and hence productivity growth, this paper examines the two main measureable channels through which upstream anti-competitive sector regulations impact on productivity growth: investments in R&D and in ICT. This is possibly the first paper to attempt to empirically investigate the channels and mechanisms through which upstream anti-competitive regulations have an impact on productivity growth. Using an unbalanced panel of fifteen OECD countries and thirteen industries for 1987–2007, they find that the total impact of upstream regulations on TFP is sizeable, with a large impact being transmitted mainly through investments in R&D but also ICT. This study points the way for possible future work using firm-level data for different countries and industries, which would further advance understanding of this important issue for policy formulation.

The "Effects of Financial Crises on Productivity, Capital and Employment" are examined in the paper by Oulton and Sebastiá-Barriel. Using data on 61 countries for the period 1954–2010, they examine the hypothesis that capacity can be permanently damaged by financial crises, especially those arising from the banking sector. Their model allows a financial crisis to have both a short-run effect on the growth rate of labor productivity and a long-run effect on its level. They find that a banking crisis (using the Reinhart and Rogoff, 2009, definition) reduces the long-run level of GDP per worker, and also that of capital per worker, by on average 1.1 percent, for each year that the crisis lasts. Interestingly, it also reduces the TFP level by 0.8 percent. In addition, they find a large negative effect on the level of GDP *per capita* of 1.8 percent, indicating that there must also be an impact on employment. Finally, they find that the effects on labor productivity, capital and TFP are larger in developing than in developed countries, but the reverse is the case for employment. The authors take pains to acknowledge that no two banking crises are alike, and hence their average results may not be applicable to any particular country or period. However, their paper raises significant concerns about the potential large long-run effects that can arise, highlighting the importance of further research in this area.

The sixth paper is by Gu and Yan on "Productivity Growth and International Competitiveness." The authors present Multifactor Productivity (MFP) growth estimates for Canada, the U.S., Australia, Japan, and 10 European Union countries, using the World Input-Output Database and the EU KLEMS database. The interesting twist here is that their measure of MFP growth is different from a standard measure in that it measures productivity growth in the production of

different types of products instead of by industry, and it captures the effect of productivity gains in both foreign and domestic upstream industries. They label this measure as "effective MFP." In taking this approach, they are explicitly acknowledging that firms take advantage of differences in production costs and technologies across countries, and hence their supply chains have become global. They find that increases in effective MFP are closely associated with the declines in output price and improvement in international competitiveness, and that MFP growth for small, open economies and for the production of manufacturing, investment and export goods can be partly attributed to productivity gains in the production of intermediate inputs in foreign countries. That is, offshoring contributes to international competitiveness through its positive impact on effective MFP growth in domestic production.

The next paper, by Cao and Kozicki, "Real GDI, Productivity and the Terms of Trade in Canada," examines the determinants of real domestic income. The authors begin by noting that use of annual TFP data sets produced by national statistical offices have their limitations; they are available with a lag and the low frequency restricts their use in policy formulation when dealing with economic variations with a year. Hence the authors construct a quarterly data set of productivity for the Canadian business sector, and recently published estimates of annual productivity growth are revised and updated to reflect changes in the new Canadian system of national economic accounts. Their new and original data set is then used to study the contribution of TFP and the terms of trade to growth of real gross domestic income, using an index number approach based solidly in microeconomic theory. They find that for much of the 2000s, the contribution of the terms of trade became significant in real income growth. In contrast, that of TFP growth is described to have been "stagnant." As the authors eloquently note, "the large contribution from one factor relative to another over different episodes suggests that well-designed policies intending to promote real income growth and improve welfare need to properly assess the growth of both real output and real income, as well as their sources."

"Getting Rental Prices Right for Computers: Reconciling different perspectives on depreciation" is the topic of the paper by Diewert and Wei. The authors take up the problem of how the depreciation of a high-tech asset should be thought about, with particular reference to the practices of national statistical offices. They start by noting that the standard assumption of high geometric depreciation rates for computers is inconsistent with the approximately constant service flows that they generate. A "one-hoss-shay," or "light bulb" model of depreciation, where a constant stream of services is delivered until the asset life expires, seems to be more appropriate for computers. The authors show that under certain assumptions, a geometric model can provide an exact approximation to an underlying one-hoss-shay model. Interestingly, they are able to extend this exactness result to a more general model of depreciation, the Constant Efficiency Profile model. The authors also show how well the geometric approximation fits a one-hoss-shay model when the assumptions for the exactness result are not satisfied. Using data on computer investment in Australia over a 25 year period, 1989–2013, one-hoss-shay and geometric depreciation estimates of computer capital stocks and flows are constructed. With their "best" geometric

approximations to one-hoss-shay models, they find that the capital services results are quite close to the corresponding one-hoss-shay model, but the same is not true for the capital stocks. Overall, the results suggest that national statistical offices should consider moving to one-hoss-shay models of depreciation for computers, and possibly for a diverse array other assets as well, such as pipelines, electricity and telecommunications networks and even railway lines.

In the ninth and last paper, on "Measuring Output, Input and Total Factor Productivity in Australian Agriculture: An industry-level analysis," Sheng, Jackson, Zhang, and Zhao use a growth accounting approach to estimate TFP in the Australian agriculture industry for the period 1949 to 2012. Given the very specific nature of the sector, measurement of agricultural productivity is notoriously difficult, yet of great policy interest given the economic and environmental advantages of being able to produce food more efficiently. The authors advance measurement for this sector with three interesting contributions, starting with demonstrating the feasibility of combining national accounts statistics with farm surveys to estimate TFP. They then compare *ex ante* and *ex post* estimates of returns to capital and labour inputs; the *ex ante* approach assumes that farmers cannot accurately predict rates of return on capital investments and hence their decisions are based on expected rates of return, whereas the *ex post* approach assumes that there is perfect foresight in predicting rates of return. They find the *ex ante* approach performs better in the context of the agricultural production account. Acknowledging that there can be heterogeneity in both output and input quality, the authors show how productivity measurement can be improved by explicitly accounting for such heterogeneity. Finally, the authors note that their estimates "are distinct from existing statistics in both the time length and industry coverage and provide new information about the long-term trend of agriculture productivity in Australia." Over the six and a half decades of the sample period, the annual average TFP growth rate was found to be a quite stellar 2.1 percent.

Collectively the papers that constitute this volume provide insight into the advances being made in the measurement of productivity, assisting in the understanding of the drivers of productivity and the trends which feed into policy analysis and forecasts. In addition, they provide numerous further directions for productivity research in the coming decades.

References

Brandt, N., P. Schreyer, and V. Zipperer, "Productivity Measurement with Natural Capital," *Review of Income and Wealth*.

Cao, S. and S. Kozicki, "Real GDI, Productivity and the Terms of Trade in Canada," *Review of Income and Wealth*.

Cette, G., J. Lopez, and J. Mairesse, "Upstream Product Market Regulations, ICT, R&D and Productivity," *Review of Income and Wealth*.

Diewert, W. E. and H. Wei, "Getting Rental Prices Right for Computers: Reconciling Different Perspectives on Depreciation," *Review of Income and Wealth*.

Goodridge, P., J. Haskel, and G. Wallis, "Spillovers from R&D and Other Intangible Investment: Evidence from UK Industries," *Review of Income and Wealth*.

Gu, W. and B. Yan, "Productivity Growth and International Competitiveness," *Review of Income and Wealth*.

Hilmer, F. G., "The Red Tape Challenge—from Meat Axe to Scalpels," paper presented at the IARIW-UNSW Special Conference on "Productivity Measurement, Drivers and Trends," Sydney, November, 2013 (http://iariw.org/papers/2013/HilmerPaper.pdf).
Lowe, P., "Productivity and Infrastructure," opening address at the IARIW-UNSW Special Conference on "Productivity Measurement, Drivers and Trends," Sydney, November, 2013 (http://www.rba.gov.au/speeches/2013/sp-dg-261113.html).
Niebel, T., M. O'Mahony, and M. Saam, "The Contribution of Intangible Assets to Sectoral Productivity Growth in the EU," *Review of Income and Wealth*.
Oulton, N. and M. Sebastiá-Barriel, "Effects of Financial Crises on Productivity, Capital and Employment," *Review of Income and Wealth*.
Reinhart, C. M. and K. S. Rogoff, *This Time Is Different: Eight Centuries of Financial Folly*, Princeton University Press, Princeton, NJ, 2009.
Sheng, Y., T. Jackson, D. Zhang, and S. Zhao, "Measuring Output, Input and Total Factor Productivity in Australian Agriculture: An Industry-Level Analysis," *Review of Income and Wealth*.