**INFORMATION NOTE[1]**

# Productivity dispersion in Australia

Productivity growth is the key determinant of improvements in living standards in the long run. However, looking at productivity trends only at the aggregate level hides the differences in productivity performance between businesses. Examining the productivity gap at the business level (known as productivity dispersion) can help our understanding of the economy and ultimately help to better inform policy advice. A recent joint Working Paper by Treasury and the Australian Bureau of Statistics, *Measuring productivity dispersion in selected Australian industries*, uses data from the Business Longitudinal Analysis Data Environment (BLADE) to find persistent yet declining differences between the most and least productive quartiles of businesses in all studied industries. The paper also explores potential drivers of productivity dispersion and its relationship with aggregate productivity.

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1  The views expressed in this note are those of The Treasury and do not necessarily reflect those of the Australian Government. This note was prepared by Simon Campbell in Macroeconomic Group, Alexander Sibelle in Revenue Group and Thai Nguyen and Franklin Soriano from the Australian Bureau of Statistics.

## What is productivity dispersion?

Productivity dispersion tells us the difference in productivity performance between the most and least productive businesses.

'Productivity dispersion' is a measure of the difference in productivity between high and low productivity businesses. That is, some measure of the width in the distribution of the productivity levels of businesses. There are a number of ways this can be calculated – this note uses one of the more common methods which is calculating the ratio of the interquartile range (rIQR) of value added based labour productivity. This tells us how many times more productive the business at the 75th percentile of an industry is compared to the business at the 25th percentile.

Calculating productivity dispersion at the most detailed, narrowly-defined level of industry is important as it ensures the comparison of businesses undertaking similar productive activities. That is, it ensures that as much as possible we are comparing apples with apples.

## Why does it matter?

There has been a well-documented slowdown in global productivity growth since the early 2000s. This slowdown is of concern to policy makers and researchers given labour productivity growth is, and is expected to continue to be, the key determinant of improvements in living standards in the long run.

The level of and changes in productivity dispersion are not of themselves necessarily good or bad for aggregate productivity growth. For example rising dispersion could be a product of increasing innovation and experimentation or increasing resource misallocation. Measuring the degree of productivity dispersion in an economy's industries and understanding what drives the trends in dispersion can help form a better understanding of the forces driving productivity growth at the aggregate level and the policies that can support it.

There have been a number of productivity dispersion studies over the past two decades in a range of countries, both across industries and time. These studies consistently find persistent dispersion in productivity performance among firms within a given industry (albeit to varying degrees). Indeed one of the reasons put forward to explain the global slowdown in aggregate productivity growth is widening productivity dispersion between firms, even in narrowly defined industries, with the frontier pulling away from the laggards.[2]

Rising productivity dispersion may indicate frontier firms are pulling away from the laggards.

A possible explanation for widening productivity dispersion could be a breakdown in technology diffusion between frontier firms and laggards, with lower within-firm productivity growth from the laggards weighing on aggregate productivity growth. Another potential factor weighing on aggregate productivity growth is the ongoing survival of firms that would otherwise exit in a competitive market, which crowds out growth opportunities for more productive firms and therefore inhibits productivity-enhancing resource reallocation.[3]

Better understanding what is happening within particular industries is critically important given the degree of productivity dispersion between firms in an industry – and how resources are allocated between these firms – is likely to have a significant effect on aggregate productivity growth in Australia.

Indeed, there is evidence that the level of dispersion in a particular narrowly defined industry is related to that industry's average productivity level. Analysis of six selected industries reveals above-average labour productivity dispersion in an industry is associated with a below-average level of labour productivity (and vice versa).

Figure 1 relates the level of labour productivity to the rIQR at the 4-digit industry-year unit of observation.

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2   See Andrews, D., Criscuolo, C. and Gal, P.  2016, 'The Global Productivity Slowdown, Technology Divergence and Public Policy: A Firm Level Perspective', OECD Productivity Working Papers, No 5.

3   See Adalet McGowan, M., Andrews, D., Millot V. 2017, 'Insolvency regimes, zombie firms and capital reallocation', OECD Economics Department Working Papers, No. 1399, OECD Publishing, Paris.

### Figure 1: Labour productivity and productivity dispersion, 2001-02 to 2013-14
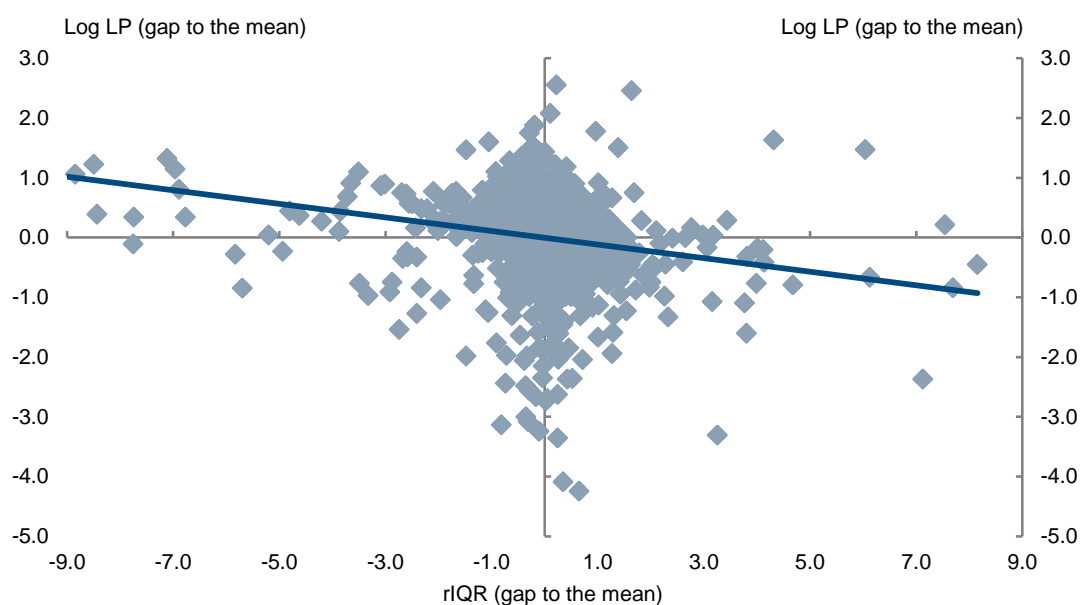


Source: Business Longitudinal Analysis Data Environment (BLADE).

While this suggests rising productivity dispersion can be a policy concern from a productivity growth perspective, appropriate policy responses will depend on the causes and drivers of changes in dispersion.

For example, if dispersion is influenced by a persistence of unproductive firms in the market and therefore an inefficient allocation of resources, policies aiding the restructuring of unproductive firms and addressing barriers to more efficient resource allocation would be most effective to lift aggregate productivity growth. This could include reforms that promote competition and increase business dynamism (such as changes to insolvency laws to make it easier for low-productivity firms to exit) which in turn reduces productivity dispersion among firms in a given industry.[4]

Additionally, as the tax system in particular plays a key role in how resources are allocated across the economy, resource misallocation can be reduced by ensuring firms' decisions are made for business and not tax reasons.[5]

## How much productivity dispersion is there in Australia?

*Productivity performance varies most in Wholesale Trade.*

Analysis using the Business Longitudinal Analysis Data Environment (BLADE) reveals that Australian industries appear to be similarly dispersed in terms of productivity performance as other countries. There are differences in the degree of dispersion across industries – for example the ratio between the most and least productive firms in Wholesale Trade is significantly greater than the equivalent ratio in Manufacturing – but even in the least dispersed industries the top firms are at least twice as productive as the bottom firms.

Table 1 below shows weighted averages (by number of firms) of 4-digit labour productivity dispersion ratio (rIQR) aggregated across the period of 2001-02 to 2013-14.

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4 See Oulton, N. 1998, 'Competition and the Dispersion of Labour Productivity amongst UK companies', Oxford Economic Papers 50 (1998), 23-38; Martin, R. 2008, 'Productivity Dispersion, Competition and Productivity Measurement', Centre for Economic Performance Discussion Paper No. 692, June 2008.

5 See International Monetary Fund (IMF). 2017, 'Fiscal Monitor: Achieving More with Less', Washington, April.

Table 1: Productivity dispersion by industry, 2001-02 to 2013-14

| Industry | rIQR |
|----------|------|
| **Manufacturing** | 2.6 |
| **Construction** | 3.1 |
| **Wholesale Trade** | 4.9 |
| **Retail Trade** | 3.5 |
| **PST Services** | 2.6 |
| **Administrative and Support Services** | 2.8 |

Source: BLADE.

The rIQR at these main industry levels are formed from dispersion at the 4-digit industry level, where weights are proportional to the number of business in the 4-digit industries.

Overall, businesses at the 75th percentile are about 2½ to five times as productive as those at the 25th percentile, depending on the industry being examined.

The degree of dispersion can vary quite a lot between the different subindustries in an industry. To highlight this, dispersion results averaged across 2001-02 to 2013-14 for all 4-digit industries in Manufacturing and Wholesale Trade, by way of example, can be found in Figure 2 below. The number of businesses in each 4-digit industry is on the x-axis and the rIQR is on the y-axis. Each marker represents a 4-digit industry within each 1-digit industry division.

Figure 2: Dispersion by number of businesses, 2001-02 to 2013-14
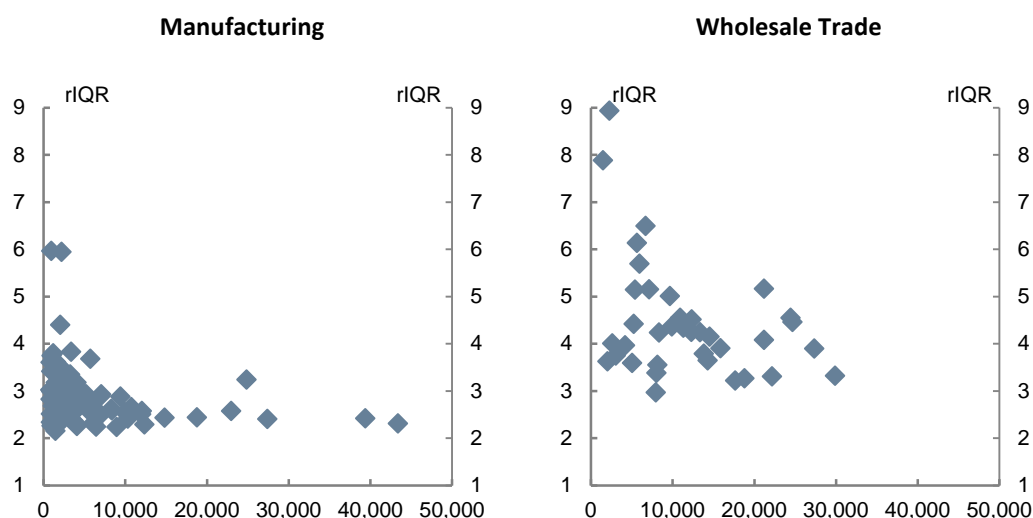


Source: BLADE.

Figure 2 shows industries characterised by a large number of businesses tend to show fairly low productivity dispersion. For example, Printing and Bakery Product Manufacturing have the largest business counts in Manufacturing and are among the least productivity-dispersed industries. This is consistent with the theory that low productivity dispersion in an industry tends to be correlated with high product substitutability and vice versa.[6]

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6  See Syverson, C.  2004, 'Market Structure and Productivity: A Concrete Example', Journal of Political Economy, 112(61), 1181-22; Syverson, C.  2003, 'Product Substitutability and Productivity Dispersion', University of Chicago and NBER, July 2003.

## How is productivity dispersion changing over time?

Figure 3 shows year-by-year productivity dispersion (weighted average) for the six selected Australian industries over 2001-02 to 2013-14.

### Figure 3: Productivity dispersion over time
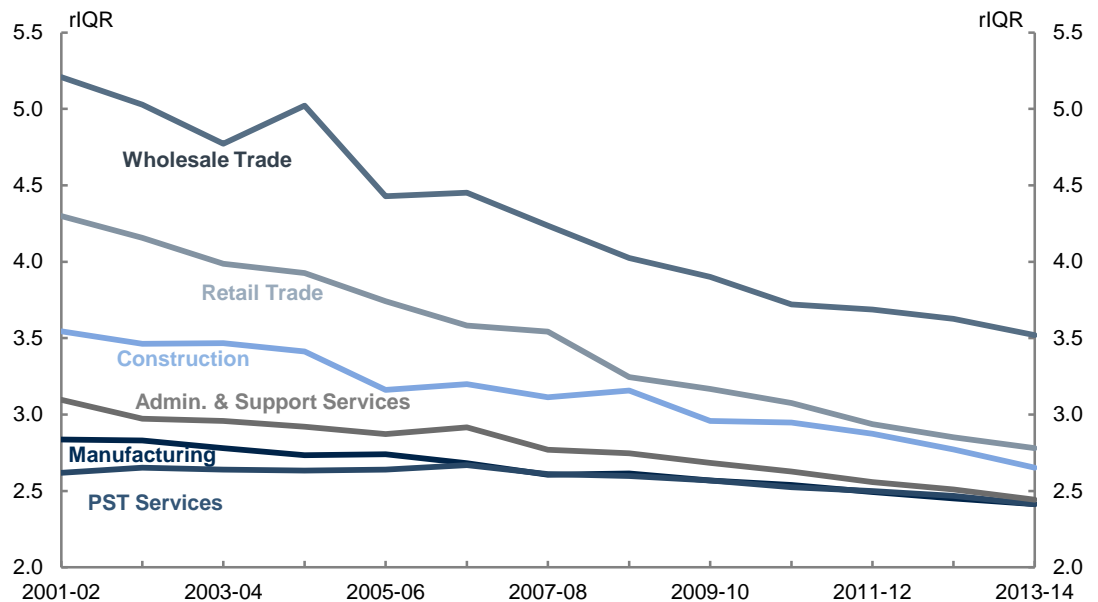


Source: BLADE.

In all six of the selected industries productivity dispersion shows a downward trend, to varying degrees. Most of the decline in dispersion occurs by 2010-11 before flattening out. This differs from the findings in recent international studies which tend to find productivity dispersion increasing over time.

These downward trends in dispersion are due to productivity levels for the bottom quartile growing faster than the top quartile. Using Retail Trade as an example to show this, Figure 4 below charts the growth in labour productivity levels of the top and bottom quartiles, along with the rIQR, indexed to 100 in 2001-02.

### Figure 4: Nominal labour productivity by quartile and rIQR – Retail Trade
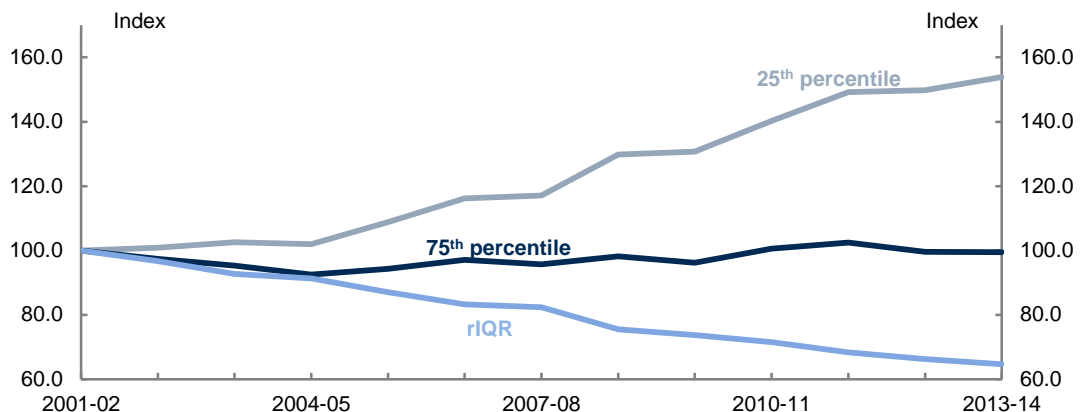


Source: BLADE.

Figure 4 shows over the time period, the labour productivity of the weaker performing firms (25th percentile) has grown to over 1½ times its 2001-02 level while the productivity of the stronger performing firms (75th percentile) has remained the same. Naturally, this convergence in performance has driven down the dispersion ratio as the laggards have caught up.

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# What could be causing this decline in dispersion?

Less dispersion may be a product of more efficient use of intermediate inputs by the laggards but also could be due to reduced business dynamism.

While value-added based labour productivity dispersion is declining, dispersion in sales per worker has remained effectively flat. This implies that lower quartile firms are becoming relatively more efficient in their use of intermediate inputs. There could be a number of reasons behind this, such as a growing capability of smaller, less productive firms to join international value chains previously more accessible to larger, more productive firms; or an increasing online presence by these firms reducing their overheads.

To better understand productivity dispersion and its evolution, it is necessary to undertake further work to examine potential factors such as entry and exit rates of firms; labour reallocation; changes in industry structure, concentration or competition; productivity persistence; and productivity catchup of young or new firms.

Some initial exploration of these potential factors suggests changes in market concentration do not provide a compelling explanation for the decline in productivity dispersion in Retail and Wholesale Trade. However, further work examining a potential tightening of margins in these industries due to smaller independent or family-owned firms being replaced by fewer, larger firms is necessary to gain a full picture of this relationship.

One factor that does appear to be a significant driver of the decline in dispersion is reduced business dynamism. Firms typically enter the market as relatively unproductive. They have no established business processes and networks of suppliers and customers. They also often engage in innovative activity of which there is no established 'best practice'. This suggests rising entry rates could increase productivity dispersion (and vice versa).[7]

In Retail Trade and Wholesale Trade, the industries with the largest decline in productivity dispersion, the entry rate has fallen from around 18 per cent to around 13 per cent and around 17 per cent to around 12 per cent over 2003-04 to 2013-14, respectively.[8]

Therefore the downward trend in productivity dispersion may be due to mature firms, whose productivity is less dispersed, making up a greater proportion of these industries.

The Australian data supports this, with evidence of a relationship between an industry's entry rate and its productivity dispersion level. Figure 5 relates the level of rIQR to the firm entry rate at the 4-digit industry-year unit of observation.

## Figure 5: Productivity dispersion and entry rates, 2002 03 to 2013-14
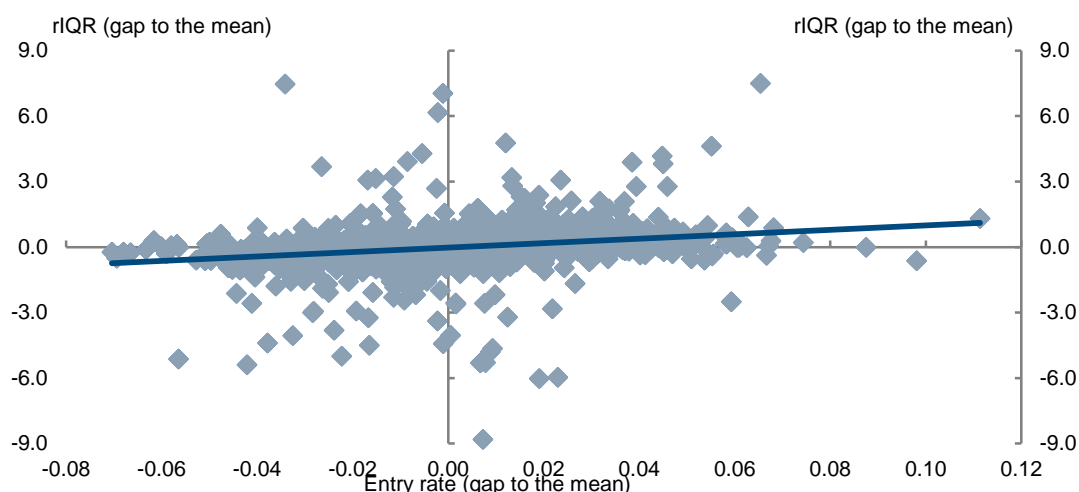


Source: BLADE.

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7   See Decker, R.A., Haltiwanger, J., Jarmin, R.S. and Miranda, J. 2016, 'Declining business dynamism: implications for productivity?', Hutchins Center Working Paper #23, September 2016; Foster, L., Grim, C., Haltiwanger, J. and Wolf, Z. 2018, 'Innovation, Productivity Dispersion, and Productivity Growth', US Census Bureau Center for Economic Studies Paper No. CES-WP-18-08.

8   ABS Cat. No. 8165.0 (Counts of Australian Businesses, including Entries and Exits).

Although reduced dynamism, in particular a lower entry rate, appears to be at least partly responsible for the decline in dispersion – and lower dispersion is associated with higher labour productivity levels – it would be wrong to advocate for a continued decline in dynamism by, for example, discouraging new firm entrants. While the productivity of new firms is likely to initially be more dispersed and on average lower than incumbent firms, over time these new firms are likely to become more productive and help boost aggregate productivity growth.

## Conclusion

Forthcoming work on labour reallocation will provide further insights.

The persistence of labour productivity dispersion in the six industries analysed suggests that improving allocative efficiency and the productivity growth of low productivity firms can help lift aggregate productivity growth. Industries in Australia that have less productivity dispersion experience higher aggregate labour productivity performance. Forthcoming Treasury research shows that within-industry labour reallocation was noticeably productivity-enhancing over the course of the 2000s, which is consistent with the observed decline in labour productivity dispersion.

Further work is necessary to better understand the nature and implications of the observed decline in labour productivity dispersion. At this stage, it is premature to assign a technological explanation to the decline in labour productivity dispersion. In this regard, an important next step in understanding productivity dispersion is to calculate firm-level multifactor productivity (MFP), which will be aided by Treasury sponsored work (in collaboration with the ABS) to estimate reliable capital stocks at the firm level. To make more progress on the issue of technology diffusion in Australia, future Treasury research will exploit these new MFP estimates to examine how Australian firm's productivity performance has fared relative to that of firms at the global technological frontier.

## ABS data disclaimer

The results of this note are based, in part, on ABR data supplied by the Registrar to the ABS under *A New Tax System (Australian Business Number) Act 1999* and tax data supplied by the ATO to the ABS under the *Taxation Administration Act 1953*. These require that such data is only used for the purpose of carrying out functions of the ABS. No individual information collected under the *Census and Statistics Act 1905* is provided back to the Registrar or ATO for administrative or regulatory purposes. Any discussion of data limitations or weaknesses is in the context of using the data for statistical purposes, and is not related to the ability of the data to support the ABR or ATO's core operational requirements. Legislative requirements to ensure privacy and secrecy of this data have been followed. Only people authorised under the *Australian Bureau of Statistics Act 1975* have been allowed to view data about any particular firm in conducting these analyses. In accordance with the *Census and Statistics Act 1905*, results have been confidentialised to ensure that they are not likely to enable identification of a particular person or organisation.