

Which Firms Drive Business Investment? New Evidence on the Firm-size Distribution

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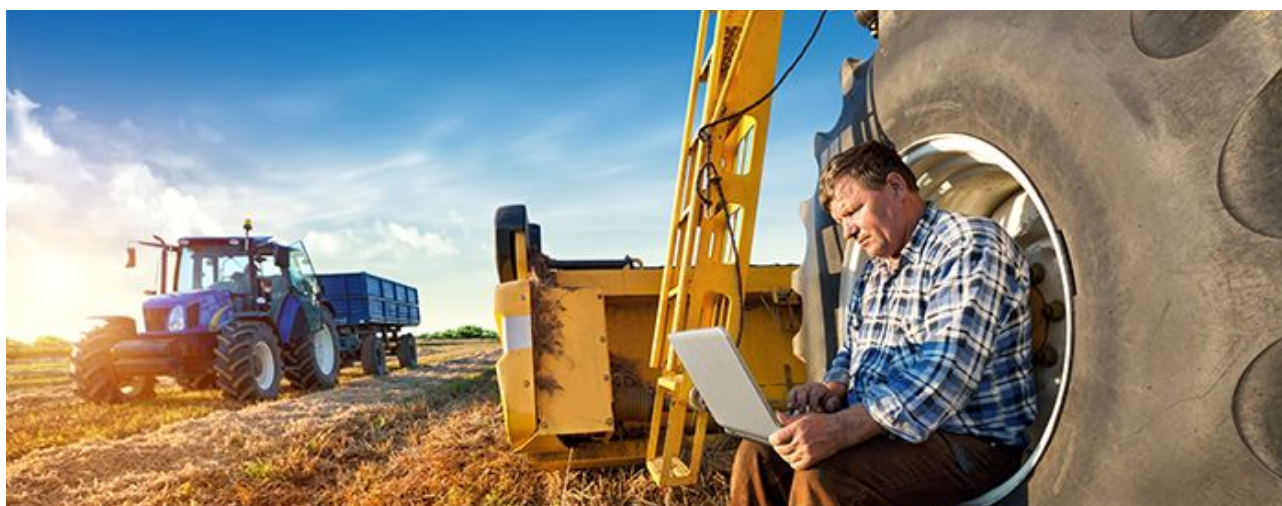


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Abstract

Business investment plays a key role in our current and future economic prosperity. Aggregate investment can be difficult to predict, however. This may be because different firms face different investment environments, and the factors behind their decisions can vary. This gives rise to the question: which types of firms are most important for driving aggregate outcomes? Detailed, firm-level data shows that large firms account for a significant share of investment in Australia, and are the major drivers of the patterns in aggregate non-mining investment. Understanding how firms of various sizes contribute to overall outcomes will help us to gauge the potential impact of any differences they might face, including via policies, on investment outcomes and the economy.

Introduction

Business investment is an important determinant of both current and future economic outcomes. Investment in assets – such as machinery, buildings and software – not only supports current economic activity, but also adds to the economy's productive capacity and income-earning potential. Despite its importance for current and future economic growth, trends in aggregate investment have proven difficult to model. Investment is one of the

most volatile components of GDP, which makes it hard for economic models to explain changes from quarter to quarter or even between years (Cockerell and Pennings 2007). Longer-term trends, such as the weak levels of non-mining investment over the past decade, have also been difficult to fully explain (Hambur and Jenner 2019; van der Merwe *et al* 2018).

The sum of many (different) parts

Aggregate business investment is the sum of the investment decisions of many firms across the economy. Traditionally, economic models of aggregate investment have made the (implicit) assumption that the factors affecting firms' investment decisions are similar across all firms. However, there is an increasing appreciation that there may be more variation than was once assumed. Firm size has been found to be associated with important differences in the factors that may influence firms' investment decisions. For example:

- There are large differences in the cost of debt, with smaller firms typically paying higher interest rates than larger firms. The onset of the global financial crisis saw differences between small and large business lending rates increase further (Hambur and La Cava 2018b).
- Smaller firms typically find it harder to access external finance compared with larger firms, which means internal financing (such as cash flow) may be more important for investment (Carpenter and Petersen 2002).
- Smaller firms' balance sheets and credit access may be more affected by monetary policy shocks (Gertler and Gilchrist 1994; Ehrmann 2000).
- Uncertainty has been shown to affect firm investment behaviour (Bloom 2009; Moore 2016), and studies suggest smaller firms may be more sensitive to changes in uncertainty than larger firms (Ghosal and Loungani 2000).
- Changes in the economic cycle can be felt differently across the firm-size distribution. Studies have found that smaller firms experience larger fluctuations in sales and investment over the business cycle (Crouzet and Mehrotra 2020), and their revenue streams are generally more volatile from period to period (Connolly, Norman and West 2012). The COVID-19 pandemic is likely to have affected smaller firms more severely compared with larger firms (Lewis and Liu 2020).
- Firms of different sizes can face different tax obligations, some of which may be directly relevant to investment decisions such as

depreciation allowances. Depreciation allowances were introduced by the Australian Government during the global financial crisis and again during the pandemic. In both instances, the benefit to firms varied according to their size (Rodgers and Hambur 2018).

How might these differences translate to aggregate investment outcomes? A key piece of information to link the firm-level outcomes to overall outcomes is an understanding of the firm-size distribution of investment – that is, how much firms of differing sizes contribute to overall investment outcomes. However, until now, our insight into the firm-size distribution of investment has been limited.

Globally, some notable studies have highlighted the importance of the firm-size distribution for understanding aggregate output outcomes (see Gabaix 2011), and there have been a few extensions into the area of investment, with similar findings (Gala and Julio 2012; Grullon, Hund and Weston 2013). Large, firm-level data sets using administrative sources have become increasingly available for research purposes over recent years, and this has made the construction and analysis of full distributions of investment, output and other economic variables feasible and reliable, both in Australia and overseas.

Data and approach to constructing the distributions

This article draws on the Australian Bureau of Statistics (ABS) Business Longitudinal Analysis Data Environment (BLADE) to construct distributions of investment and output by firm size. BLADE combines annual business tax data from business activity statements (BAS) with information from ABS surveys and other administrative data, covering almost all Australian companies and unincorporated businesses. BAS data contains information on firms' output (revenue), capital purchases (investment), wages and operating expenses.

The focus is on private businesses (incorporated and unincorporated) in the non-mining sector, from 2001/02 to 2016/17. The mining sector is excluded as it is well known that it is dominated by a handful

of very large firms, whereas very little is known about the non-mining sector. This analysis only includes data up to 2017 because small businesses were no longer required to report capital expenditures to the Australian Taxation Office (ATO) in their BAS from 2018. Firms with annual output less than \$10,000 have also been excluded.

In this work, firms are classified by revenue (hereafter referred to as output). For each year of the sample period, firms are categorised based on their output using two different approaches: ranked by percentiles; and grouped by pre-defined size categories (small, medium, large and very large).

Large firms account for a very large share of business investment ...

Business investment is highly concentrated in the economy’s largest companies. The top 20 per cent of firms by output represent around 80 per cent of all investment, while the top 1 per cent of firms account for around half of all non-mining investment activity (Graph 1).

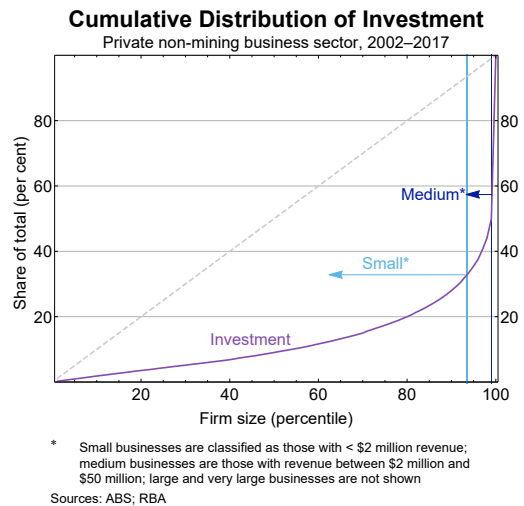
Around 93 per cent of all firms by number are small businesses (with annual output of less than \$2 million), and a further 6 per cent are medium-sized (with annual output above \$2 million but less than \$50 million) (Graph 2; Graph 3; Graph 9 in Appendix).^[1] Together, small and medium enterprises (SMEs) represent more than 99 per cent of all private non-mining firms, but around 60 per cent of non-mining investment.^[2]

Large firms (\$50 million to \$5 billion output) represent just 0.3 per cent of all firms but account for more than one-third of all investment. Very large firms (more than \$5 billion annual output), of which there were only around 30 in 2017 (or 0.005 per cent of firms), accounted for just under 10 per cent of all investment activity.

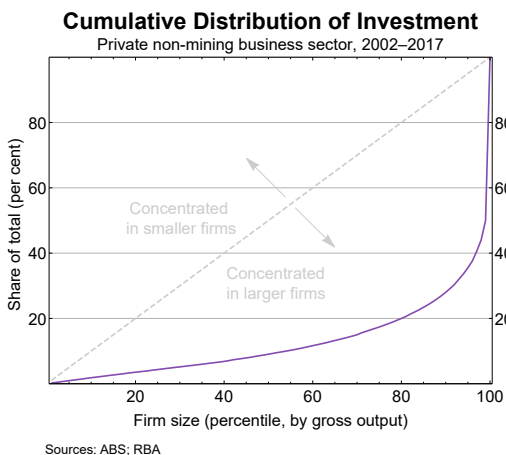
... and are the major drivers of the growth patterns and volatility in aggregate investment

The concentration of investment among the economy’s largest firms means they play a significant role in determining the patterns in aggregate non-mining investment over time, in terms of both growth and volatility (Graph 4;

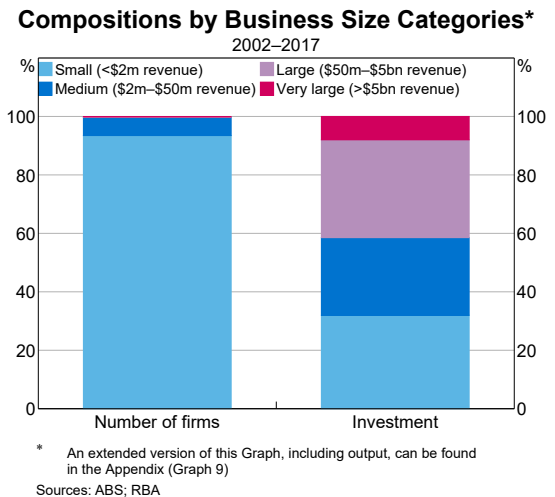
Graph 2



Graph 1



Graph 3



Graph 5).^[3] Investment by the top 1 per cent of firms accounts for around half of all investment, and also tends to be more volatile (in aggregate) compared with the investment behaviour of smaller firms; over the sample period, annual investment growth of the top 1 per cent of firms was around twice as variable as that of other firms. As a result, investment by the top 1 per cent of firms explains more than 80 per cent of the variation in aggregate investment.

A large part of the difference in variability is likely due to the number of firms being aggregated in these two groups.^[4] Firm-level investment tends to be 'lumpy' or 'intermittent' as firms concentrate their investment in a particular period rather than making smooth adjustments to their capital stock over time (see Doms and Dunne 1998; Caballero, Engel and Haltiwanger 1995; Cooper and Haltiwanger 2006). Variability at the firm level is less likely to 'wash out' for the top 1 per cent of firms simply due to the significantly smaller number of firms being aggregated.

The finding that firm-level outcomes at the economy's biggest firms can explain a large degree of variation in economic aggregates was highlighted by Gabaix (2011). Gabaix argued that, contrary to the common assumption at the time, firm-level shocks do not average out in the aggregate. This was because large firms accounted for a significant share of economic activity and so

aggregate fluctuations could result from granular, firm-specific origins.

Others have extended the work of Gabaix and found large firms to be important drivers of aggregate investment growth for the United States (see Gala and Julio 2012; Grullon, Hund and Weston 2013). However, we are not aware of any similar studies for Australia.

The concentrated nature of investment broadly reflects the concentration in output

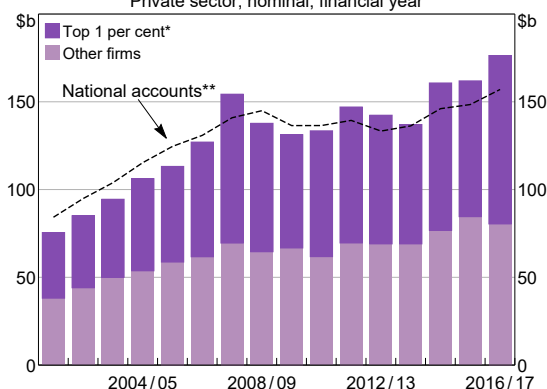
Why is investment so concentrated among the largest firms? Is it that larger firms invest proportionally more of their output than smaller firms? Or do large firms simply account for a larger share of economic activity? The answer appears to be the latter – large firms account for an extremely large share of economy-wide output. In fact, the distribution of output is even more concentrated than investment (Graph 6). The largest 1 per cent of firms account for almost 70 per cent of output, compared with 50 per cent for investment.

The highly concentrated nature of the output distribution is consistent with empirical evidence on firm size distributions globally. Similarly shaped distributions are found in natural and biological phenomena, languages (word frequency), network theory, wealth distributions, city sizes and more (see Axtell 2001; Gaffeo, Gallegati and Palestrini 2003; Gabaix 2016).^[5]

Graph 4

Non-mining Investment by Firm Size

Private sector, nominal, financial year



* By annual gross output (revenue)

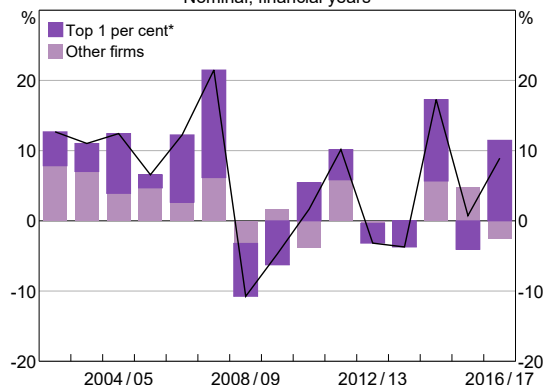
** Annual national accounts; private non-mining business investment

Sources: ABS; RBA

Graph 5

Contribution to Growth in Investment

Nominal, financial years



* By gross output; total sales or revenue

Sources: ABS; RBA

For the investment distribution, there do not appear to be any clear examples of papers that have actually constructed and presented the economy-wide investment distribution by firm size, internationally or domestically, making direct comparisons difficult.

The more concentrated nature of the output distribution suggests that, on average, small firms actually invest more heavily than large firms relative to their output; this is consistent with observations of US firms (Gala and Julio 2016). It is not obvious why this is, but a few potential reasons may be: smaller firms are more likely to be younger firms, and younger firms are found to be more capital-intensive (Hambur and Jenner 2019); smaller firms may be more present in more capital-intensive industries; or firm size acts as a proxy for firms' unobservable real investment opportunity set (Gala and Julio 2016). Future work could further investigate the differences in capital intensity by firm size in Australia and their implications.

The distribution of investment has become more concentrated over time

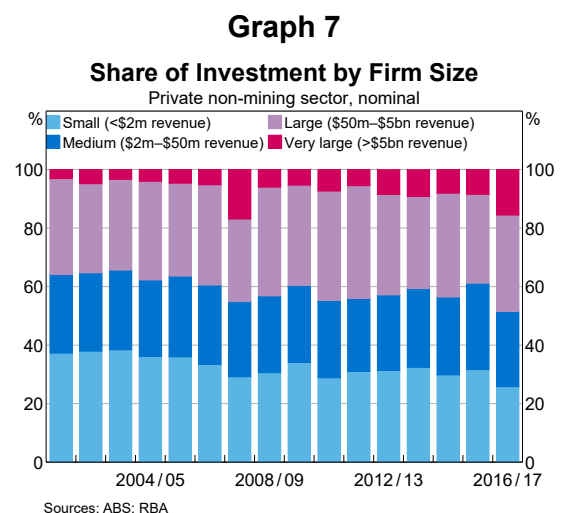
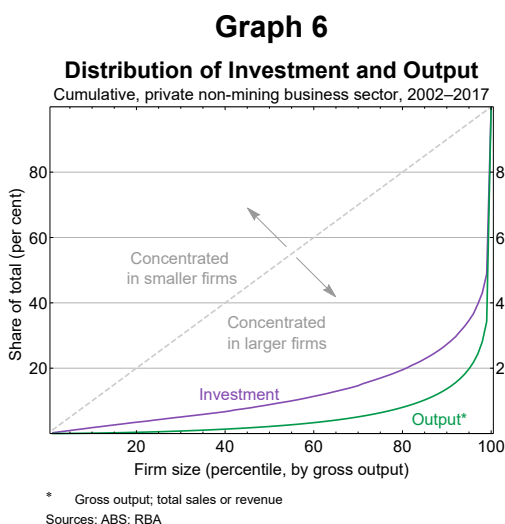
Since the early 2000s, very large firms have grown their share of investment, from an average of 4 per cent over 2002–2007 to almost 10 per cent over 2012–2017. Meanwhile, small firms' share of investment has declined, while the shares of medium and large firms have been roughly steady.^[6]

To the extent that the output and investment distributions are related, the result of higher concentration among larger firms is consistent with Hambur and La Cava (2018a), who found that the share of industry sales accounted for by the largest Australian businesses (or 'business concentration') has gradually risen since the start of this century.^[7]

What are the possible implications of this rising concentration of output and investment for aggregate investment dynamics? First, increased concentration of investment among a handful of firms may mean that industry-specific or firm-specific factors (such as those specific firms' investment opportunities, demand outlook and balance sheet) may become more important for explaining changes in aggregate investment. Second, given the literature tends to find that larger firms are relatively less responsive to or affected by changes in the economic cycle, cash flow, uncertainty and monetary policy stance, then it's possible that their increased share of investment could mean aggregate investment has become less responsive to these variables over time.

The distributions of output and investment vary across industries

In all industries, larger firms account for most of the investment, but the range of investment distributions by industry is wide (Graph 8). For both output and investment, the agriculture and accommodation, food, personal & other services industries are the least concentrated, while the utilities and media & telecommunications industries



are the most concentrated. The differences in concentration across industries are large: in agriculture, the bottom 80 per cent of firms account for around 30 per cent of investment; in utilities, the bottom 80 per cent represent just 5 per cent of investment. The results by industry, based on output, are broadly consistent with that of previous studies on market concentration, including Hambur and La Cava (2018a), Leigh and Triggs (2016) and Kumar, Rajan and Zingales (1999). Further detail by industry is shown in the Appendix.

There are likely to be many reasons behind the variation in concentration across industries, but a few potential explanations include differences in barriers to entry, economies of scale, financial frictions, capital-intensity, industry maturity, and other industrial organisation factors (see Bain 1954; Kumar, Rajan and Zingales 1999; Rossi-Hansberg and Wright 2007; Audretsch *et al* 2004).

Conclusions and implications

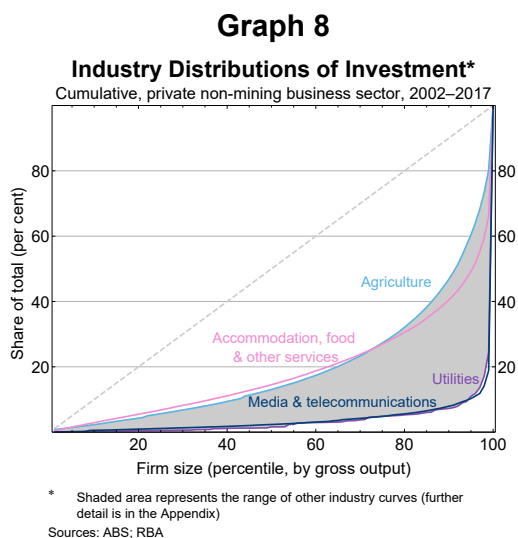
Large firms in Australia, as measured by revenue, make up a very large share of non-mining investment. The concentrated nature of the investment is consistent with (and in fact less pronounced than) the concentration of broader economic activity, at both the aggregate and industry levels. Understanding these distributional issues helps us to explain why investment is volatile at the aggregate level: if investment is lumpy for the country's largest firms, this will carry through to the aggregate because of their large share of

investment activity. This also underscores the value of the Bank's business liaison program, which includes many of the country's biggest firms, for analysing and understanding investment. The broader policy implication of this work is that the conditions faced by the economy's largest firms – the economic, tax and financial environments – are likely to be important influences on aggregate investment and other economic outcomes.

The non-mining business investment distribution has also become more concentrated over time in Australia, with a handful of top firms playing an increasing role in aggregate outcomes. This may mean that industry-specific or firm-specific factors may have become relatively more important over time for explaining aggregate investment outcomes. Similarly, if larger firms are relatively less responsive to or affected by changes in the economic cycle, cash-flow, uncertainty and monetary policy stance, as suggested by studies in other economies, then their increased share of investment may have reduced the average responsiveness of investment to these variables over time. However, these implications need to be more thoroughly investigated, especially in the Australian context, for conclusions to be drawn; this presents as an interesting avenue for potential future work.

We have focused on the contribution of firms of various sizes to aggregate investment outcomes. While larger firms are likely to contribute a larger share to aggregate investment, we have not addressed the important contribution of smaller firms to productivity, dynamism and other economic spillovers. Indeed, small and medium firms account for a large share of employment (Connolly, Norman and West 2012). Our preliminary analysis of this issue has found that small firms invest a larger share of their output back into investment. Future work could further investigate the reasons behind this, how it relates to productivity and dynamism, and the relative sensitivity of smaller firms' investment decisions to policy changes.

Understanding the distributions of investment and output helps to gauge how differences in the economic environment faced by firms may translate



to economy-wide outcomes. For example, if a particular policy emerged that targeted firms of a particular size, insights from the distribution will help to gauge its maximum possible direct impact on economy-wide investment. Previously, this was difficult and the accuracy of estimates would have been poor.

In relation to monetary policy, the international literature has tended to find that the transmission of monetary policy to firms, via the balance sheet and credit channels, is more modest for large firms

compared to small. This could be investigated in the Australian context using the micro-data in BLADE, including how transmission effects by firm size have interacted with changes in the firm-size distribution to reach an aggregate effect. If findings are similar to overseas, it's possible that a more concentrated distribution may have had the effect of dampening the average or aggregate transmission of monetary policy over time to the business sector through these channels.

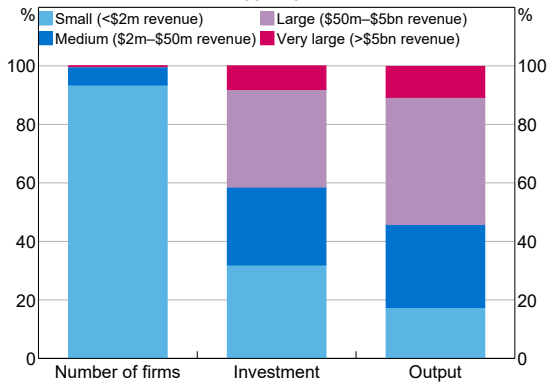
Appendix A

Graph 9 is an extension of Graph 3, showing output in addition to number of firms and investment.

The charts following show the distributions of output and investment by industry, grouped by goods industries (Graph 10; Graph 11) and services industries (Graph 12; Graph 13). For the investment distributions by industry, the steps in some industry-specific distributions are likely reflective of the lumpy nature of investment activity compared with the smoother production of output. This becomes more visible in the disaggregated data with smaller sample sizes. ✎

Graph 9

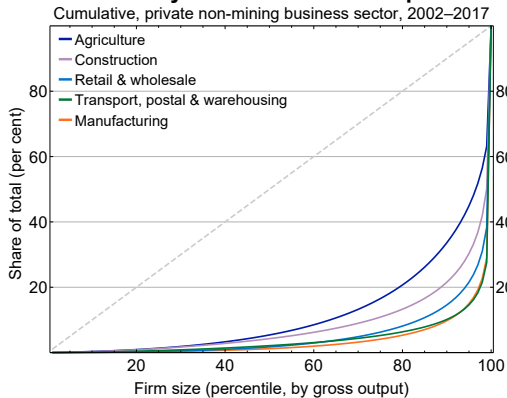
Compositions by Business Size Categories



Sources: ABS; RBA

Graph 10

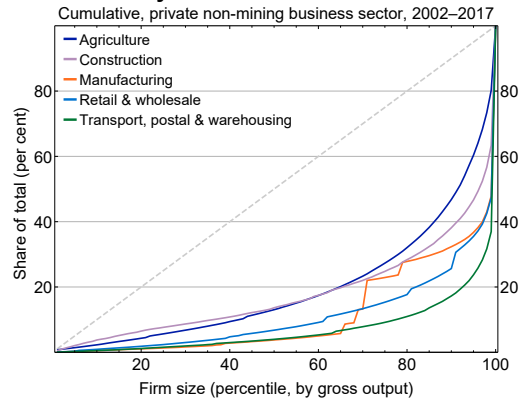
Industry Distributions of Output*



* Gross output; total sales or revenue
Sources: ABS; RBA

Graph 11

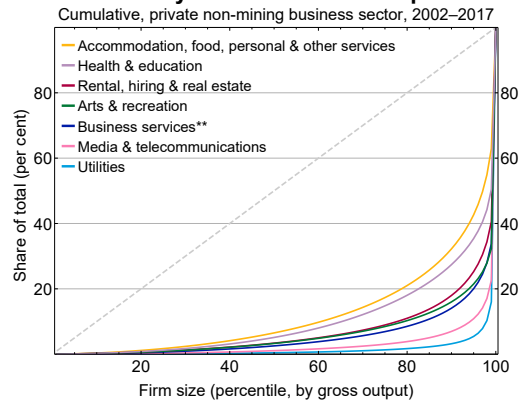
Industry Distributions of Investment



Sources: ABS; RBA

Graph 12

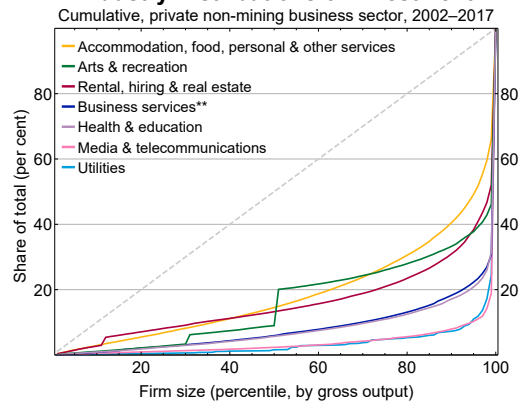
Industry Distributions of Output*



* Gross output; total sales or revenue
** Includes finance & insurance, professional, scientific & technical services, and administration & support services
Sources: ABS; RBA

Graph 13

Industry Distributions of Investment



* Includes finance & insurance, professional, scientific & technical services, and administration & support services
Sources: ABS; RBA

Footnotes

- [*] The author is from International Department, but completed this work while in Economic Analysis Department. The author would like to thank Tom Rosewall, Gianni La Cava, Matthew Carter, Tim Taylor, Benjamin Beckers, David Lancaster and Rachael Fitzpatrick for their much valued input at various stages of this work.
- [1] The definition of small business according to revenue is drawn from the ATO's definition in place until 2016/17. For medium-sized firms and SMEs more broadly there is no universally agreed definition. However, by revenue (or output), \$50 million is a commonly used threshold. For example, this is used in the APRA/ABS/RBA reporting standard (ARS 701) for EFS collection, as well as NAB's SME business surveys, and the government's Coronavirus SME Guarantee Scheme. The threshold for very large businesses (\$5 billion) is somewhat arbitrary, but is also partly informed by the Australian Government's 2020 investment incentives, which excluded firms with revenue greater than \$5 billion.
- [2] The small business share of business counts and value added in this analysis is broadly consistent with previous work by Connolly, Norman and West (2012), who found that small businesses represent around 96 per cent of businesses and around one-third of economic activity. I find a similar share of businesses are small firms, and that small firms represent around 27 per cent of profits or value added.
- [3] There are a number of potential reasons for any differences between BAS (and BLADE) data and the national accounts, including: BAS data on investment includes land purchases, while the national accounts do not; most components of national accounts investment draw upon ABS survey data, rather than economy-wide sources; and mining and non-mining classifications of investment may differ to some degree
- [4] To draw stronger conclusions here, a full analysis of firm-level 'lumpiness' or volatility in investment by firm-size is required, as well as how it interacts with the distribution. This is feasible with the data in BLADE, and could be an avenue for future work.
- [5] There is substantial literature focused on why the firm-size distribution is so concentrated in larger firms, dating back as far as Gibrat (1931) who argued that the distribution was a natural consequence of firms growing (in percentage terms) randomly and independently of one another. Meanwhile, others have argued that important determinants of the distribution are: frictions such as access to finance, which enhance larger firms' ability to survive and grow (Cabral and Mata 2003); and large firms' ability to take advantage of investments in R&D may be greater (Pagano and Schivardi 2003).
- [6] A slight disadvantage of size categorisations is that they may be susceptible to upward drift in firm classifications over time due purely to inflationary effects on firm output. However, when looking at the cumulative distributions according to firm percentile rankings, which are immune to the above-mentioned effects, it remains clear that distribution of investment has become more concentrated in larger firms since the early 2000s – for example, the top 1 per cent of firms have grown their share of investment from 49 per cent in the early 2000s to 54 per cent by 2017.
- [7] I also find that the distribution of output has become more concentrated: the top 1 per cent of firms have grown their share of output from less than 64 per cent in the early 2000s to 67 per cent by the later part of the sample.

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