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The innovation wage premium and labour mobility



Wages help shape the incentives for individuals to engage in the innovation process. Prior research has shown that within businesses, patent grants can cause substantial increases in firm productivity that are passed through into higher wages¹.

IP Australia is investigating the relationship between firm patenting and employee outcomes, such as retention, pay, job mobility and matching. A dynamic labour market, which efficiently matches people with jobs, gives businesses access to the right skills for innovation². A dynamic labour market also has broader benefits for workers. When more firms compete for productive workers, more people can find work, move jobs, upskill and receive better pay and conditions.

This research uses linked employer-employee data from the ABS, which provides information on around 14.5 million individuals employed between 2010 and 2019³.

The research identifies a significant wage premium for working in an innovative business that holds patents. The wage response is greatest for workers in lower-skill-level occupations (e.g., technicians, sales assistants and product assemblers). The results remind us how diversity in skills and backgrounds is needed for businesses to implement innovations in the market.

Over recent decades, a decline in economic dynamism has contributed to slow productivity growth⁴. In Australia, this includes a decline in job switching rates. IP Australia found evidence for this broadly and within Australia's patent sector. However, the evidence also suggests that resources flow from less productive businesses to innovative patent-holders, a process that could enhance aggregate productivity.

Key findings

- Working in an innovative business that patents is associated with an 11% wage premium in Australian SMEs.
- Patenting is associated with higher wages and a higher likelihood of retention, especially for workers in medium- and low-skill-level occupations.
- Patent-holding businesses rely on and create employment for a diverse workforce, including younger workers, migrants and those with digital technology skills, with benefits from innovation shared across occupations at all levels.

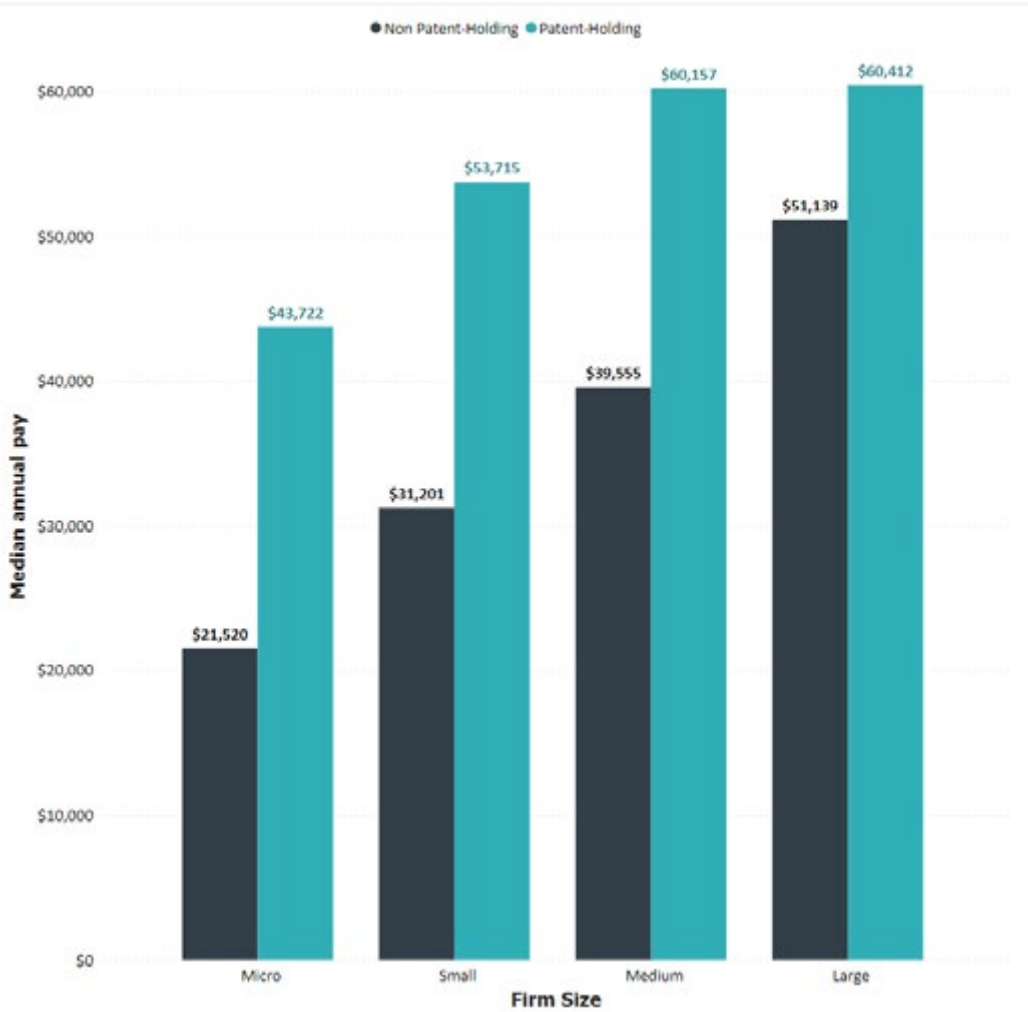
The innovation wage premium

Several studies have shown that, for workers, there is a significant wage premium associated with working in more innovative businesses. This wage response has been found for businesses that invest more in R&D, are more technologically innovative, and engage in patent activity⁵.

The wage premium is generally two-fold. On the one hand, workers may extract a share of the direct revenue from innovation. Additionally, workers may benefit from the increased business performance generally associated with innovation.

IP Australia used Australian microdata to investigate the wage premium from working in a patent-holding business. At a simple level, the median annual pay of workers in patent holding businesses is much larger than the median annual pay of workers in businesses without patents. This is the case across businesses of all sizes (micro, small, medium and large), as shown in Figure 8.1.

Figure 8.1 Comparison of the median wage for staff of different-sized businesses with and without patents

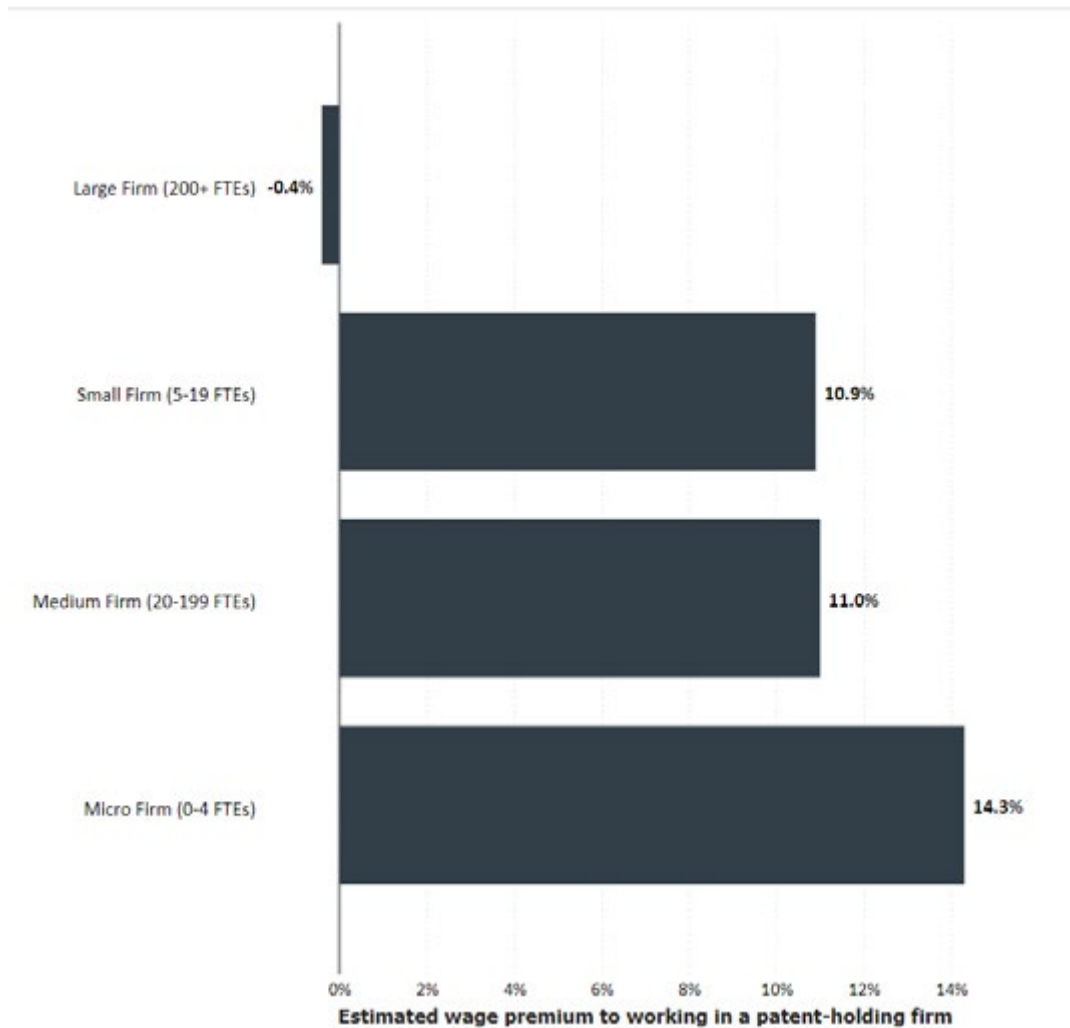


Source: MADIP, ABS, 2022; BLADE, ABS, 2022. Note: Firm size is identified based on a firm’s number of full-time equivalent (FTE) employees, consistent with ABS definitions: micro, 0–4 employees; small, 5–19 employees; medium, 20–199 employees; large, 200+ employees.

The study estimated outcomes associated with patenting, controlling for worker and business characteristics. For example, it controlled for the worker’s age, gender, occupation, years of tenure with the employer and outside wages (if they hold multiple jobs). It controlled also for unobserved personal attributes (such as natural ability) that do not vary significantly over time and which influence a person’s selection into working in an innovative business. The study also accounted for the age and productivity of the person’s employer, aspects of their regional labour market and macro conditions.

Figure 8.2 illustrates the estimated wage premium associated with patents for workers in businesses of different sizes. For workers in SMEs, employment by a patent-holding business is linked to an 11% wage premium. Patents indicate a business’s inventive capacity and can contribute to growth in business productivity, passed through into wages⁶. High-quality workers may also be selected for employment by patent-holding businesses, affecting their wages.

Figure 8.2 Estimated wage premiums for workers employed by patent-holding SMEs



Source: MADIP, ABS, 2022; BLADE, ABS, 2022. Notes: Wage premium refers to the relative increase (decrease) in annual primary job salary for workers in patent-holding firms compared to workers in non-patent-holding firms of the same size.

For workers in large businesses, employment by a patent-holding business is associated with slightly lower-than-average pay levels. This may be an artefact of the data: in larger businesses, returns on innovation may be shared through non-wage benefits, including profit-sharing arrangements.

The result may also reflect high labour market concentration around these businesses⁷. That is, relatively few large patent-holding businesses may compete in a market for skilled labour. Patent-holding businesses tend to be larger and more productive than businesses without patents. These attributes tend to increase a business’s bargaining power over wages⁸.

Across businesses of all sizes, working in a business that has held patents for three or more years is associated with higher levels of pay. This finding makes sense, as innovation may take time to improve business productivity and performance. The returns on patenting may take time to flow through as higher wages.

In addition, employees' wages increase on average with their employer's total number of patents. Research shows complementary patents – those covering technical components that combine to make a complex product – tend to increase a patent portfolio's total value⁹. Larger and more diverse portfolios are more likely to yield commercially successful patents.

Combining diverse skills for innovation

Innovation relies on collaboration between people with diverse skills and backgrounds. The study investigated how the returns to innovation in businesses that hold patents affect earnings for workers in occupations at different skill levels.

The ABS classifies occupations into different skill levels based on the level of formal education workers require to perform the occupation competently (see Table 8.1).

Table 8.1 *ABS skill levels and usual education requirements*

Skill level	Occupations have a level of skill commensurate with...	Example occupations
1	Bachelor degree or higher qualification	Engineer, Accountant, Pharmacist
2	Associate Degree, Advanced Diploma or Diploma	Science Technician, Office Manager
3	Certificate IV or Certificate III and work experience	Electrician, Mechanic, Secretary
4	Certificate II or III	Logistics Clerk, Machine Operators
5	Certificate I or compulsory secondary education	Sales Assistant, Product Assemblers

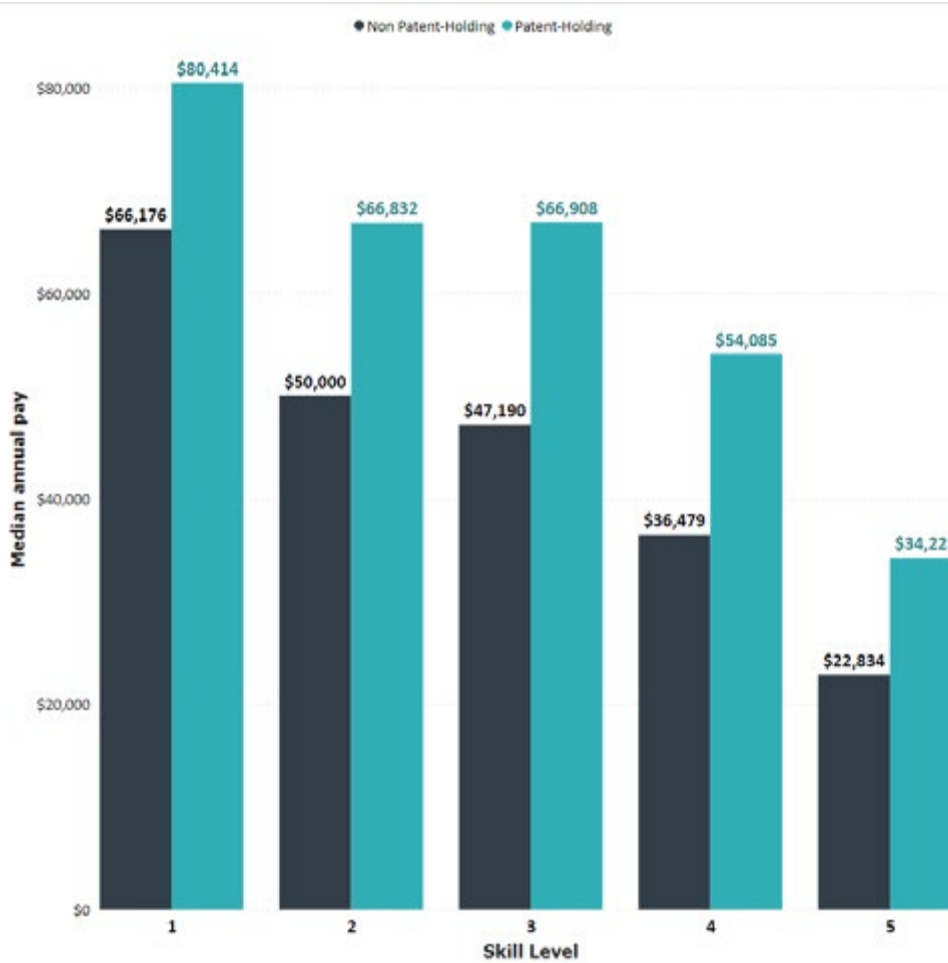
'Lower skill' occupations can require substantial experience and know-how – including soft skills and skills acquired on the job or through apprenticeships or training. Indeed, the results of this study (discussed below) highlight how having quality people across all roles – from engineers to product assemblers and sales assistants – is crucial to innovation.

Prior evidence is mixed on how the returns to innovation vary across occupations:

- Evidence from the US suggests inventors and top-earning employees receive larger wage increases from patent grants¹⁰.
- Research on UK businesses suggests that the innovation wage premium is higher for workers in lower-skilled occupations¹¹.
- Additional evidence indicates that highly skilled workers place a high value on non-wage-related job characteristics (e.g., physical working conditions, training and promotion opportunities and the opportunity to publish scientific outputs) for which they may be willing to sacrifice higher earnings¹².

In Australia, the median annual pay of workers in patent-holding businesses is much larger than the median annual pay of workers in businesses without patents across all skill levels (see Figure 8.3).

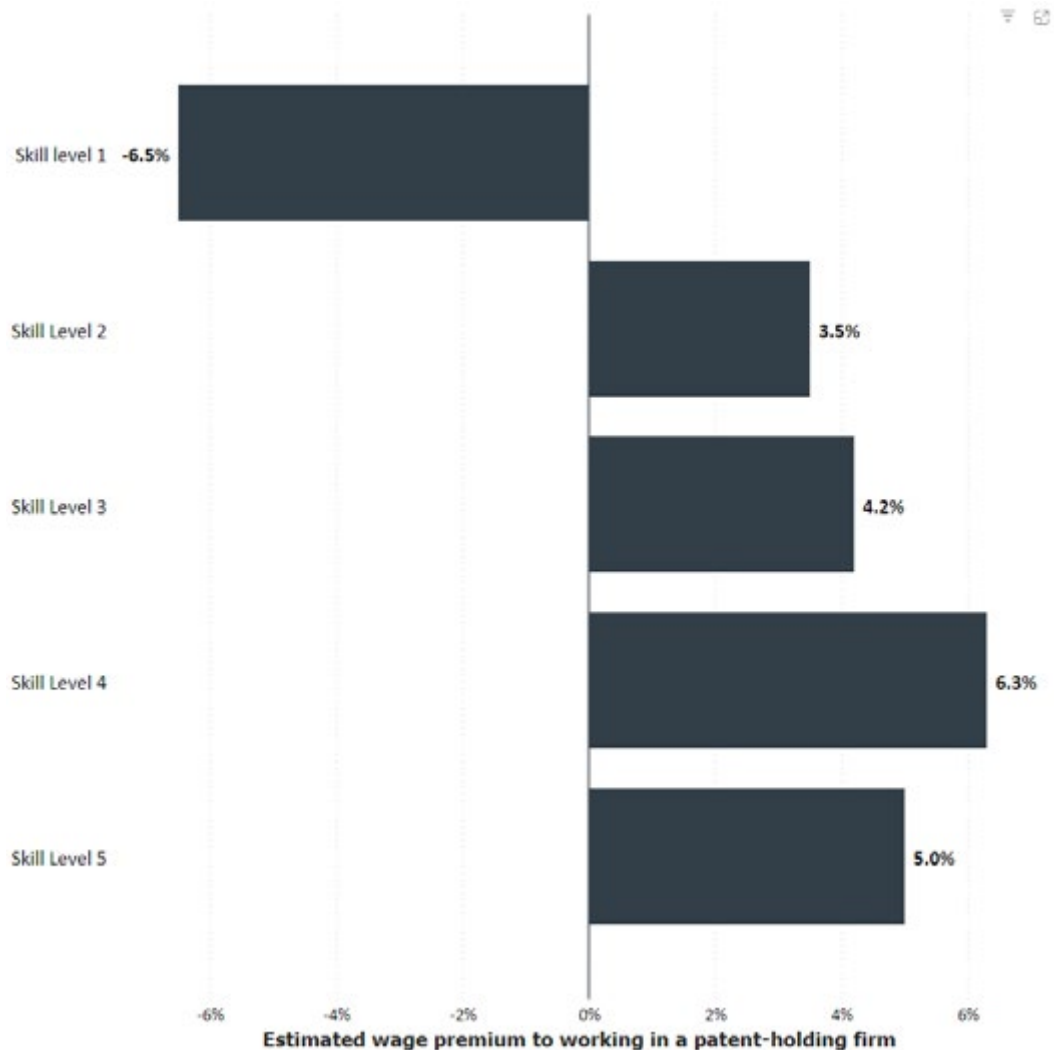
Figure 8.3 Median annual pay in patent-holding firms and non-patent-holding firms across all occupation skill levels



Source: MADIP, ABS, 2022; BLADE, ABS, 2022. Notes: Wage premium refers to the relative increase (decrease) in annual primary job salary for workers in patent-holding firms compared to workers in non-patent-holding firms of the same size.

Figure 8.4 shows the estimated wage premium associated with patents for workers of different skill levels based on economic modelling. For workers at the highest skill level, working in a patent-holding business is linked to lower pay levels. This likely reflects implementation of non-wage financial incentives and benefits to remunerate highly skilled workers. In addition, as inventors value patents as signals of their productivity to the labour market, some inventors may be willing to sacrifice higher wages to work in businesses with a strong innovation capability¹³. Further analysis reveals that workers at the high skill level in micro, small and medium enterprise enjoy a positive wage premium, akin to workers at lower skill levels.

Figure 8.4 Estimated wage premiums for workers employed by patent-holding firms based on employee skill level



Source: MADIP, ABS, 2022; BLADE, ABS, 2022. Notes: Wage premium refers to the relative increase (decrease) in annual primary job salary for workers in patent-holding firms compared to workers in non-patent-holding firms of the same size.

On average, employment in a patent-holding business was associated with a 3.5–4.5% wage premium for workers in medium-skill-level occupations. The innovation wage premium was 5.0–6.5% for workers in low-skill-level occupations. These results highlight how diverse skills are needed for businesses to implement innovations in the market. High-quality medium- and low-skill level workers may be deemed hard to replace and can command a wage premium for their contributions.

Retaining quality workers

While a degree of job churn and labour market dynamism is important for wage and productivity growth, retention offers many benefits to employees and employers. For businesses, retaining workers with relevant skills and know-how is a critical challenge – especially in a tight labour market. For workers, higher retention equates to greater job stability, which is often important for lower-income workers. Retention can also increase employers’ incentives to invest in training their employees¹⁴.

Based on economic modelling, the study found that working in a patent-holding business is associated with higher retention:

- Workers employed by a business in 2018 were 3% more likely to retain primary employment with that business in 2019 if the business held patents.
- The added likelihood was around 9% for workers in the lowest skill level occupations and 2% in medium skill occupations.

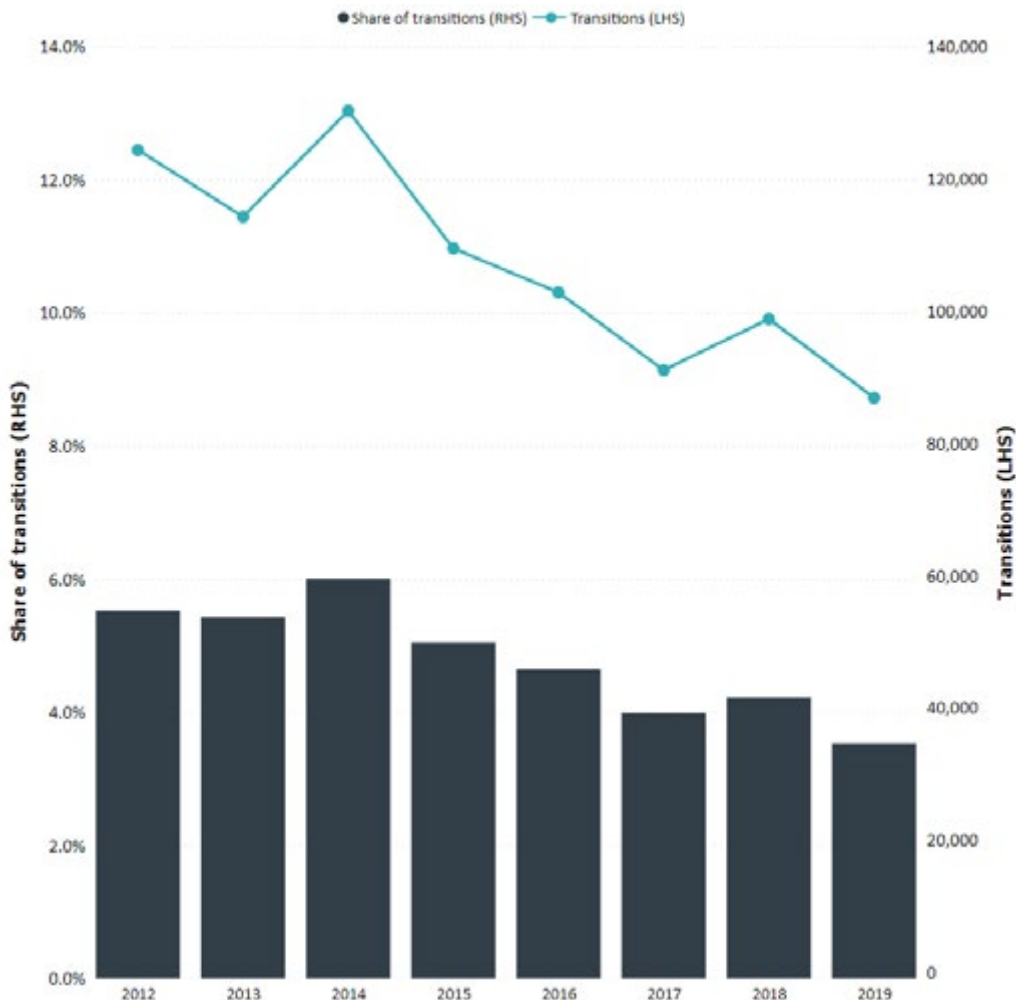
Managers can often easily observe the quality of inventors and scientists – it is reflected in their education and their patents and publications. The qualities of workers in lower-skill-level occupations may be harder to observe, making it difficult to replace quality workers in these roles¹⁵.

Moving between employers

The microdata provided insight into employment transitions across the economy – that is, where workers have changed employers in moving jobs. In Australia, the overall job switching rate fell between 2012 and 2019 (see Figure 8.5), consistent with prior research.

Over the same period, around one in five transitions were movements into a patent-holding business. Not accounting for personal attributes, a worker’s likelihood of joining a patent holding business stands at around 4.8%.

Figure 8.5 The share of job transitions into patent-holding firms and overall employment transitions from 2012 to 2019



Source: MADIP, ABS, 2022; BLADE, ABS, 2022.

When looking at transitions, it is possible to identify factors that make it more likely a worker will transition to a business with patents:

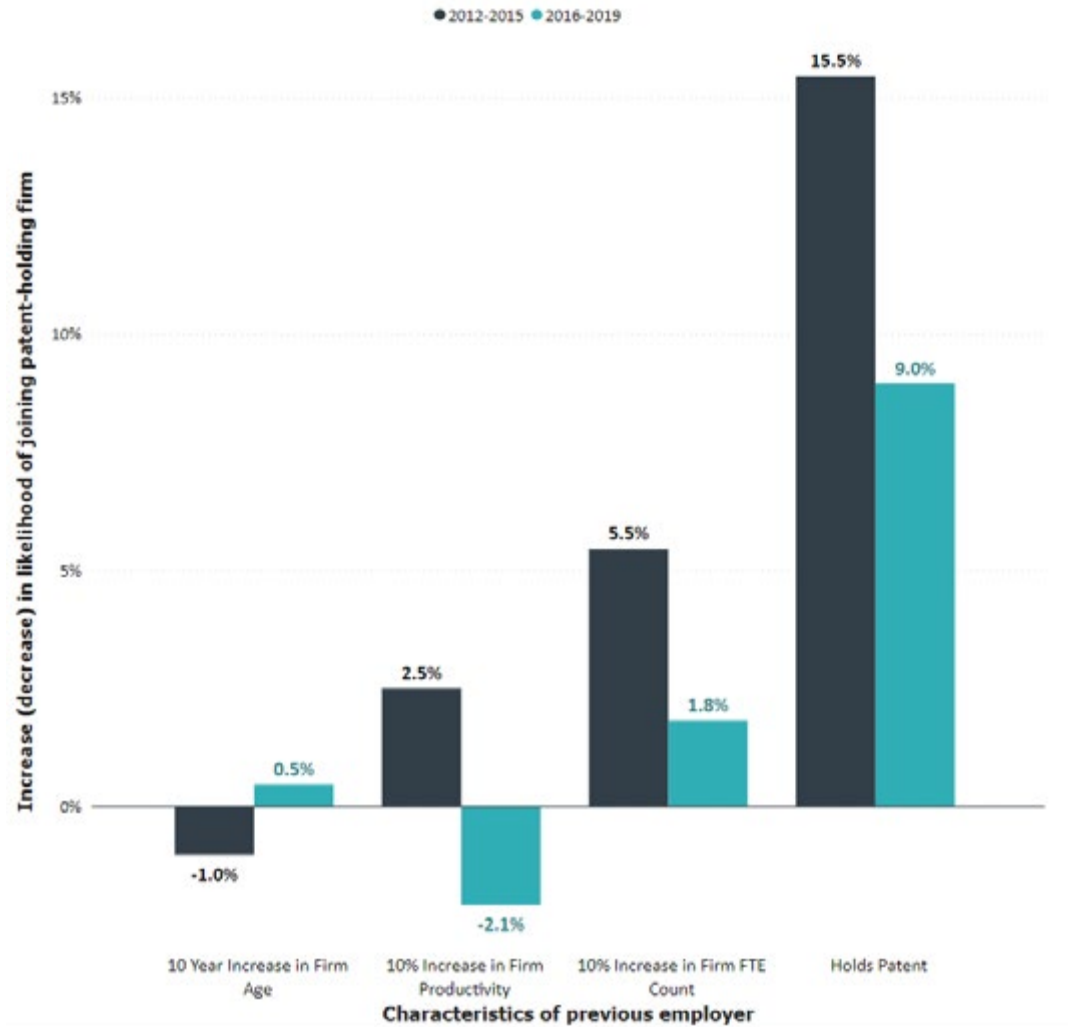
- Patent-holding businesses create employment for workers with previous experience working in digital technology (in ‘tech jobs’). Having digital technology skills increases the likelihood that an individual will join a patent-holding business by 41.7% (an increase of two percentage point above the 4.8% base rate at which workers join patent-holding businesses).
- Younger workers are marginally more likely to transition to a patent-holding business: every decade of age is associated with a 2.1% decrease in this likelihood (a 0.1 percentage point increase above the base rate).
- Men are around 10.4% more likely than women to transition to a patent-holding business (a 0.5) percentage point increase above the base rate).

These hiring patterns remained fairly constant over the study period. In addition, migrants are around 10.4% more likely to join a patent-holding business than workers born in Australia, highlighting the importance of migrants to innovation. This complements findings from the previous chapter that diversity underpins innovation in Australia.

Reallocating labour

Looking at who joins patent-holding businesses, the most dramatic shifts over the last decade have occurred in the characteristics of their previous employers (see Figure 8.6).

Figure 8.6 The characteristics of previous employers of workers who transition into patent-holding firms over time



In 2012 to 2015, people with experience working in larger and more productive businesses, especially those with patents, were more likely to be hired into businesses with patents. The likelihood of being hired into a patent-holding business was around 15.5% higher for people previously employed by a business with patents. By the second half of the decade (2016 to 2019), this relationship had weakened; in fact, the effect almost halved between the two periods.

Perhaps most strikingly, patent-holding businesses are increasingly likely to hire from less productive businesses and older businesses, whereas they used to hire from more productive businesses and younger businesses. This may reflect a rising prevalence in the economy of unproductive businesses that would typically contract or exit in more competitive markets. Recent research links this to declining levels of labour market dynamism generally¹⁶. Together, this study’s findings suggest that resources in the economy are flowing to more innovative businesses, a process which may be productivity enhancing. However, further research is needed to understand the impact of reduced dynamism on the productivity of patenting businesses.

Patent-holding businesses are hiring workers with AI skills at a higher rate

IP Australia commissioned Queensland University of Technology (QUT) to conduct a study examining the adoption of artificial intelligence (AI) within Australian and international businesses. AI technology is becoming more capable and versatile. As it transforms into a general-purpose technology, this raises key policy questions:

- Will AI develop into a new method of inventing that expands the range of possibilities for innovation and makes inventions cheaper and faster to produce? If so, what protections are needed to encourage AI-based innovation?
- Are AI developers – those creating new AI systems and components – the same or different actors to those who innovate using AI? Is IP protection needed to facilitate trade in AI technologies?
- Given AI is a black box – it can be difficult to understand and explain how it reaches outcomes – how can the IP system help spread technical knowledge in this domain?

The study by QUT forms part of a broader program of research and consultation that IP Australia is progressing.

The study measured AI adoption through LinkedIn profiles and job ads by identifying the skills businesses required for their employees and advertised positions.

The study found that small and medium enterprise are generally less focused on AI adoption than larger established businesses. However, it identified the emergence of highly specialised, technical start-ups focused on AI development in Australia.

For these businesses – as for the overall sample – having a patent was a good predictor of whether they were engaged in building AI capability: businesses with a stronger innovation and patent focus adopt AI at a higher rate. Adoption was strongly associated with patenting focused on the Physics field, which encompasses computer technologies.

This may indicate that businesses use patents to capture returns from developing AI systems.

To the extent that AI is being applied to innovate across domains, it might be expected that AI adopters will tend to patent across diverse technical fields. The QUT study found no evidence for this. Businesses appear to view AI as important for innovation across a wide range of domains, not just in niche areas. However, as currently applied, AI may be more important for automating operations than radical recombinant innovation.

Keep an eye on IP Australia's website for information about our AI consultation and research publications.

The innovation wage premium and labour mobility endnotes

- ¹ Kline, P., Petkova, N., Williams, H. & Zidar, O. (2019). *Who profits from patents? Rent-sharing at innovative firms*, The Quarterly Journal of Economics, 134(3), 1343–1404.
- ² Productivity Commission (2022). [5 year productivity inquiry: A more productive labour market](#) [Interim Report 6].
- ³ While many people may hold multiple jobs over a year, this research focuses on the outcomes and transitions in their primary job, defined as a job in which they earn at least half of their total annual earnings.
- ⁴ Hambur, J. (2022). [Product market competition and its implications for the economy](#). Economic Record. Advance online publication ; Andrews, D. & Hansell, D. (2019). *Productivity-enhancing labour reallocation in Australia* [Treasury Working Paper 2019-06]. Commonwealth of Australia; Quinn, M. (2019). [Keeping pace with technological change: The role of capabilities and dynamism](#) (Speech at OECD Global Forum on Productivity, Sydney, 20 June 2019).
- ⁵ For example, Agion et al. (2019), Cirera and Soares Martins-Neto (2020) and Kline et al. (2019).
- ⁶ Kline, P., Petkova, N., Williams, H. & Zidar, O. (2019). *Who profits from patents? Rent-sharing at innovative firms*. The Quarterly Journal of Economics, 134(3), 1343–1404.
- ⁷ Evidence for such concentration in Australia includes an overall decline in the labour share of national income. In a recent study, Hambur (2023) found that labour market concentration has negatively impacted wages in Australia and the impact has increased in severity over time. He attributes this to declining firm entry and dynamism reducing competition for labour among established businesses. See Hambur, J. (2023). [Did labour market concentration lower wages growth pre-COVID?](#) [Treasury Working Paper 2023-01]. The Treasury.
- ⁸ Yeh, C., Macaluso, C. & Hershbein, B. (2022). *Monopsony in the US labor market*. American Economic Review, 112(7), 2099–2138.
- ⁹ Gambardella, A., Harhoff, D. & Verspagen, B. (2011). *The determinants of the private value of patented inventions*. Bocconi University.
- ¹⁰ Kline, P., Petkova, N., Williams, H. & Zidar, O. (2019). *Who profits from patents? Rent-sharing at innovative firms*. The Quarterly Journal of Economics, 134(3), 1343–1404.
- ¹¹ Aghion, P., Bergeaud, A., Blundell, R. & Griffith, R. (2017). *The innovation premium to low skill jobs*. Additional evidence has shown high-skill workers place more value in non-wage related job characteristics such as physical working conditions, training and promotion opportunities, and the opportunity to work closely to scientific and innovative pursuits. This implies that wages play a smaller role in the job decisions of high-skilled workers and gives employers greater wage-setting power for these workers.
- ¹² For example, see Stern, S. (2004). *Do scientists pay to be scientists?* Management Science, 50(6), 709–853.
- ¹³ Melero, E., Palomeras, N. & Wehrheim, D. (2020). [The effect of patent protection on inventor mobility](#). Management Science, 66(12), 5485–5504.
- ¹⁴ Melero, E., Palomeras, N. & Wehrheim, D. (2020). [The effect of patent protection on inventor mobility](#). Management Science, 66(12), 5485–5504.
- ¹⁵ Aghion, P., Bergeaud, A., Blundell, R., Griffith, R. & Market, A. B. L. (2017). *The innovation premium to low skill jobs*.
- ¹⁶ Andrews, D. & Hansell, D. (2019). [Productivity-enhancing labour reallocation in Australia](#) [Treasury Working Paper 2019-06]. The Treasury.

