

Labour market impacts of technology change

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Technology is advancing at an astonishing rate. We can now open our phones just by looking at them with facial recognition technology, send a drone on a pre-programmed flight path to check on stock and fences on farms, or use Bluetooth technology to track disease outbreaks. Technology in the form of advanced robotics and AI-driven software are able to perform many tasks as well as, if not better than, humans. Technologists predict that AI-driven technologies will exceed human capabilities on a number of tasks. The number of tasks that machines can do better than us, and more cheaply than us, is growing rapidly.

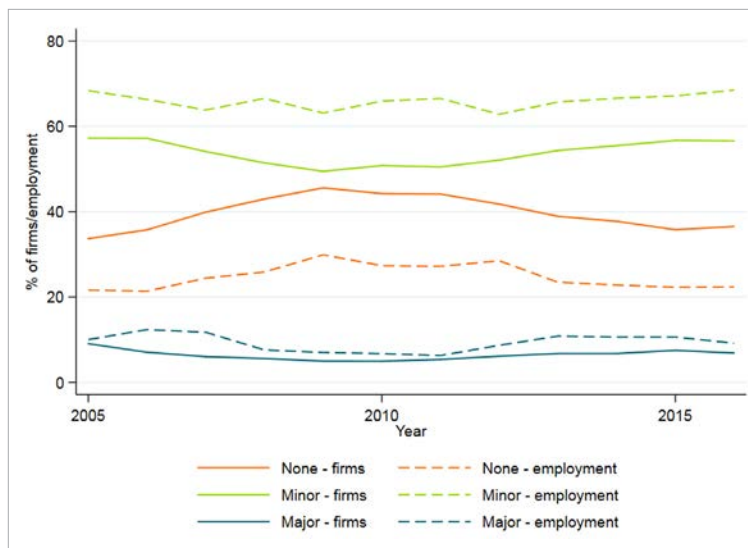
All this does raise the question “Are machines coming to take our jobs?” Estimates for the number of jobs at risk of automation in New Zealand over the coming decades range from 13% by the OECD to 47% by NZIER. So the answer appears to be yes, some jobs will be displaced by machines over the next 20 or 30 years. But this is not a new challenge; we’ve been replacing workers with machines since the onset of the industrial revolution. The new machines and new ways of organising our resources to produce goods and services has led to the creation of new jobs, jobs that couldn’t have been imagined before the invention and adoption of new technologies.

Other advanced economies, particularly the US, UK, Germany, and France have already begun to see changes in their labour markets consistent with more advanced technologies replacing workers that tend to perform more routine, predictable tasks. These are the kinds of jobs that are most susceptible to automation and have historically been good, stable middle-class jobs. Since we’re seeing these kinds of effects in other countries it seems natural to ask, are we seeing the same types of effects here?

How much disruption are we seeing in New Zealand?

We looked to see if there was evidence of technology-driven disruption in New Zealand's labour market. To do this, we compared the skill composition, total employment, and earnings distribution of firms in NZ who reported undertaking a major technology change to firms who reported undertaking no change. We did this by looking at responses to the Business Operations Survey (BOS), an annual survey of business practices and perceptions administered by StatsNZ.

First, we looked at which kinds of firms are more likely to report undertaking a major technology change.



Rates of major technology change are relatively low, with between 6% and 9% of firms reporting undertaking a major or complete technology change over the period 2005-2016. Firms are much more likely to report minor technology change, with at least 60% of firms reporting minor change over the period. Firms that report some form of technology change (major or minor) are at least twice as large on average. Rates of technology change don't seem to have increased substantially over the period. Most of the

changes in reported technology change seem to be related to the onset of the Global Financial Crisis and the subsequent recovery.

Major technology change tends to be a one-off event. Among firms that report major technology change, 80% report only one instance of change over a 3 year period. A small number report major change each year over a 3 year period, and this group looks to be where we are seeing the most changes to the workforce.

Larger firms, more capital intensive firms, and firms with a more highly skilled workforce are most likely to report a major technology change. Firms that report experiencing hiring difficulties are also more likely to report technology change in subsequent years.

New technologies appear to be embedded in new plant, machinery and equipment and new computer hardware/software. Firms that report major technology change are investing more in most types of assets, but their investments in new machinery and computer equipment are substantially higher in years of major technology change.

So we have a better picture of the kinds of firms that are undertaking major technology changes, and some idea of the kinds of technologies that they are investing in. The question remains, how are these changes affecting workers?



How are new technologies impacting firm workforces?

When we compare firms that reported a major technology change to those that reported no change, what we see is that firms reporting a major technology change experience much more rapid employment growth over the next two years. Firms that make a change get bigger, rather than shedding employees.

We see little change in the firm earnings distribution compared to firms that make no change. There is no difference between the two groups of firms in either growth in average monthly earnings of employees or changes in within-firm inequality.


This suggests that we shouldn't expect to see much change in the types of workers the firm has in its workforce. Firms that reported a major change hire slightly more workers with a university education, but this difference is small, equivalent to an extra 0.5 workers (at a firm with around 140 workers). There is some evidence that workers with a post-school (but pre-degree) qualification may find it more difficult to find jobs at these firms. We calculate that firms that undertake a major technology change collectively hired 1,700 extra workers with a university education. Given that these firms get a lot bigger after reporting a technology change this seems more to do with hiring more highly-qualified people rather than replacing current workers who have lower levels of qualification. These changes are more evident in firms that report undertaking an organisational or process innovation alongside a major technology change. This suggests that the other changes firms are making are complementary to their technology changes, allowing firms to reap the full benefits of new technologies.

Overall the effects we see are small. However, there is one small group of firms who have quite different experiences following technology change. This is the small group of firms that report undertaking repeated major technology change. These firms experience much more rapid employment growth than firms that report no change, and those that report undertaking one major change over a 3 year period. They also exhibit larger changes to their workforce (3 extra highly-qualified workers). However, these changes in high-skilled employment remains small relative to the size of firms, and has limited aggregate impact due to the small number of firms involved.

Conclusions and implications

New Zealand does not appear to be seeing the scale of disruption that has been documented in other countries, at least not yet. There are a number of possible reasons for this and these raise further questions. One reason is the relatively low rates of technology change, something that the Productivity Commission also noted in their 'Technology Change and the Future of Work' inquiry. This raises the question about barriers that firms are experiencing when thinking about changes to their core technologies.

Firms may also not be investing in automation technologies. We know that firms reporting technology change are investing in plant, machinery and equipment and computer hardware and software, but we don't know the capabilities of the new investments. They may be new technologies where we wouldn't actually expect to see much in the way of labour market disruption. A better understanding of the types of technologies being adopted would help us think about the potential labour market impacts.



Lastly, we don't know what other changes firms are making when they report no technology change. An important driver of investing in automation technologies is that they can perform certain tasks as well as (if not better than) people but at lower cost. But there are other ways that firms can ensure tasks are completed at a lower cost, for example outsourcing the task to another firm. These types of changes may have a similar effect to that of new technologies. If firms that report no change are making these choices, we won't see an effect of new technologies using those that report no technology change as the comparison group. A better understanding of the different choices that firms are making to ensure that tasks are completed will help us understand the role of technology change in shaping the labour market.

It seems that technology change hasn't had a large impact on New Zealand's labour market over the period we study (2007-2016). This is also the conclusion that the Productivity Commission came to in their 'Technology Change and the Future of Work' inquiry. However, the work sheds light on the types of effects that we may begin to see when (if) more firms begin making major technology changes, particularly if they make repeated major changes. Workers with university-level qualifications are likely to benefit, while those with mid-level qualifications may face some difficulty. Continuing to monitor the uptake of new technologies by firms will be important for signalling when we might begin to see larger impacts and ensuring appropriate support for potentially affected workers is in place.

It's unclear what effect the COVID-19 pandemic has had on the rate of technology adoption. The pandemic created a significant amount of uncertainty over the future direction of the economy, which would typically discourage firms from making large, risky investments. On the other hand, many firms were incredibly nimble and agile, making changes to their businesses (including technology changes) so they could continue to operate within the restrictions at different alert levels. Some of these technologies may be very new, but others were likely ones that are relatively widely used. It remains to be seen what impact technologies adopted to cope with the pandemic will have on the labour market.

One finding from our research that is relevant in the COVID age is that firms that experience hiring difficulties are more likely to report a major technology change. With borders closed, some firms are finding it more difficult to access some of the workers they need. These labour shortages may induce firms to invest in new technologies. Future work could consider the role of technology adoption in helping firms adjust to the COVID shock and the post-COVID world.

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