

# ULTRA-FAST BROADBAND, SKILL COMPLEMENTARITIES, GENDER & WAGES

An Executive Summary of Motu Working Paper 19-23

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## SUMMARY HAIKU

Ultra-fast broadband  
a flowering of earnings  
for some but not all.

## INTRODUCTION

New Zealand's central government initiated a large roll-out of fibre starting in 2011. Our statistics show one result of this large-scale programme was that firms' use of ultra-fast broadband (UFB) rose markedly, with the UFB penetration rate rising from 21% in 2010 to 55% in 2016. Large firms tended to be early UFB adopters as did firms in the financial and media and telecommunications sectors. Firms for which internet speed was considered important are shown to have adopted early and to have had a higher UFB penetration rate throughout the sample period. This research investigates the impact of UFB adoption on wages for employees of adopting firms.

Our earlier research (Fabling and Grimes 2016) documented multi-factor productivity gains of around 6% for firms that adopted both UFB and that implemented management practices that were designed to take advantage of UFB adoption. Notably, we found that firms which adopted UFB but which did not implement new practices to leverage the new technology, made no productivity gains as a result of UFB adoption.

## DATA

Our data are obtained from Stats NZ's Longitudinal Business Database and Integrated Data Infrastructure. We split workers by gender, qualification level and qualification type (STEM versus other) to test whether UFB is a complementary input for certain worker types.

For a worker to be included in the sample, we must know their sex and age (retaining only those aged 18-64), and we exclude workers in multiple jobs or who are in part-time employment. The resulting sample comprises 1,324,400 observations of workers with a job in a specific firm across the four years (810,100 observations for men and 514,300 for women).

Data on the firm's UFB status is obtained from the ICT module of the Stats NZ Business Operations Survey. This is an annual survey of firms with at least six employees. The response rate for the survey is approximately 80% giving responses from approximately 6,000 firms per wave. The ICT module is run every second year of the survey, with our coverage extending through four waves from 2010 to 2016. 2,061 firms are observed in all four waves, 1,818 in three waves and 1,887 in two waves.

## RESULTS - WORKERS

Within our predominant job sample, females are, on average, slightly more qualified than males:

- 13.4% of workers are unskilled (12% for females, 15% for males),
- 50% are semi-skilled (51%, 50%),
- 19% are skilled (22%, 18%)
- we are missing qualifications information for 17% (15%, 18%).

Within our predominant job sample, 15% of workers have a STEM qualification. However, only 6% of females have a STEM qualification (at any level) compared with 21% of males.



There is a clear pattern of winners and losers following firms' adoption of UFB. It leads to some wage increases for incumbent workers, but these effects differ by gender, qualification level and skill type. The major beneficiaries are men with STEM qualifications, plus men with university level (non-STEM) qualifications. Women with Masters level qualifications in non-STEM subjects may also benefit.

Other groups either experience no wage benefit from UFB adoption or experience a small wage decrease (around 0.5%) compared to similar workers in firms that do not adopt UFB.

While statistically significant, none of the effects is large: we find up to a 2% wage premium for STEM-qualified males with degrees and a less than 1% wage reduction for unskilled females.

The implication is that adoption of UFB enables firms to substitute for lower skilled workers, e.g. through greater use of out-sourcing for roles that utilise lower skilled workers.

## RESULTS - FIRMS

By 2016, approximately 85% of the largest firms had UFB whereas this figure was below 60% in 2010. For the smallest firms, only around 35% of firms had UFB in 2016 an increase on the 5% that had UFB in 2010. Nevertheless, the cross-sectional distribution of UFB remains diverse even in 2016 at which time the penetration rate varies from 17% (agriculture, forestry and fishing sector) to 79% (financial and insurance services).

Firm size is an important determinant of adoption throughout the sample period, while higher wage firms (within industries) were more likely to be early adopters. Firms that already had access to cable and cellular internet connections were more likely to adopt UFB. Firms that listed connection speed as a determinant had an increased likelihood of adopting UFB. Adopting firms increased employment (by almost 3%) relative to non-adopters.

A higher percentage of women work for firms that have UFB than males, although the gap closed over the sample period. This pattern likely reflects a greater early uptake of UFB in (relatively female-intensive) services firms within urban areas.

## CONCLUSIONS

Our results suggest that this new technology magnifies existing wage gaps between skilled (especially STEM-skilled) employees and other workers. This may occur because workers with STEM skills and workers in management roles are best placed to leverage a new UFB connection to the benefit of the firm.

This may point to a technology-related factor that could be contributing to the disparity between men's and women's wages. For instance, the task of leveraging new technologies may be allocated more to men than to women. Alternatively, men may be more likely than women to be rewarded through performance pay schemes when firm productivity rises.

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