

New Zealand's Workforce: QUALIFICATIONS AND EVIDENCE OF UPSKILLING

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Abstract

In this paper, I investigate the prospect that there has been a general 'upskilling' (understood as extensive skill-biased technological change) in the New Zealand workforce. This research, a descriptive study rather than an explanatory one, allows me to tentatively conclude several points. First, there is reason to believe that a general upskilling has occurred. Second, with certain assumptions, it can be shown that real incomes have been growing in the face of increasing supply, indicating strong, increasing relative demand for educated workers. Further, there is more to the determination of incomes than qualifications; to an important extent, the incomes of peers, regardless of qualifications, affect wages. Fourth, women are entering the labour force at a greater rate than men; significantly, this is true at the university end of the qualification spectrum. Finally, there is evidence to suggest a persistent, wide-spread disparity between the incomes of men and women, regardless of qualification, industry, and occupation.

Introduction

There is an increasingly common presumption of wide-spread skills shortages, especially at the upper end of the skills distribution. Common sense, and economic theory, would predict that skills-shortages would drive up wages for higher-skilled workers; these relatively higher wages would attract new supply (through education and immigration). This process, if it exists, could be called 'upskilling'. The purpose of this paper is to explore and, where possible, quantify this upskilling.

In this process, I am looking at one part of the labour market system: qualifications. I make the assumption that formal qualifications are a good proxy for skills. Thus, if there is a general and significant turn towards a 'high skilled' economy, then there, reasonably, ought to be a sign of it in the data on qualifications.¹

Specifically, in this paper I address three themes. First, I look at the trend in qualifications across the three most recent census cycles to estimate whether there is a general upward trend in skill acquisition. Second, I discuss the relationship between qualifications and occupations, where the intersection is alternately median wages and the number/share of incumbents. Third, by combining the data from the four qualifications categories created, I construct a single variable with which I solve for growth in income, supply, and demand of 'relatively skilled' workers from 1991 to 2001.

An additional outcome from this analysis is a comparison of men's qualifications and incomes to women's. It is not unexpected that there are differences in the types of skills acquired or the choice of occupation between the genders. But, this research allows me to isolate observationally equivalent (by qualification, occupation, and industry) individuals and compare their incomes. Thus, in each of the three sections below, I offer some observations on the differences and similarities between men and women.

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This research allows me to make several tentative observations. There is reason to believe that a process of upskilling has occurred. Higher skills, measured by higher qualifications, are associated with higher incomes. These real incomes have been growing in the face of increasing supply, indicating a strong relative demand for educated workers. But, there is more to incomes than qualifications; the market broadly determines income opportunities for workers, regardless of qualifications, by occupation and industry. (Further, and not explored here, there is a considerable analytical fog surrounding the affect of unobserved abilities on incomes.) Women are entering the labour force at a greater rate than men; significantly, this is true at the university end of the qualification spectrum. Finally, (and bearing in mind the effects of unobservable characteristics) there is a persistent, wide-spread disparity between the incomes of men and women, regardless of qualification, industry, and occupation.

The paper is organized in the following manner. The first section presents census data on the incomes and numbers of full-time workers by their qualifications. Qualifications are allocated to four exclusive groups: *University*, *Other Post-School*, *Higher school*, and *Fifth-Form or Less*. Using the same data, the next section constructs several occupation categories. The criterion used for creating these exclusive categories is the density of representation of the four formal education levels in each occupation. The third section uses the four qualification groups to construct a single variable for relatively higher skilled workers. This variable is used to shed light on the idea of ‘upskilling’ and its unfortunate shadow, ‘skills shortage’. A final section brings together the various conclusions of the paper and offers some ideas for future work.

Trends in Qualificationsⁱⁱ

One starting point in an analysis of general upskilling is with income and employment. Changes in incomes and levels of employment (by occupation and qualification) tell us much about the labour market, or, at least, the short side of the labour market. Table 1 provides information on growth in median income by qualification.ⁱⁱⁱ

Table 1: Real Median Income^{iv} by Qualification^{v, vi}

Qualification	1991	1996	2001	Growth (96-01)	Growth (91-01)
University	\$ 49,985	\$ 47,955	\$ 49,883	4.0%	-0.2%
Other Post-Secondary	\$ 34,175	\$ 35,990	\$ 37,394	3.9%	9.4%
Higher school	\$ 32,709	\$ 33,050	\$ 33,770	2.2%	3.2%
5th Form or Less	\$ 26,939	\$ 28,186	\$ 29,201	3.6%	8.4%
Total	\$ 31,947	\$ 32,371	\$ 34,405	6.3%	7.7%

Source: Censuses of Population and Dwellings

There are a few things that become immediately clear from the table. First, as far as qualifications signal skills and productivity, the higher the qualification earned, the higher the likely remuneration received. Second, incomes growth was uneven among the categories, but jumped significantly at the bottom end over the decade. However, growth was more even across the categories during the second half of the decade and, in fact, slightly favored the top-end. The third notable point is, perhaps, the most striking: In the age of the purported high-skill boom, the real return to those with the highest qualifications stayed about the same between 1991 and 2001 (last column). However, there was solid growth at the top end during the second-half of the decade (next-to-last column).

Using median wages can lead to some odd results. For example, whereas the over-the-decade growth in *University* wages was stagnant in Table 1, the components of this category (wage growth of male and

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female university graduates) show no sign of this stagnation in Table 2. In other words, the real wages of university graduates grew over the decade, and especially so from 1996 to 2001, suggesting increasing demand for these graduates. This latter point will be taken up in greater detail in section three.

Table 2: Median Income^{vii} by Qualification by Gender

Qualification	Gender	1991	1996	2001	Growth (96-01)	Growth (91-01)
University	Male	\$ 55,332	\$ 54,101	\$ 58,713	8.5%	6.1%
	Female	\$ 40,724	\$ 39,610	\$ 42,416	7.1%	4.2%
Other Post-Secondary	Male	\$ 36,501	\$ 38,552	\$ 40,097	4.0%	9.9%
	Female	\$ 30,490	\$ 31,928	\$ 33,373	4.5%	9.5%
Higher school	Male	\$ 36,499	\$ 37,295	\$ 36,945	-0.9%	1.2%
	Female	\$ 28,772	\$ 29,396	\$ 30,107	2.4%	4.6%
5th Form or Less	Male	\$ 29,524	\$ 30,621	\$ 31,709	3.6%	7.4%
	Female	\$ 22,725	\$ 24,220	\$ 25,870	6.8%	13.8%
Average	Male	\$ 34,635	\$ 35,921	\$ 37,103	3.3%	7.1%
	Female	\$ 27,383	\$ 28,448	\$ 30,482	7.2%	11.3%

Source: Censuses of Population and Dwellings

From Table 2, it's again clear that the higher the qualifications, the higher the expected income. But, the premium earned for higher qualifications is much greater for men than for women. Indeed, the 2001 pay step from *Other Post-Secondary* to *University* for men was \$18,600, while, for women, the step was about \$9,000. Moreover, the spread of male earnings by qualification (*University* minus *Fifth Form or Less*) was \$27,000, versus \$16,500 for women, which is another way of saying that women's incomes are much more concentrated than men's.

Between 1991 and 2001, there was very strong income growth in the lowest qualification category, especially for women. Moreover, the growth rate was greater overall for women than men. The same pattern held between 1996 and 2001. The big, but not surprising, finding is that the wage differential between men and women is still quite large. While women earned 82 cents for each dollar earned by men overall – an increase of 3 cents from 1991 – they earned a mere 72 cents for each dollar earned by men at the *University* level – a decrease of nearly two cents since 1991. The literature on this yawning is extensive, much of it dedicated to 'explaining' away much – but never all – of the gap.^{viii}

The next table looks at wages for each qualification category relative to the (excluded) *Fifth-Form or Less* category (men are compared to men; women, women).

Table 3: Income Ratios per Gender (Fifth-Form or Less Excluded)

Qualification	Gender	1991	1996	2001
University	Male	1.87	1.77	1.85
	Female	1.79	1.64	1.64
	Total	1.86	1.70	1.71
Other Post-Secondary	Male	1.24	1.26	1.26
	Female	1.34	1.32	1.29

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	Total	1.27	1.28	1.28
Higher school	Male	1.24	1.22	1.17
	Female	1.27	1.21	1.16
	Total	1.21	1.17	1.16
Average	Male	1.17	1.17	1.17
	Female	1.20	1.17	1.18
	Total	1.19	1.15	1.18

Source: Censuses of Population and Dwellings

Table 3 reveals that wages by qualification became more concentrated, or less unequal, over the decade. As the previous tables revealed, this is greatly due to the significant increases in incomes going to full-time employees with fifth form (or less) education. In other words, even though wages at the top-end increased for both men and women, wages at the bottom end increased by more, thus reducing the differential. There was one exception to this outcome: The earnings differential for men between *Fifth-Form or Less* and *Other Post-Secondary* qualifications increased. (Likewise, the premium for male university graduates jumped significantly after 1996). Nevertheless, from this perspective, the high-skill wage premium has fallen somewhat. And, if true, the argument regarding a shortage of higher skilled workers seems to stumble.

I now turn to changes in employment by qualification, which, when combined with wage data, will allow me to draw some tentative conclusions. Table 4 presents data on total, male, and female employment by qualification.

Table 4: Employment by Qualification and Gender^{ix}

Qualification	Gender	1991	1996	2001	Growth (96-01)
University	Male	69,171	89,628	107,928	20.4%
	Female	32,007	50,490	79,122	56.7%
	Total	101,175	140,121	187,053	33.5%
Other Post-Secondary	Male	257,274	180,759	179,253	-0.8%
	Female	120,411	95,424	106,740	11.9%
	Total	377,682	276,183	285,990	3.6%
Higher school	Male	60,099	85,725	134,325	56.7%
	Female	36,762	59,535	94,074	58.0%
	Total	96,861	145,263	228,399	57.2%
5th Form or Less	Male	226,404	251,532	249,681	-0.7%
	Female	131,532	152,889	150,351	-1.7%
	Total	357,933	404,421	400,032	-1.1%
Total	Male	629,850	683,502	727,998	6.5%
	Female	334,065	403,017	458,271	13.7%
	Total	963,915	1,086,516	1,186,269	9.2%

Source: Censuses of Population and Dwellings

Bearing in mind the corresponding details from the income tables above, this table fleshes out some interesting suppositions. First, I am struck by the simultaneous jump in full-time employment of women with university degrees – up nearly 60 percent from 1996 (and 150 percent over the decade) – and that same group's increasing (median) real wages – up by over 7 percent. Together, this implies that demand for women with university qualifications outstripped supply by a significant amount.^x Second and more generally, the demand for full-time university-educated labour must have exceeded the supply of workers willing to work full-time, since employment moved ahead by just over 33 percent while wages climbed 4 percent.

Next, there was a stark difference in outcomes at the *Other Post-Secondary* level with male employment holding steady while female employment jumped 12 percent. Nevertheless, wages for

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both men and women in this category moved ahead by about 4 percent. But the real eyebrow-raising outcome is at the *Higher school* level: Both male and female full-time employment grew by nearly 60 percent. However, only women's wages increased in the category.

Finally, it is also reasonable to assume that because of such strong growth in top-end employment, coupled with solid growth in top-end wages, that there has been increasing demand for higher skilled workers, but no indication that this demand has exceeded or been in the absence of lower-skilled demand. In other words, from this perspective there isn't enough information to conclude one way or the other about a *skills* shortage; rather there seems to be general labour market tightening across the skills spectrum. I estimate this increase in demand later in the paper.

Heterogeneity of Qualifications and Occupations

In this section, I stratify occupations according to the qualifications of incumbents. The data in this section are limited to the 2001 Census. By applying qualification density criteria to 3-digit occupations, I have created several categories of occupations.^{xi} Due to space considerations, I limit the discussion to just a few such categories.

Table 5: Occupation Groupings and Income^{xiii} by Incumbent Qualification

3-digit Occupation	Percentage Concentrations				Income Deciles		
	Univ	Other Post-Secondary	Higher school	Fifth Form or Less	10th	Median	90th
University Qual Occupations					\$ 29,549	\$ 56,722	\$ 100,001
Legal Professionals	88.3	3.9	4.7	3	\$ 29,562	\$ 68,963	\$ 100,001
Health Professionals (Except Nursing)	84.4	9	5.7	0.9	\$ 35,677	\$ 80,547	\$ 100,001
Mathematicians, Statisticians Professionals	78	9.1	10.3	2.6	\$ 32,389	\$ 53,601	\$ 100,001
Physicists, Chemists Professionals	75.8	14.1	6.9	3.2	\$ 29,548	\$ 52,327	\$ 90,005
Tertiary Teaching Professionals	71.2	20.5	5.4	2.9	\$ 27,701	\$ 53,831	\$ 88,841
Secondary Teaching Professionals	70.4	25.8	3	0.8	\$ 30,485	\$ 52,288	\$ 67,253
Social and Related Science Professionals	65.9	20.3	8.5	5.4	\$ 24,229	\$ 46,905	\$ 86,925
Other Post-Secondary Qual Occupations					\$ 20,722	\$ 36,743	\$ 63,634
Nursing Associate Professionals	5.4	77.7	4.2	12.7	\$ 17,469	\$ 28,693	\$ 42,859
Electricians	1	77.1	9.9	12	\$ 21,545	\$ 38,124	\$ 65,154
Higher school Qual (Only) Occupations							
Nil							
Fifth-Form or Less Qual Occupations					\$ 12,879	\$ 27,357	\$ 47,286
Agricultural, Earthmoving Equip't Operators	1.2	13	12.3	73.4	\$ 15,524	\$ 30,973	\$ 53,681
Railway Engine Drivers and Related Workers	0.6	11.6	15.8	72	\$ 26,667	\$ 52,783	\$ 67,160
Motor Vehicle Drivers	1.6	11.8	14.6	71.9	\$ 15,294	\$ 29,720	\$ 48,500
Leather and Related Products Processors	1.8	12.5	15.5	70.1	\$ 16,206	\$ 28,305	\$ 43,378
Refuse Collectors and Related Labourers	1.6	14.2	14.2	70	\$ 10,444	\$ 26,574	\$ 50,251
Food and Related Machine Operators	2	12.8	16.1	69.2	\$ 15,078	\$ 28,150	\$ 45,663
Labourers	2.2	12.7	16.8	68.3	\$ 10,752	\$ 25,077	\$ 42,464
Textile Products Machine Operators	2.1	8.5	22.2	67.2	\$ 10,405	\$ 21,080	\$ 36,204
Packers and Freight Handlers	2.3	11.2	20	66.6	\$ 10,890	\$ 25,483	\$ 46,121
Wood-Processing and Related Operators	2.2	18	14.1	65.7	\$ 16,907	\$ 33,030	\$ 67,117
Univ/Other Post-School Qual Occupations					\$ 18,229	\$ 37,171	\$ 61,201
Special Education Teaching Professionals	55.7	32.6	6.8	4.9	\$ 17,286	\$ 40,213	\$ 63,683
Archivists, Librarians Professionals	40.8	35	13.5	10.8	\$ 18,836	\$ 35,806	\$ 56,698

Source: Censuses of Population and Dwellings (2001)

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Other Post-Secondary Qual Occupations	University Qualification	\$ 36,556	0.99	\$ 36,154	0.95	\$ 35,625	1.26
	Other Post-Secondary Qualification	\$ 37,924	1.03	\$ 39,526	1.03	\$ 28,257	1.00
	Higher school	\$ 33,848	0.92	\$ 34,369	0.90	\$ 31,853	1.12
	Fifth Form or Less	\$ 32,419	0.88	\$ 34,220	0.89	\$ 26,980	0.95
	Total	\$ 36,743	1.00	\$ 38,236	1.00	\$ 28,318	1.00
Total Fifth-Form or Less Qual Occupations	University Qualification	\$ 24,931	0.91	\$ 26,049	0.89	\$ 21,213	1.03
	Other Post-Secondary Qualification	\$ 29,853	1.09	\$ 31,786	1.09	\$ 19,875	0.97
	Higher school	\$ 26,491	0.97	\$ 28,554	0.98	\$ 20,827	1.02
	Fifth Form or Less	\$ 27,425	1.00	\$ 29,310	1.00	\$ 20,617	1.00
	Total	\$ 27,357	1.00	\$ 29,260	1.00	\$ 20,519	1.00

Source: Censuses of Population and Dwellings (2001)

For men, possessing a university degree does not necessarily guarantee the highest income within a given occupation classification. For example, a university-degreed male employee in the *Fifth Form or Less* classification earns about 11 cents *less* per dollar of income than a higher-school non-completer and 21 cents per dollar *less* than someone with some other post-secondary education. This would seem to imply that, to some extent, education is not simply a sorting process or a signalling device.^{xiv} The same doesn't necessarily hold true for women. For each occupation category, the income of the university-educated women is above that for her lesser-educated occupational peers.

Thus, there is more affecting income in any given classification than just the effect of that qualification group's pay range. A university graduate will earn considerably more in university-type occupations than in non-university-type occupations (in general, education matters), but may earn less than his less-well-educated counterparts in these non-university-type occupations (more specifically, education isn't the whole story). And for any given qualification, expected income increases with the incomes of occupational peers (i.e., those within the same occupation).

I noted earlier that women earned about 82 cents for every dollar earned by men. This was an aggregate figure. Thus, the 18-cent difference *could* simply reflect the choice of occupation – the so-called composition effects. In other words, (to use an extreme example) maybe the differences in income results from university-educated women working as librarians while university-educated men work as lawyers.

The following table allows us to compare 'like with like' by breaking down single occupations (3 digit) for men and women by qualifications and median earnings. I've simply chosen three occupations (representing different types of work and expectations) to compare, but the pattern holds for nearly every 3-digit occupation.^{xv}

Table 7: Median Income by Qualification by Gender

Occupation	Qualification	Male	Female
Legal Professionals	University Qualification	\$ 95,349	\$ 52,658
	Other Post-Secondary Qualification	\$ 47,917	\$ 39,167
	Higher school	\$ 51,819	\$ 38,445
	Fifth Form or Less	\$ 38,621	\$ 33,368
	Total	\$ 89,849	\$ 48,496
Religious Professionals	University Qualification	\$ 33,742	\$ 31,462
	Other Post-Secondary Qualification	\$ 30,783	\$ 22,116
	Higher school	\$ 22,693	\$ 14,436
	Fifth Form or Less	\$ 24,197	\$ 13,500
	Total	\$ 31,134	\$ 20,663
Legislators	University Qualification	\$ 79,707	\$ 66,364
	Other Post-Secondary Qualification	\$ 65,000	\$ 43,001

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Higher school	\$ 56,667	\$ 46,429
Fifth Form or Less	\$ 48,637	\$ 35,001
Total	\$ 62,882	\$ 46,667

Source: Censuses of Population and Dwellings (2001)

For the occupations chosen the difference in incomes is greater at this level of comparability. In fact, in the above table, women earn an average of 72 cents on the male dollar. The legal profession offers a stark contrast in earnings: Women earn just a bit more than half of what men earn. At the other extreme, in the religious profession, university educated women earn about 93 cents for every dollar earned by men. In between these extremes lie the legislators' incomes. A higher percentage of female legislators possess a university degree (34%, versus 30%), and these women take home about 83 cents for each dollar paid to their male colleagues.

However, the table's results do not take account of other factors that one would expect to influence the incomes of men and women, like relevant experience and the effects of broken careers. In fact, if it shows anything, then the above table shows that even in the highly structured employment environment of Legislators, a pay gap persists, which indicates that other, notoriously-hard-to-measure factors are the drivers behind persistent wage gaps.^{xvi}

An occupation describes the work that is done, irrespective of what is produced and this omission may matter. Thus, another way of looking at the data is by the allocation of qualifications among industry groups. Admittedly, the level of industry detail in Table 8 doesn't appear particularly informative, but it does help to highlight some employment outcomes. As with other tables, I am forced to limit the exposition because of concerns about length.

Table 8: Median Income by Industry for Two Qualifications

	University		Fifth Form or Less	
	Median	Share	Median	Share
Total All Industries	\$ 49,883	100%	\$ 29,201	100%
A Agriculture, Forestry and Fishing	\$ 35,367	3%	\$ 27,207	13%
B Mining	\$ 77,374	0%	\$ 36,926	0%
C Manufacturing	\$ 49,089	7%	\$ 29,853	20%
D Electricity, Gas and Water Supply	\$ 68,095	1%	\$ 36,195	0%
E Construction	\$ 45,108	1%	\$ 31,294	8%
F Wholesale Trade	\$ 54,318	5%	\$ 33,374	8%
G Retail Trade	\$ 32,745	4%	\$ 25,589	12%
H Accommodation, Cafes and Restaurants	\$ 29,880	2%	\$ 22,242	3%
I Transport and Storage	\$ 41,695	2%	\$ 33,621	6%
J Communication Services	\$ 60,891	1%	\$ 32,502	1%
K Finance and Insurance	\$ 62,643	5%	\$ 36,997	2%
L Property and Business Services	\$ 59,295	24%	\$ 31,993	8%
M Government Administration and Defence	\$ 51,927	8%	\$ 34,368	3%
N Education	\$ 49,864	20%	\$ 25,192	2%
O Health and Community Services	\$ 48,407	12%	\$ 24,176	4%
P Cultural and Recreational Services	\$ 38,828	3%	\$ 28,596	2%
Q Personal and other Services	\$ 41,338	3%	\$ 29,711	3%
R Not Elsewhere Included	\$ 36,408	1%	\$ 22,413	4%

Source: Censuses of Population and Dwellings (2001)

Note that the education premium – the difference in earnings between the two education categories – for some industries is quite small, especially relative to the opportunity costs associated with obtaining a university education. Where there is a reliance on expert and specific knowledge, the premium is much higher. Thus, for example, I am relieved not to find much of a difference in earnings in the retail trade group. However, I expected, and find, a big difference in finance and business.

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The table also provides information on qualification concentrations among industry groups. It is not surprising to see that university graduates are concentrated in the more cerebral industry groups; likewise, there is a high concentration of fifth-formers (or less) in the more manual industries.

Table 9 breaks the information down by gender and limits the qualification to just one: university. University graduates are distributed among the industries in broadly similar patterns for the genders, with concentrations in the tertiary industries. Men, however, are more highly concentrated in business, whereas women are more concentrated in education and health.

Table 9: Median Income by Industry and University Qualification

University Qualifications	Male		Female	
	Median	Share	Median	Share
Total All Industries	\$ 58,713	100%	\$ 42,416	100%
A Agriculture, Forestry and Fishing	\$ 38,537	4%	\$ 28,815	2%
B Mining	\$ 81,667	0%	\$ 57,001	0%
C Manufacturing	\$ 55,303	8%	\$ 39,040	5%
D Electricity, Gas and Water Supply	\$ 75,600	1%	\$ 47,283	0%
E Construction	\$ 46,858	2%	\$ 36,205	0%
F Wholesale Trade	\$ 60,537	6%	\$ 43,411	3%
G Retail Trade	\$ 35,991	4%	\$ 28,955	3%
H Accommodation, Cafes and Restaurants	\$ 33,200	1%	\$ 27,515	2%
I Transport and Storage	\$ 48,027	2%	\$ 36,267	2%
J Communication Services	\$ 68,382	1%	\$ 49,530	1%
K Finance and Insurance	\$ 77,097	5%	\$ 44,492	4%
L Property and Business Services	\$ 66,273	29%	\$ 45,866	17%
M Government Administration and Defence	\$ 59,521	7%	\$ 45,145	8%
N Education	\$ 55,986	14%	\$ 45,687	28%
O Health and Community Services	\$ 76,287	9%	\$ 40,131	17%
P Cultural and Recreational Services	\$ 42,687	2%	\$ 36,133	3%
Q Personal and other Services	\$ 43,135	3%	\$ 38,889	3%
R Not Elsewhere Included	\$ 41,398	1%	\$ 30,268	1%

Source: Censuses of Population and Dwellings (2001)

The previous two tables don't exhaust the possibilities of analysis with this type of data; perhaps occupational choice is informative. Table 10, on the next page, drills down one more level by directly comparing, across industry groups, university graduates working within the occupation of Computer Professionals.

Table 10: Median Income by Industry for Univ Grad Computer Professionals

	Total		Male		Female	
	Median	Share	Median	Share	Median	Share
Total All Industries	\$ 56,610	100%	\$ 59,277	100%	\$ 47,824	100%
A Agriculture, Forestry and Fishing	\$ 51,251	1%	\$ 51,539	1%	\$ 50,000	1%
B Mining	\$ 90,000	0%	\$ 95,000	0%	\$ 45,001	0%
C Manufacturing	\$ 54,461	7%	\$ 56,667	7%	\$ 43,572	5%
D Electricity, Gas and Water Supply	\$ 60,385	1%	\$ 63,913	1%	\$ 45,001	1%
E Construction	\$ 44,546	1%	\$ 45,556	1%	\$ 40,000	0%
F Wholesale Trade	\$ 57,513	10%	\$ 59,299	11%	\$ 48,261	7%
G Retail Trade	\$ 47,250	2%	\$ 49,706	2%	\$ 36,000	2%
H Accommodation, Cafes and Restaurants	\$ 44,167	0%	\$ 48,000	0%	\$ 35,001	1%
I Transport and Storage	\$ 57,144	1%	\$ 56,001	1%	\$ 60,001	1%
J Communication Services	\$ 62,299	4%	\$ 65,082	4%	\$ 55,770	5%
K Finance and Insurance	\$ 63,629	6%	\$ 65,898	5%	\$ 58,572	9%
L Property and Business Services	\$ 59,240	51%	\$ 61,691	53%	\$ 49,587	44%
M Government Administration and Defence	\$ 51,792	6%	\$ 56,237	5%	\$ 45,278	10%
N Education	\$ 43,029	4%	\$ 45,268	4%	\$ 37,037	6%
O Health and Community Services	\$ 46,806	2%	\$ 48,421	2%	\$ 45,001	4%
P Cultural and Recreational Services	\$ 47,693	1%	\$ 53,334	1%	\$ 40,000	1%
Q Personal and other Services	\$ 48,500	1%	\$ 53,334	1%	\$ 45,001	2%
R Not Elsewhere Included	\$ 45,001	1%	\$ 43,334	1%	\$ 47,500	1%

Source: Censuses of Population and Dwellings (2001)

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Of all such computer professionals, about one-half are working in business services and about one out of ten in wholesale trade. Women are slightly more concentrated than men in the finance and government industries. Interestingly, a woman's expected income as a university educated computer professional is nearly 85 percent of a man's – which, is 13 cents better than the overall average for university graduates.

Changing Demand for Higher-Skilled Workers

Above, I made several assertions regarding the demand for high-skilled workers. I also proposed that the demand for high-skilled women might be different than the demand for high-skilled men. In this section, I test these ideas.

It's informative to look at the changing shares of employment by qualification. Table 11 shows employment share by qualification by gender for the three most recent censuses. While *University* and *Higher school* employment shares increased (especially the latter), *Other Post-Secondary* and *Fifth Form or Less* employment shares dropped (the former, significantly). (It appears that much of the drop in *Other Post-Secondary* qualifications between 1991 and 1996 resulted from non-responses.) The jump in university qualified employment and in higher school employment provides us with a mixed signal as to whether there was a significant upskilling in the workforce.

Table 11: Education Distribution by Gender

Gender	Year	University	Other Post-Secondary	Higher school	Fifth Form or Less	Non-Response
Male	1991	11%	41%	10%	36%	3%
	1996	13%	26%	13%	37%	11%
	2001	15%	25%	18%	34%	8%
Female	1991	10%	36%	11%	39%	4%
	1996	13%	24%	15%	38%	11%
	2001	17%	23%	21%	33%	6%
Total	1991	10%	39%	10%	37%	3%
	1996	13%	25%	13%	37%	11%
	2001	16%	24%	19%	34%	7%

Source: Censuses of Population and Dwellings

To get around this mixed signal, a single variable bringing together the information from the four qualifications groups is constructed. This variable, relative skilled labour, is the ratio of skilled labour to unskilled labour for each of supply, demand, and wages. Two methods are used in constructing the ratio. In the first instance, the variable is constructed based on the assumption that the dividing line falls in the *Other Post-Secondary* qualification range in such a way that one-half of the group is considered higher skilled and one-half lower skilled. This assumes that one-half of *Other Post-Secondary* workers are one-for-one substitutes for *Higher school* and *Fifth Form or Less* workers. It also implies that the other half of *Other Post-Secondary* workers are one-for-one substitutes for *University* graduates.^{xvii} But, once allocated to their respective halves, those with *Other Post-Secondary* are not one-to-one substitutes for one another.^{xviii}

The objective is to construct a very simply model of the labour market in order to estimate the relative importance of shifts in supply and demand of labour on changes in income from 1991 to 1996 to 2001. Assuming full employment, the estimated model is $S=DW^\sigma$, which can be simplified to:

$$\frac{\Delta D}{D} = \sigma \frac{\Delta W}{W} + \frac{\Delta S}{S}, \text{ where}$$

D is relative demand, W is relative wage, and S is relative supply of skilled labour; sigma represents the elasticity of substitution between skilled and unskilled labour.^{xix} Since I can derive W and S from

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the census data, I solve for D. Thus, I am able to estimate how much of the changes in wages have been the result of increasing demand.

Table 12 displays the results. Between 1991 and 1996, the change in relative demand for skilled workers was slightly negative overall.^{xx} For men, the change was essentially zero, but for women, demand dropped by about one percent. This outcome is consistent with, and provides context to, what I observed in Tables 2 through 4. Wages increased for the higher-skilled women, but increased by more for lower-skilled women, thereby closing the relative earnings gap. Employment followed a similar pattern. If relative demand for higher skilled women had not fallen, then wages would have increased – an outcome incompatible with our data.

Table 12: Avg. Annual Changes in Relative Skilled/Unskilled

Period	Gender	Relative Wage	Relative Supply	Relative Demand
1991 – 1996	Male	0.3%	-0.7%	-0.3%
	Female	-0.6%	-0.1%	-1.0%
	Total	0.0%	-0.5%	-0.5%
1996 – 2001	Male	4.8%	-1.0%	6.1%
	Female	3.2%	2.7%	7.0%
	Total	3.9%	1.1%	6.5%

Source: Author's calculations on data from Censuses of Population and Dwellings

In the second half of the decade, the dynamic changed somewhat. Overall, supply increased; for men, relative supply continued to sink, but for women, relative supply shot forward. The crux of the dynamic was the strong increase in demand for both men and women. Because the relative supply of the former continued to retreat, men's relative wage gains were superior to women's. The relative demand for skilled women was significantly greater than the relative demand for skilled men, but because of the increase in relative supply, wage growth lagged a bit behind men's. Importantly, what this points to is demand outstripping supply, or a shortage of skilled workers.

However, the above results are predicated upon the choice of grouping *University* with (a weighted) one-half of *Other Post-Secondary* to create the skilled category. The question that presents itself, as a result, is whether modifying the relative skilled group to include *only University* graduates would change the outcomes reported in the Table 12. As it turns out, this second measure of relative skilled labour has a significant impact on the outcomes. The results are shown in the Table 13.

Table 13: Avg. Annual Changes in Relative University/non-University

Period	Gender	Relative Wage	Relative Supply	Relative Demand
1991 – 1996	Male	-1.0%	6.3%	5.2%
	Female	-1.2%	8.1%	6.8%
	Total	-1.3%	6.9%	5.3%
1996 – 2001	Male	1.0%	2.1%	3.4%
	Female	0.2%	6.6%	6.8%
	Total	0.0%	3.8%	3.8%

Source: Author's calculations on data from Censuses of Population and Dwellings

Matching the skilled category exclusively with *University* fundamentally affects the shifts of supply and demand – and, therefore, fundamentally changes relative wages – and leads to quite a different conclusion regarding skill shortages and income inequality. Focusing on the 1996 – 2001 period for Total, Table 13 shows a more modest (relative to Table 12) increase in demand, combined with a

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slightly larger increase in supply. The result: The skilled wage premium over this period was unchanged; that is, income inequality, by this measure, was unaffected by the changing economy – in stark contrast to the early outcome in which the skill premium jumped by nearly 4 percent per year. For the earlier part of the decade, instead of contracting supply and demand for skilled workers, this calculation shows very large outward shifts in both. Thus, instead of more-or-less stationary relative wages, this table shows declining wage premia. Unfortunately, there is no way to resolve the conflict; neither is incorrect.

Yet, there is a significant difference in the implication one is to draw regarding the idea of an economy-wide skills shortage. In Table 12, we saw that the data argued strongly in favour of the idea that demand for was outstripping supply of skilled workers (also known as a skills shortage). The market's answer to this situation is rising wages. Contrast that outcome with Table 13, in which only university students were considered high skilled workers. Here, the supply of skills to the market seemed sufficient to offset rising demand. In this case, upward wage pressures for unskilled and skilled workers are offsetting one another. In other words, either there is *no* skills shortage, or there is a general shortage of workers, skilled and unskilled.

Concluding Remarks

I had rather modest objectives for this paper; namely, an exposition of the relationship of qualifications and occupations and a discussion of the changing nature of demand for skilled workers. Through this and in addition to the value of such a descriptive analysis, I hoped to shed some light on the idea of skills-shortages.

What this analysis showed was that education matters for earnings, but it's not the whole story. Other influences on incomes were apparent: occupation, industry, the incomes of colleagues, and gender. Thus, the labour market doesn't necessarily compensate holders of like qualifications similarly.

In the last part of the paper, I offered two crude models for calculating relative supply of and demand for skilled workers. The objective was to test the assumption of an upskilling New Zealand workforce. What the first model showed was that, on balance, relative demand for higher-skilled workers has been on the increase over the past half-decade or so. At face value, more people have higher skills and these skills are in demand by employers – who are willing to pay a wage premium to get what they want. In fact, with demand for skilled workers growing at a stronger rate than their supply, it is reasonable to conclude that there is, at this general level, a skills shortage. Further, from this model, it appeared to be the case that there are differences between the supply and demand factors affecting men and women. Indeed, both relative demand and supply of skilled female workers have grown faster than for skilled male workers.

The second model found that, in fact, there is no relative shortage of skilled workers. If a shortage exists, it is of both skilled and unskilled workers. This significant difference notwithstanding, the supposed difference between the markets for men and women was shown to exist under this alternative specification.

However interesting these findings, they are tempered by the limitations of both the data and the assumptions behind the analysis. Although I restricted the data to the full-time employed aged 24-and-over, there is still much unaccounted-for heterogeneity in the data. For example, as regards the persistence of the gender wage gap, a fuller analysis would incorporate characteristics of both the worker and the workplace. Many domestic and overseas studies have shown that worker characteristics like age, broken careers, specific qualifications, and years of relevant experience, and firm characteristics like size, ownership and export-focus combine to moderate wage gaps between men and women. Also, it would be worth examining the wage effects of the female education bulge (so many women entering the job market with university degrees over a very short period may pull down the average). Finally, the data reported here seem to indicate that issue of gender-based income disparities is much too complicated to distil to a single, pervasive monolithic cause.

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Regarding a more robust test of demand for skilled workers, it would be worth looking over a longer time horizon. Incorporating several more censuses' worth of data would allow for some interesting comparisons between pre- and post-reforms and the changes in skills acquisition and demand. Of course, the analysis would be greatly aided by using record-level, as opposed to aggregated, data. Yet, census data would not overcome the biggest limitation: The five-yearly census imposes rather arbitrary time frames. The interesting stuff about changing supply and demand would correlate more closely with the changing structure and cycles of the economy, which don't occur on a 5-yearly cycle.

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* The views expressed in this paper are those of the author. The paper does not represent the views of the Department of Labour.

Notes

ⁱ Of course, this isn't necessarily true. More university-degreed workers don't necessarily mean that there are more highly skilled workers; it depends upon the actual degree and job. Nevertheless, if more people are getting degrees, then that is, more than likely, a good sign for the economy.

ⁱⁱ An exposition on the change in formal qualifications sounds reasonable enough. But, it isn't without at least one very large problem: It completely misses skills acquired on the job (both formal and informal). But, I don't feel too constrained by this because I am more concerned with the idea that formal qualifications reflect skill acquisition that could not adequately be addressed through workplace training programs (except at the margin of skills gaps).

ⁱⁱⁱ The data used here (and in the next section) come from the 1991, 1996, and 2001 censuses. I limit the data to full-time workers, both male and female, over the age of 24.

^{iv} All income data are in 2001 dollars; 1991 and 1996 earnings are inflated using the CPI.

^v Qualifications are grouped in the following way: University (Bachelor Degree, Higher Degree); Other Post-Secondary (Basic, Skilled, Intermediate, and Advanced Technical Certificate); Higher school (6th Form, Higher School Certificate, Other NZ Secondary, and Overseas Secondary); and Fifth-Form or Less (No Qualification and 5th Form Certificate).

^{vi} Note that Total can have higher growth than average of components. This is due, among other reasons, to using *median* income, as opposed to *mean* income.

^{vii} As pointed out in fn. 5, the use of *median* income can lead to the outcome where components of a total income grow faster than total income. Thus, male and female median university incomes grow at a greater rate than total university income, as shown in Table 1.

^{viii} I mention some of the explanatory variables anon. However, it is worth noting that a persistent gender-based earnings gap is not *prima facie* evidence of persistent *discrimination*. In fact, this persistence may indicate the primacy of other factors. For a useful introduction to the issue of gender-based wage gaps, see Sylvia Dixon's "Pay Inequality Between Men and Women in New Zealand": <http://www.lmpg.govt.nz/PDFs/op2000-1main.pdf>.

^{ix} The sharp decline in *Other Post-Secondary* employment is related to problems the way questions were interpreted by respondents. Thus, much of the decline from 1991 to 1996 appears to be off-set by the number of people who did not report any qualification, the 'residual' category (see below).

^x Two points need mentioning. First, I acknowledge that the size of the growth is partly due to the level of employment in the base year. Second, and, perhaps, more contentiously, I assume that the labour market for women with university degrees is somewhat distinct from the market for similarly qualified men; this is partly due to employment concentrations in different occupations, but also due to differences in the personal characteristics of female workers compared to male. It is also worth noting that in 2001 the share of full-time employed women with a university degree exceeded the share of full-time employed men with a university degree.

^{xi} I use as density thresholds the figures of two-thirds and one-third. For 'pure type' occupations, I apply the first standard: In order to be a 'pure type' occupation, at least two-thirds of the incumbents

must have one type of qualification. ‘Mixed type’ occupations result from combinations of qualifications per occupation – each making up between one-third and two-thirds.

^{xii} Top incomes in the university qualifications are truncated at \$101,000 because Statistics New Zealand’s income bands end at \$101,000.

^{xiii} It is also true that this representative male (who didn’t finish higher school) earns more than this representative female university graduate, but because I’m not discussing occupations, that comparison is rather inappropriate.

^{xiv} If anything, it would signal, at least in the non-university occupation classification, that the degree holder is somehow inferior to other potential candidates.

^{xv} There is quite a bit more to the story of earnings differential than simply education. Nevertheless, that story simply reduces the earnings differential; it does not eliminate it. I speak more of this in the conclusion.

^{xvi} The alternative explanation would be that discrimination acts along more a subtle avenue, like through voting preferences. However, second-order explanations, such as this, are often too vague to be convincing – do women, who make up at least one-half of the electorate, act on this purported socially created, pervasive prejudice at the polls?

^{xvii} I also solved the model using University as the complete set of ‘skilled’ workers. The outcomes were slightly different (but not contradictory), although less interesting. I use the variable construction steps outlined by Johnson (*JEP*, Volume 11:2, 1997).

^{xviii} The process, following Johnson (*ibid.*) for creating the ‘relatively skilled’ variable is to divide ‘skilled’ by ‘unskilled’. Creating these variables is indicated by the following:

$$\begin{aligned} \text{Unskilled} &= (\# \text{ of employees with } < 7^{\text{th}} \text{ form}) * \frac{(\text{medianwage_with } < 7^{\text{th}} \text{Form})}{(\text{medianwage_with } 7^{\text{th}} \text{Form})} \\ &+ (\# \text{ with } 7^{\text{th}} \text{ Form}) + .5(\# \text{ with Other Tert}) * \frac{(\text{medianwage_with_OtherTert})}{(\text{medianwage_with_7thForm})}; \text{ and} \\ \text{Skilled} &= (\# \text{ with Univ Qual}) + .5(\# \text{ with Other Tert}) * \frac{(\text{medianwage_with_OtherTert})}{(\text{medianwage_with_Univ})}. \end{aligned}$$

^{xix} For sigma, I use the commonly accepted estimation of 1.5. Other sigma values scale the results.

^{xx} Given the classification changes affecting *Other Post-Secondary* qualifications, the estimated change in demand or 1991 – 1996 should be looked upon with some scepticism.