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Evidence from a Lottery**

John Gibson
David McKenzie
Halahingano Rohorua
Steven Stillman

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John Gibson

University of Waikato

David McKenzie

World Bank and IZA

Halahingano Rohorua

University of Waikato

Steven Stillman

University of Otago and IZA

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IZA

P.O. Box 7240

53072 Bonn

Germany

Phone: +49-228-3894-0

Fax: +49-228-3894-180

E-mail: iza@iza.org

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ABSTRACT

The Long-Term Impacts of International Migration: Evidence from a Lottery*

We examine the long-term impacts of international migration by comparing immigrants who had successful ballot entries in a migration lottery program, and first moved almost a decade ago, with people who had unsuccessful entries into those same ballots. The long-term gain in income is found to be similar in magnitude to the gain in the first year, despite migrants upgrading their education and changing their locations and occupations. This results in large sustained benefits to their immediate family, who have substantially higher consumption, durable asset ownership, savings, and dietary diversity. In contrast we find no measureable impact on extended family.

JEL Classification: F22, O15

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Corresponding author:

John Gibson
Department of Economics
University of Waikato
Private Bag 3105
Hamilton 3240
New Zealand
E-mail: jkgibson@waikato.ac.nz

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1. INTRODUCTION

Income differences between developed and developing countries are vast: in 2014, GDP per capita in high income OECD countries was 9 times that in middle income countries, and 68 times the per capita income in low-income countries.¹ These differences hold even within every narrowly defined occupations, with Ashenfelter (2012) showing that McDonalds' workers' wages differ by as much as a factor of 10 across countries. How much of this difference can someone migrating from a poorer to a richer country hope to gain? The answer depends on the sources of these income differentials. If better institutions, higher quality capital, and other factors serve to raise the productivity of all workers, then the same worker will be immediately vastly more productive working in a rich country than in a poorer one, and therefore should earn more as soon as they move. In contrast, to the extent that benefiting from these factors requires language skills, higher education, country-specific knowledge, and other attributes that are embedded in native workers, immigrants may be no more productive abroad than they were at home, and their scope for immediate income gains from migrating much more limited. Longer-term income gains will then only occur to the extent that immigrants can assimilate and gain these country-specific skills.

Determining the gain in income possible through international migration is complicated by the fact that migrants are self-selected, differing in a wide range of skills, wealth, ambition, and many other attributes from those who do not migrate. One approach is to try to control for as many observable differences as possible between migrants and non-migrants, and then argue that the amount of self-selection on unobserved factors needed to overturn the measured gains is too extreme to be likely. Using such an approach Clemens et al. (2009) document that a typical individual from the average developing country should expect to earn 2.5 to 3 times

¹ Source: World Bank World Development Indicators online query 23 September 23, 2015: high income OECD countries had a per-capita GDP of US\$43,619, middle-income countries US\$4,694 and low-income countries US\$639.

their income upon moving to the United States. Matching on a broader range of characteristics, Gibson and McKenzie (2012, 2014b) also show large immediate income gains for both high-skilled migrants and seasonal migrants.

An alternative approach to dealing with the selection issue has to been to use evidence from migration lotteries. In the first such study, McKenzie et al. (2010) examine the short-term impacts of migrating to New Zealand through the Pacific Access Category and find that Tongan migrants had large wage gains in the first year equivalent to a 263 percent gain in income. While large, this is only half of the gap in per-capita incomes, with their evidence suggesting that even the best-performing non-experimental methods would overstate these income gains by at least 20 percent. Stillman et al. (2015) use data from the same migrant population four years after migrating and find their income gain is approximately 20 percent higher than it was at one year. Clemens (2010) provides a second example.² He finds Indian IT workers getting six-fold increases in income when working for the same company with the same technology and getting to migrate to the U.S. as a result of being selected by lottery to have their H1-B visa processed. While large, US per capita income was more than 30 times that of India's during the same period, so the gain from migration is only one-fifth of the per-capita income gap.

This existing literature therefore shows that migrants gain some, but not all, of the income gap between countries upon migration. A key question, for which there is little evidence to date, is whether they are then able to gain more of this gap over time? One hypothesis is that the income gains increase over time as migrants assimilate and gain new skills. But a competing hypothesis is that the gains may weaken over time if migrants have given up occupations at home that had growing income trajectories to work in occupations abroad that offer higher immediate incomes but less prospects for career growth. For example, migrants working as

² Two other migration lotteries have been used to examine the impact on those left behind, but not the gains to migrants themselves: Mergo (2011) does this for Ethiopian households with a family member migrating through the U.S. Diversity Visa lottery, while Gibson et al. (2013) examine outcomes for Samoan households with a family member migrating through the Samoan Quota lottery.

teachers, government workers, or doctors in their home countries may face wage structures determined strongly by seniority, and earn more abroad as cleaners, shop assistants, and agricultural workers abroad, but with more stagnant wages. There is a large literature that examine assimilation by comparing the income and career trajectories of migrants to natives (e.g. Chiswick et al, 2005; Akresh, 2008). However, the appropriate counterfactual for our question of interest requires examining the longer-term income and occupation paths of migrants to what these would have been had they stayed in their home countries.

This paper uses a long-term follow-up survey of Tongans applying to the migration lottery conducted under New Zealand's Pacific Access Category (PAC) in order to measure the long-term impacts of migration, almost ten years after migrants first moved. Such long-term tracking of international migrants is costly and complicated, and unlikely to be possible in many other settings. We deal with the issues that arise in this longer-term including individuals who on-migrate to other countries, individuals who had not moved at the time of the short-term follow-ups but have now moved (and who are hence "slow compliers" rather than non-compliers") and ballot losers who migrated via substitute pathways. We also consider locational changes within the destination country that were less prevalent when the migrants were first studied, along with (associated) occupational changes.

The largest gains from migration typically occur for the migrants themselves (and the immediate family members who accompany them when migrating), and the focus of our surveys and work is on measuring these gains using unsuccessful applicants to the lotteries as a counterfactual. The gains to migrants are not always counted when the benefits and costs of migration for sending countries are calculated, due to statistical convenience rather than on welfare-theoretic grounds (Clemens and Pritchett, 2008). We consider that these gains are important components of development possibilities, especially for small, island, countries where economic opportunities will always be limited by lack of scale.

The results show monetary gains to the immigrants similar to the first year effects found by McKenzie et al (2010) and a little less than the impacts after four years reported by Stillman et al (2015). The economic payoff to migrating to a richer country seems to come immediately, and then not grow further, notwithstanding various investments by the immigrants in qualifications, internal mobility, and occupational change. Despite more occupational change than non-migrants, the average status of migrant occupations never returns to what it was pre-migration; in fact, much of the impact of migration on occupation occurs through the counterfactual group who reach an age for leaving public sector jobs in Tonga and become farmers and other such occupations.³ Nevertheless, since the initial gains in income are so enormous, migrants derive very large lasting benefits from migration. They continue to earn almost 300 percent more than non-migrants, have better mental health, live in households with more than 250 percent higher expenditure, own more vehicles, and have more durable assets. We estimate a conservative lifetime gain to migration of NZ\$315,000 in net present value terms (approx.. US\$237,000). These gains seem to accrue mostly to the migrant and their immediate family who accompany them, with little significant measureable impact of this migration on extended family remaining in Tonga.

The remainder of the paper is structured as follows: Section 2 provides context to our surveys and the sampling design; Section 3 discusses the empirical methods; Section 4 provides the results, and Section 5 concludes.

2. CONTEXT TO OUR SURVEYS

The Kingdom of Tonga is an archipelago of islands in the Pacific, approximately three hours north of New Zealand by airplane. The resident population is just over 100,000, and the gross national income (GNI) per capita is \$4,150 (in 2005 PPP \$), which is similar to Indonesia

³ Early retirement is a symptom of the limited job opportunities in small, island, countries, as noted by a Fijian MP: “we have more people coming out of University and Polytechnic; they’ll need civil servants jobs...[does this]... suggest reducing the retirement age from 55 to 50”. <http://fijione.tv/motion-to-change-retirement-age-fails/>

and ranks Tonga 121st out of 190 countries.⁴ Average incomes in New Zealand are about six times as high, with a per capita GNI of \$24,400 in 2012. Tonga and New Zealand both rank 26 places higher in the Human Development Index than they do in terms of GNI, making New Zealand the largest positive outlier of very high human development countries and Tonga the second largest outlier of countries with medium levels of human development (UNDP, 2013, p.27). Hence, this migration flow allows a very large positive income shock, where the higher incomes are not compensating for lower levels of other aspects of human development.

Emigration out of Tonga is high, with 30,000 Tongan-born living abroad, mainly in New Zealand, Australia and the United States. Despite an earlier history of employment migration to New Zealand, family reunification (mostly marriage) was the main channel of access in the 1990s following New Zealand's implementation of a points-based immigration system that favors highly skilled migrants. In 2002, New Zealand introduced a new migration program, the Pacific Access Category (PAC), that lets a quota of 250 Tongans permanently migrate each year. Any Tongan citizens aged 18 to 45 who meet certain English, health and character requirements may register. A random ballot selects amongst applicants, with odds of about 10% during the 2002-05 ballot years that our sample is drawn from. If their ballot is selected, applicants have six months to obtain a full-time job offer in New Zealand that meets an income threshold similar to the minimum wage. This ensures self-reliance since Tongans are not eligible for most forms of welfare until they reside in New Zealand for two years. After a job offer is filed along with a residence application, it typically takes from three to nine months to receive residence approval and immigration to New Zealand must then occur within 12 months. Spouses and any unmarried children up to age 24 are also eligible to immigrate with the ballot winner (and are part of the annual quota of 250 people).

⁴ All statistics in this section are from the 2013 *Human Development Report* (UNDP, 2013).

The typical applicant is an average age of 33 at the time of application, with two-thirds of them married, and an average education level of between 11 and 12 years of schooling (McKenzie et al, 2010). Just over half of the applicants were living in households in which all members would be eligible to migrate if they won, while the rest were living in households that contained extended family such as their parents, siblings, nephews and nieces (Gibson et al, 2011). The context is thus one in which migration results in a nuclear household moving permanently abroad, and potentially leaving behind extended family members who they had been living with at the time, but would not necessarily continue living with as they got older even if they stayed.

2.1 Sampling Design

Our population of interest consists of entrants to the 2002 to 2005 PAC migration lotteries. There were a total of 4,696 applicants, of whom 367 were randomly selected as ballot winners (Figure 1). Official records provided by the New Zealand immigration authorities in late 2012 show that 307 of these winners (84%) had approved residency applications and had ever migrated to New Zealand after winning. The remaining 60 ballot winners did not migrate, and are thus non-compliers to the treatment of migration.

Our prior studies measuring the short-term impacts of migration through this lottery began with a 2005/06 survey that included only 66 migrant households in New Zealand (McKenzie et al, 2010) who had entered the 2002-04 ballots.⁵ This sample was expanded to incorporate 101 migrant households by including also winners of the 2005 ballot, as well as tracking some of the individuals who had won the 2002-04 ballots but had been slower to move (Stillman et al, 2009). A follow-up survey three years later tracked 89 of these migrants (Stillman et al, 2015). This sample is still only one-third of the ballot winners who eventually moved to New Zealand. The main reason for this was that the New Zealand Government's

⁵ Note that at the time of this first survey only 33% of the ballot winners had moved to New Zealand.

longitudinal survey of immigrants had randomly selected a large pool of the ballot winners as potential individuals to interview in their survey, and to avoid respondent burden, their details were not released to us at the time of these initial surveys. In addition, there were individuals we could not locate, or who had moved to parts of New Zealand where it was too costly to conduct our in-person surveys.⁶

In late 2012 we received permission from the immigration authorities to view the names of all PAC ballot winners from 2002-05, including those earlier reserved for the official government survey. In order to have a larger sample to examine long-term impacts, this paper attempted to track all migrants from this full list. However, the only address details for these migrants were from about eight years earlier, when they had submitted their residence applications, and in many cases these addresses were for relatives in either New Zealand or Tonga. In order to locate these migrants so as to survey them, we needed fieldwork in both New Zealand and Tonga since people in their home village were often the best source of updated contact information. It is notable that only one-third of the migrants surveyed used fixed line telephones, with the remainder relying on mobiles and even those with fixed lines were typically not listed in any type of directory. Moreover, a large fraction of the migrants had moved out of the main destination city of Auckland, into regional centers, which made it harder to track them through churches and other local social networks. These tracking and surveying operations were costly and unlikely to be possible in many other contexts when the countries and populations involved are larger.

Our main survey approach was an extensive face-to-face interview, coupled with health data measurements such as anthropometrics, blood pressure, and peak lung flow, and lab-in-the-field games whose results will be used in a companion paper. This long survey was completed for 133 of the winning principal applicants in New Zealand between late 2013 and

⁶ McKenzie et al.(2010) report a tracking rate of just over 70% for the sample frame they were given.

the end of 2014. In order to bolster our sample size, in early 2015 we fielded a shortened survey with no health measurements and no lab-in-field games. The interviewing for this survey was typically by telephone, and was mainly designed to reach those who had on-migrated beyond New Zealand or were located in parts of New Zealand that were impractical for face-to-face interviewing. But since surveying often uncovers details for other people (through snowball effects) we also gave this short survey to some recently identified migrants in areas where the longer survey had already been fielded. In total this yielded an additional 61 ballot winners who had ever migrated to New Zealand, of which 11 of these people had now on-migrated to Australia (10) and the UK (1).

In total this gives data on 194 households with principal applicants who ever migrated to New Zealand after winning the ballot (Figure 1), which is 64 percent of the population of 307 such individuals.

We had even less information available for the ballot losers and non-compliers, since these individuals had not filled out residency applications. We therefore used the same surveying approach for these groups as we had for the short-term impact work, which was to use the village of origin of the migrants as a way to sample, locating these households when tracking details for the migrants in Tonga. This yielded a sample of 143 ballot losers administered the long form survey, and 39 who received the short survey (of which 9 had subsequently moved to New Zealand through alternative pathways, including through winning a later round of the PAC). In addition we have a sample of 9 non-compliers, consisting of 6 which received the long survey and 3 the short survey. Figure 1 shows these groups.

We weight the ballot winner sample to reflect the population proportions of ever migrating to New Zealand versus non-compliers. We also examine robustness to two alternative weighting schemes. The first uses a snapshot of data from late 2012 on cross-border movements coming from passport scans, which revealed that 265 of the 307 ballot winners

were in New Zealand at that point in time.⁷ This set of weights allows for the possibility that we found it harder to track individuals who had left New Zealand and so puts more weight on the ballot winners in our survey who were found outside New Zealand. The second alternative weighting scheme allows for the possibility that on-movement among the ballot losers is higher than our sample suggests.

This sample provides us with data on the principal applicants, and the household members living with them, and is the focus of the majority of our analysis. As noted, migration here is typically an adult in their early 30s leaving with their spouse and children. We linked these PAC applicants to a “partner” household in Tonga containing either a parent or elder sibling of the PAC principal applicant (with priority on parents over siblings and females over males). The sampling was based on these rules because we had the principal applicants and the partners play lab-in-field games and we wanted to restrict the dyads for the games to specified relationships. In about 15% of cases the partner defined by these rules was in the same dwelling in Tonga as the unsuccessful PAC applicant but most are not co-residents and in this regard differ from the left behind family studied in Gibson et al (2011). We have a sample of 258 such households, which we use to measure the impact on one specific type of extended family from having the principal applicant migrate.

2.2 Assessing Balance

The random lottery should ensure that the ballot winners and losers should have similar characteristics in the population of ballot applicants. However, since we only have a sample of this population, we check the extent to which this sample is balanced on observable, pre-determined, characteristics. Since the ballots were at least a decade ago, the only such characteristics available are age, gender, and birthplace (a dummy for being born off the main

⁷ This snapshot will overstate the importance of on-migration since the PAC migrants who reside in New Zealand but were abroad on the day we received the record of arrivals and departures would not be counted in the 265.

island of Tongatapu). Table 1 compares these characteristics for the ballot winner and ballot loser samples. We see our samples are balanced on gender and island, but not completely balanced on age. Nevertheless, a joint test of orthogonality cannot reject that these three characteristics are jointly balanced. This suggests that our treatment (ballot winner) and control (ballot loser) samples are comparable and we can use the random assignment provided by the lottery to assess causal impacts. Nevertheless, we condition on age, gender, and island of birth to improve power and control for any effect of this slight difference in age, and also consider robustness to alternative weighting schemes that allow for different response rates among subgroups.

Table 1 shows that the average applicant is 41 years old at the time of the follow-up survey. A 10-90 percentile range for age is 32 to 51. Two-thirds of the principal applicants are male.

2.3 *Survey Variables for Measuring Impacts*

In both the long and short survey the PAC principal applicant reported pre-tax earnings in the previous week, and also total weekly earnings of all household members. These earnings, and other monetary values, are converted to New Zealand dollars (NZD) at the average market exchange rate for the month of the interview. The New Zealand CPI rose just 0.4 percent from December 2013 to March 2015, covering the span of the survey, and so nominal values can also be treated as real values.⁸ For robustness we will also show impacts using PPP exchange rates to convert the income gains, using prices we collected in both countries.⁹

The earnings data are also a component of household annual income calculated for the sample given the long survey, along with net returns from sales of food crops, fish, livestock,

⁸ Over the same period the Pa'anga exchange rate averaged 0.65 NZD, and had a range of just three NZ cents. To allow comparison with results from other countries, the NZD--USD exchange rate averaged 1.33 over this period.

⁹ The PPP exchange rates for Tonga from sources such as the International Price Comparison Project and the World Bank are extrapolations from other countries rather than being based on directly collected prices and these extrapolations do not appear to be reliable. See McKenzie et al. (2010).

tapa cloth and mats (from household reports on an average month), income from investments, pensions, and rentals (from reports for the previous fortnight), imputed values for own-produced or own-captured food consumed by the household (from reports for the previous week), and remittance receipts (from a household-level annual recall).

Household expenditure is measured with a 20 category recall module, with reference periods ranging between one week and six months depending on the source of expenditure. The imputed value of items consumed from own-production is added to the cash expenditure variable to measure total expenditures on consumption. Impacts on income and expenditure are estimated for totals and in per capita terms since household size can change with migration. One category of expenditure collected separately is remittance spending over the previous year, which is captured also for the PAC applicant households in Tonga from questions about transfers given to other Tongan households. The other monetary measures for households in the long survey are the total value of savings and of net worth, while ownership of various durable goods, financial access and dietary diversity is also collected at the household level.

In addition to measuring monetary welfare, the subjective well-being of the principal applicant was elicited. Respondents were asked to imagine a 10-step ladder, where on the bottom step were the poorest people and the top step the richest people, and to state which step of the ladder they were on today. Ravallion and Lokshin (2001) refer to this as an economic ladder question, and note that it leaves it up to the individual to define what constitutes “poor” or not, and captures subjective economic welfare. A similar ladder question was used to ask about social respect. Prior research shows PAC migrants perceive climbing the welfare ladder, if making a retrospective comparison with their pre-migration life, but the comparison with the ladder position of the unsuccessful PAC applicants shows no change (Stillman et al, 2015).¹⁰

¹⁰ In contrast, Tongan seasonal migrants show significant rises in their ladder position compared to respondents in households without seasonal workers (Gibson and McKenzie, 2014b). These divergent results may be due to frame of reference effects; settlement migrants may use destination country standards to reevaluate their former

Other questions answered at an individual level, in both the short and long surveys, are for education, physical and mental health, and occupations. Mental health was measured using the MHI-5 index of Veit and Ware (1983). Respondents were asked if they had changed their main occupation in the past five years, and what the prior and current occupations were. We code these responses using the New Zealand Socioeconomic Index of Occupational Status (NZSEI) of Davis et al (1997), which gives a continuous measure ranging from 10 (eg. non-ordained religious associate professionals) to 90 (eg. health professionals). Scores reflect characteristics of occupations that either translate into observable lifestyle factors, such as incomes, or reflect valued socioeconomic inputs, such as educational levels. An occupational status index for New Zealand should give a better basis for cross-country comparisons with occupations in Tonga than would an explicit international index, such as the ISEI developed by Ganzeboom and Treiman (1996), since an international index is unlikely to have a country as small as Tonga in mind. Moreover, given the role of New Zealand as the major migration outlet and one of the main suppliers of higher education to Tonga, it is reasonable to believe that the same occupations have similar status in both countries.

3. METHODS

We are interested in the long-term impact of migration on the immigrants themselves and on their families. To deal with self-selection bias, we rely on the PAC lottery randomly choosing a subset of individuals who become eligible to migrate from a larger pool of individuals who wanted to migrate. Given this mechanism, in the absence of non-compliance such as drop-out and substitution, all of the lottery winners would migrate and all of the lottery losers would stay in Tonga. A comparison of the movers and stayers (and their households and extended family) would then be sufficient to measure migration impacts.

life in Tonga while seasonal migrants continue to evaluate using Tonga as a reference standard since they are not attempting to integrate into the destination country.

However, in practice some lottery winners do not migrate, and some lottery losers still manage to migrate to New Zealand. We therefore use two approaches to measure impacts. The first is the *intention-to-treat* (ITT) effect, of being offered the opportunity to migrate through the Pacific Access Category irrespective of whether the individual does migrate. We estimate the ITT through the following equation for a particular outcome for individual or household i :

$$Outcome_i = \alpha + \beta BallotWin_i + \gamma X_i + \varepsilon_i \quad (1)$$

Where *BallotWin* takes value one if the principal applicant was chosen in the 2002 to 2005 Pacific Access Category ballots and zero otherwise, and X is a vector of controls for the pre-determined characteristics (age, gender, and island of birth), for survey type, and for each of the different PAC ballot years that the individual entered. The median and modal applicant in our sample entered only one of the ballot years between 2002 and 2005. However, since those who entered multiple times had a higher probability of getting chosen, we correct for this by conditioning on the lotteries entered (Abdulkadiroglu et al, 2011).

The second approach is to use assignment to the treatment (winning the PAC lottery) as an instrumental variable (IV) for the actual treatment of migrating, in regressions like:

$$Outcome_i = \mu + \lambda * Migrate_i + \delta X_i + \omega_i, \quad (1)$$

where $Migrate_i$ is a dummy variable that equals one if person i ever migrated to New Zealand and is zero otherwise. This includes any individuals who thereafter on-migrated to other countries. The IV estimator of $\hat{\lambda}$ is a Local Average Treatment Effect (IV-LATE), interpreted in this case as the impact of migrating on people who would migrate only if they won the PAC lottery and not otherwise.

4. RESULTS

We begin by examining the impact on income earned by the principal applicant, and then other outcomes measured at the individual level for the principal applicant. We then turn to measuring household level outcomes, first for the household that lives with the principal

applicant, and then for the specific type of extended family defined by our partner household rules.

4.1 Impacts of Migration on Income of the Migrant

Table 2 presents the estimated gain in weekly income (in current New Zealand dollars) under a variety of different specifications. Columns 1 to 3 show ITT impacts, and Columns 4 to 6 the LATE impacts. Our base specification is seen in Panel A, columns 1 and 3. This estimate the impact using the exchange rate to convert Tongan pa'anga into New Zealand dollars, and uses the weighting in Figure 1 to reflect the population proportions of ever migrating to New Zealand versus non-compliers. This results in a NZ\$247/week gain from winning the ballot and NZ\$340/week gain from migrating. The ballot losers average NZ\$126 per week in income in Tonga, so the gain from migrating represents a 271 percent increase in weekly income.

Columns 2 and 4 use an alternative weighting scheme that uses cross-border passport scan data to weight differently the migrant ballot winners in New Zealand from those who have moved to other countries, while Columns 3 and 6 allow further for the possibility that on-movement among the ballot losers is higher than our sample suggests by giving twice the weight to the migrants among the ballot loser sample as to the non-migrants. We see that our measure of the income gain is relatively insensitive to these choices of weighting scheme: the LATE gain varies from NZ\$328 to NZ\$340 per week across the three specifications.

Panel B then examines robustness to adjustments for cost of living. We make two adjustments here. The first was to collect prices for a common basket of goods in Tonga and New Zealand to allow us to calculate a PPP exchange rate. When we did this in 2005 (McKenzie et al, 2010) we found the exchange rate and PPP exchange rate coincided at the time. Redoing these calculations in 2015, the PPP exchange rate was 1.62 Pa'anga per New Zealand Dollar, and a time when the market exchange rate varied from 1.43 to 1.54. As a result,

using the market exchange rate would slightly undervalue the gains to migration.

The second adjustment was to put everything into Auckland prices, based on a spatial cost of living index driven by rental cost differences and a housing share of 44 percent. One of the big movements over the 10 years appears to have been a movement of migrants out of the Auckland metro area, towards locations with cheaper living costs (see Figure 2). The proportion of our sample located outside Auckland rose from 14 percent in the first survey in 2005/06 to 39 percent in 2013/14. These are cross-sectional estimates and our samples differ over time but our surveying methods are the same (the figures are for ‘long’ surveys requiring face-to-face interviewing), with the same lead interviewer in all years, and similar resources available for tracing people and traveling to interview them, so we believe that this dispersion reflects a genuine trend.

The final point to note about the movement of the migrants out of Auckland is that the regional destinations overlap with the main locations for Tongan seasonal workers. Just one-sixth of the migrants outside of Auckland were found in the two other main cities of Wellington and Hamilton. More were in the Bay of Plenty, Gisborne, and Hawkes Bay, which are all horticultural regions and include two of the main destinations for Tongans under the seasonal worker scheme. It was not the case that PAC migrants had adopted an itinerant lifestyle and moved to regions in search of seasonal work (a multitude of tasks are carried out by seasonal workers so there is no well-defined ‘season’ anyway). Instead, in our follow-up qualitative interviews most said that they only became aware of opportunities in these regions through the experience of the seasonal workers, often mediated by extended family in Tonga. Several of the PAC migrants who moved to the regions also noted that they had been employed in elementary occupations in Auckland, such as factory workers and cleaners, and did not expect to get back to the same occupations they had in Tonga (which was most commonly teaching, and also police and clerical work) and if they were going to do work of similar elementary

status they might as well get the benefits of a lower cost of living and less crowded accommodation by moving out to the regions.

These adjustments increase the gain to migrating by 5 to 6 percent, which is only a small fraction of the overall gain of between 275 and 285 percent. By comparison, the estimated income gain approximately one year after migration was NZ\$308 (Stillman et al, 2015) in June 2006 currency (equivalent to NZ\$366 in current dollars), which was a 263 percent income gain.¹¹ These results suggest that almost a decade after migration the impacts on earnings are much the same as they were in the first year. In other words, the economic payoff to migrating from a poor country to a richer one seems to come immediately and not grow substantially over time.

Given that the gain in migration appears to be a level effect of approximately NZ\$340 per week, and that we do not observe return migration over the decade, we can estimate the lifetime income gain from winning the PAC ballot. The typical PAC migrant moves to New Zealand aged around 32. If we assume they work for 33 years, then the lifetime earnings gain is NZ\$583,440. Note this assumes all income is consumed, so that there is no return on this gain. In addition, they would then be eligible for New Zealand superannuation (retirement benefit), which currently averages a net of NZ\$288 per week for each spouse in a married couple. In contrast, Tonga's retirement benefits fund is a defined contribution fund that will offer much less.¹² If we assume a retirement of 15 years, this is an additional benefit of NZ\$188,760, for a total lifetime benefit of NZ\$772,200. Using a 5 percent discount rate, this has a net present value of NZ\$315,000. This is conservative as it allows for no asset earnings, and yet still represents a 48-fold increase in annual income for the applicants.

¹¹ The four year impact reported in Stillman et al. (2015) is NZ\$367, with a 95 percent confidence interval of \$305 to \$428.

¹² It is a defined contribution fund, with the worker and government each paying 5-7.5% of the worker's pay into an account, with the worker then getting this benefit plus any earnings upon retirement. Taking 7.5% of the average income of ballot losers of NZ\$125/week, and assuming 2% annual income growth and 5% annual return, this benefit is equivalent to NZ\$35,807 at retirement, or NZ\$46/week for 15 years.

4.2 Impacts of Migration on Other Individual Outcomes for the Migrant

Table 3 examines the extent to which these large gains in income are accompanied by other gains at the individual level. We examine changes in employment, occupation, subjective welfare and mental health, education, and physical health. Since these are outcomes in several different domains, it does not make sense to aggregate them into a single index. Instead we allow for multiple hypothesis testing by noting whether the result is still statistically significant when using the Holm (1979) sequentially rejective Bonferroni method.

Column 1 shows a strong and significant impact on the likelihood of being employed for pay, which survives corrections for multiple hypothesis testing. The LATE impact is a 30 percentage point increase in the likelihood of paid employment. Column 2 shows that migrants are more likely to have changed occupation in the past five years, although this impact is only significant at the 10 percent level and does not survive any correction for multiple testing. Migrants who change occupation appear to maintain their occupational status relatively constant, with an average value of 33 for the old jobs and 34 for the new jobs, on the 10-90 point NZSEI scale. One-third of the occupational changes recorded amongst the migrants were to farm, orchard, or pack-house work. Figure 3 provides a summary of the occupational history of the PAC migrants from their pre-migration occupations in Tonga, their first job in New Zealand, and the occupations at the time of the first two surveys that were roughly one and four years after they moved. The figure also includes the previous and current occupation at the time of the current (third) survey, but this is available only for those who had changed occupations in the last five years. Since the samples are changing over time and since there is a larger than 5-year gap between the second and third surveys, the figure does not give a longitudinal account but should still approximate the pattern experienced by the migrants. There is a literature on a U-shaped pattern of occupational change for migrants, from their last job in the origin country

to their first and then subsequent jobs in the destination country (e.g. Chiswick et al. 2005, Akresh, 2008), but the pattern in Figure 2 is much more of a reverse-J where occupational status falls with migration and never recovers.

Despite largely static occupational status for the PAC migrants, the treatment impacts in columns 3, 4, and 5 show a strong and significant impact of migration on occupational status for those who do change occupations. The change in occupations is 22 points higher on an 80 point scale for the migrants, largely coming through the occupation score for the new occupation being larger than is the case for non-migrants changing jobs. This impact remains significant after applying the multiple testing correction. The effect comes from ballot losers, where those changing occupations dropped from an average occupational score of 40 down to just 23, as seen in the control group means in columns 4 and 5 for the new and old occupations. Some of this reflects people leaving professional careers to farm their ancestral lands and may be due to a relatively early retirement age in Tonga. Since many of the PAC migrants were public sector workers in Tonga and some are now in their early 50s, the correct counterfactual for what their occupations in Tonga would have been is unlikely to be a continuation of the pre-migration occupation shown in Figure 2. So a potential benefit of migration in this case is the movement to a labor market with fewer restrictions on older workers, where those restrictions in turn reflect a lack of employment opportunities for qualified young people.

The apparent lack of growth in post-migration wage impacts, and in occupational status is surprising because there seems to be a significant migration impact on human capital. Migrants are more likely to be currently studying (only available in the long survey) and significant even after multiple testing correction, and are 20 percentage points more likely to have attained tertiary education (which are typically from polytechnics, bible colleges and other sub-degree tertiary providers rather than from universities).

Columns 8 and 9 examine subjective welfare measures (the economic ladder and social

respect ladder) and column 10 mental health. Consistent with the short-term results in Stillman et al. (2015), we find no impact on subjective welfare, likely reflecting that migration changes the reference group used for these calculations. However, we do find an improvement in mental health, with the ITT impact being significant after multiple testing corrections (the LATE impact has a p-value of 0.020). This is consistent with the positive impact on mental health seen in the first year after migration (Stillman et al, 2009), although the magnitude of the long-term impact (0.87) is just under half of the one-year impact (1.94). The final two columns show that migration has had no impact on two measures of physical health: whether or not the individual smokes, and whether health problems disrupt their usual activities.

4.3 Household-Level Impacts

The typical migrant lives in a nuclear household in New Zealand. Average household size is 4.1, with 84 percent of the migrants living with a spouse, and 80 percent having a child in the house. Conditional on having at least one child, the mean (median) oldest child in the household is aged is 11.1 (12). Household outcomes for the migrant therefore reflect the gain from migration on this family unit that is eligible to move with the migrant under the Pacific Access Category.

Table 4 provides estimates of the impacts of migration on outcomes for these migrants. The incomes and expenditures are transformed into logarithmic terms, since they are always non-zero whereas weekly earnings may be zero; thus the proportionate changes for these measures may be estimated as: $[\exp(\beta_j) - 1]$. We consider both total and per-capita impacts, although row 5 shows that there is no significant different in household size with migration. Household income of the migrants is 195 to 216 percent higher (LATE) impacts, a large and statistically significant effect. Household expenditure rises by even more, with an impact of 272 to 299 percent higher.

These household-level monetary indicators are only available from the long survey,

while the next set of indicators on durables and earned income are available for both surveys. We find annual household labor earnings to be NZ\$29,220 higher for the migrants, with this gain almost five times as large as labor earnings in Tonga. This is greater than the gain in total income, reflecting that households in New Zealand are not earning the same value from own production as households in Tonga. Migrant households also have substantially more durable goods: they have 0.9 more vehicles, are 63 percentage points more likely to own a computer, 28 percentage points more likely to own a DVD player, almost all have microwaves, and are 63 percentage points more likely to own a washing machine. The only durable asset that there is no change in is cell phone ownership. We do not see any significant impact on financial access as measured by having a bank account or ATM card, with there being little room for improvement here due to 99 percent of ballot loser households in Tonga having these. We also see migrant households having 18 times the level of savings as ballot loser households, and to be consuming a more diverse diet of food. All these significant impacts are significant at the 1 percent level, and survive corrections for multiple hypothesis testing. Households of migrants are therefore better off.

A key reason given for migration is often to improve the welfare of one's children through gaining them access to better schooling opportunities. Schooling in Tonga is near universal through secondary education, and 100 percent of the 14 to 17 year olds in ballot loser households in Tonga are currently attending school. The margin of schooling action is therefore likely to occur in terms of tertiary education, where opportunities are much more limited in Tonga. However, most children are too young to be at this age range yet¹³, and so more time needs to pass before we are likely to see impacts on child's education.

4.4 Impacts on Extended Family

Finally we consider the impacts of migration on one particular type of extended family,

¹³ Only 28 of the 282 households in the long survey have a child in the 18 to 22 age range.

consisting of a household containing a parent or elder sibling of the PAC applicant. These households tend to be slightly smaller, containing an average of 3.7 individuals in the ballot loser households, and 3.5 individuals in ballot winner households. The partner relative is aged an average of 45 for elder siblings, and 54 for parents.

The impacts of having a child or younger sibling migrate through the PAC on these extended households are reported in Table 5. The only significant differences found are that families of PAC migrants receive more remittances and are slightly more likely to have bank accounts and an ATM card. However, the magnitude of additional remittances received is relatively low: NZ\$215 annually in additional remittances, which is less than the weekly income gain to migrants and only 1.4 percent of annual total household income for ballot loser households. Given this small difference in remittances, it is unsurprising that we do not see impacts on other household outcomes for this extended family.

The limited impact is in a context where the households applicants lived in at the time of applying for the migration lottery are naturally dissolving as adults leave their parental homes and set up households of their own. Even had these individuals lived in Tonga, they would almost all be living in a separate dwelling from this extended family. As such, these extended households will have had to adjust to the absence of the applicant regardless of their migration outcome. One caveat that we should note is that it is possible that a key benefit of having a migrant abroad is as an insurance policy, who can provide help in the case of major shocks, something we are unable to measure with our data.

5. CONCLUSIONS AND DISCUSSION

A long-term follow-up survey of Tongans who applied to migrate to New Zealand through a visa lottery enables us to measure the impact of international migration after a decade. We find that the income gain for migrants is similar to that in the immediate period after migration. There is a large initial increase in income that occurs immediately upon migrating

to a richer country, suggesting that the same labor and skills can be vastly more productive when used with the institutions and complementary physical and human capital present in a developed country than in a developing country. Nevertheless, the gain in income is less than the per-capita income gap between countries, and does not appear to grow further despite various post-migration investments made by the immigrants in qualifications, occupational change and internal mobility. Nevertheless, the initial gain in income is so large that the lifetime benefit from migrating for the migrant and his or her accompanying spouse and children is enormous.

The effort and cost of tracking applicants down a decade after applying for migration, coupled with the migration lottery make this study unique in its ability to provide long-term causal impacts of migration. A question which then arises in any evaluation is then the extent to which its findings may apply beyond the specific setting of the study. The findings here are most likely to generalize to the likely longer term impacts of migration on people from small, island, countries. Özden et al (2011, p. 15) note the salience of such places: “the origin countries most affected by international migration are small, typically island states, mostly in the Pacific or the Caribbean. The destination countries most affected by migration are the countries of the New World (the United States, Canada, Australia, and New Zealand)...”.

In addition, two other factors make Tonga-New Zealand migration of potential interest beyond the methodological value provided by the lottery-determined migration flow. First, it may provide some insight into on-migration because the immigrants have unrestricted entry to Australia under the Trans-Tasman Travel agreement once they obtain New Zealand permanent residence. The easy access to an economy that is over five times larger sees New Zealand lose about one percent of its residents per year to Australia, which it then replaces with immigrants (in both countries one-quarter of the resident population are foreign born). The *de facto* free mobility for third-country nationals once within the borders of the Schengen area

(Koikkalainen, 2011) is likely to be affected by similar economic forces but may be harder to study since those border crossings require no documents, unlike for trans-Tasman travel.

The second factor of potential interest is that in 2007 New Zealand opened a much larger seasonal work option for up to 9000 migrants per year in horticulture, with preference for Pacific Islanders. About 1500 Tongans come to New Zealand each year under this scheme (Gibson and McKenzie, 2014a); more than six times the number coming via PAC settlement migration. There is no formal interaction between these two migration pathways (seasonal workers are told they have no option to settle), and they select from different parts of the skills distribution in Tonga with the PAC applicant pool positively selected (McKenzie et al, 2010) and the seasonal workers negatively selected by a focus on people not in formal employment (Gibson and McKenzie, 2014b). Moreover, the seasonal workers go to regional New Zealand while Auckland is the first destination for most PAC migrants. Yet our surveys and follow-up qualitative interviews uncovered at least two linkages; since many Tongans come to regional areas on a rolling basis throughout the year for seasonal work it creates a derived demand for permanent resident Tongans, such as for church pastors, and some of the PAC migrants responded to these opportunities and left Auckland for the regions. Second, information about opportunities in regional centers appears to flow from seasonal workers to settlement migrants, indirectly through family and other contacts in Tonga; this stickiness of information corroborates findings of McKenzie et al (2013) that migrants may not be well informed about opportunities in destination countries. Other countries also are expanding seasonal and temporary migration so these indirect linkages may be of interest.

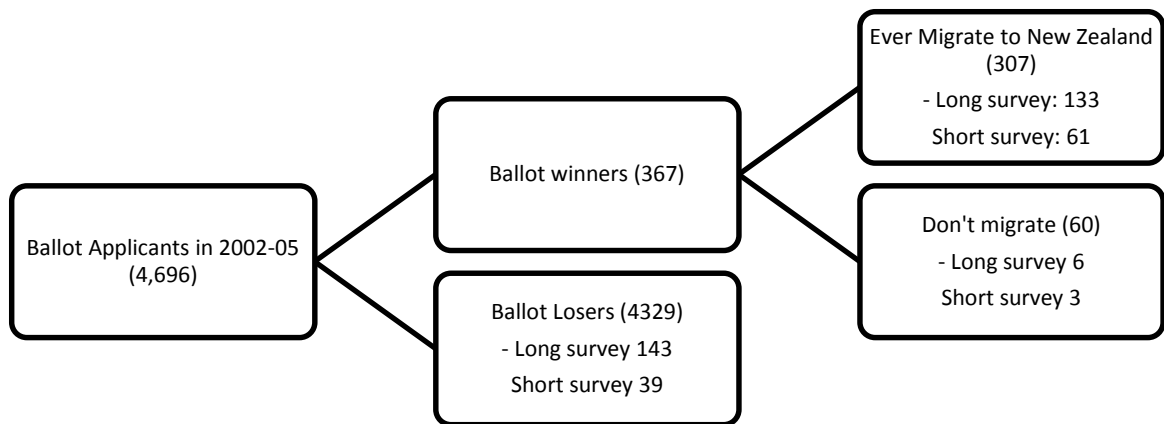
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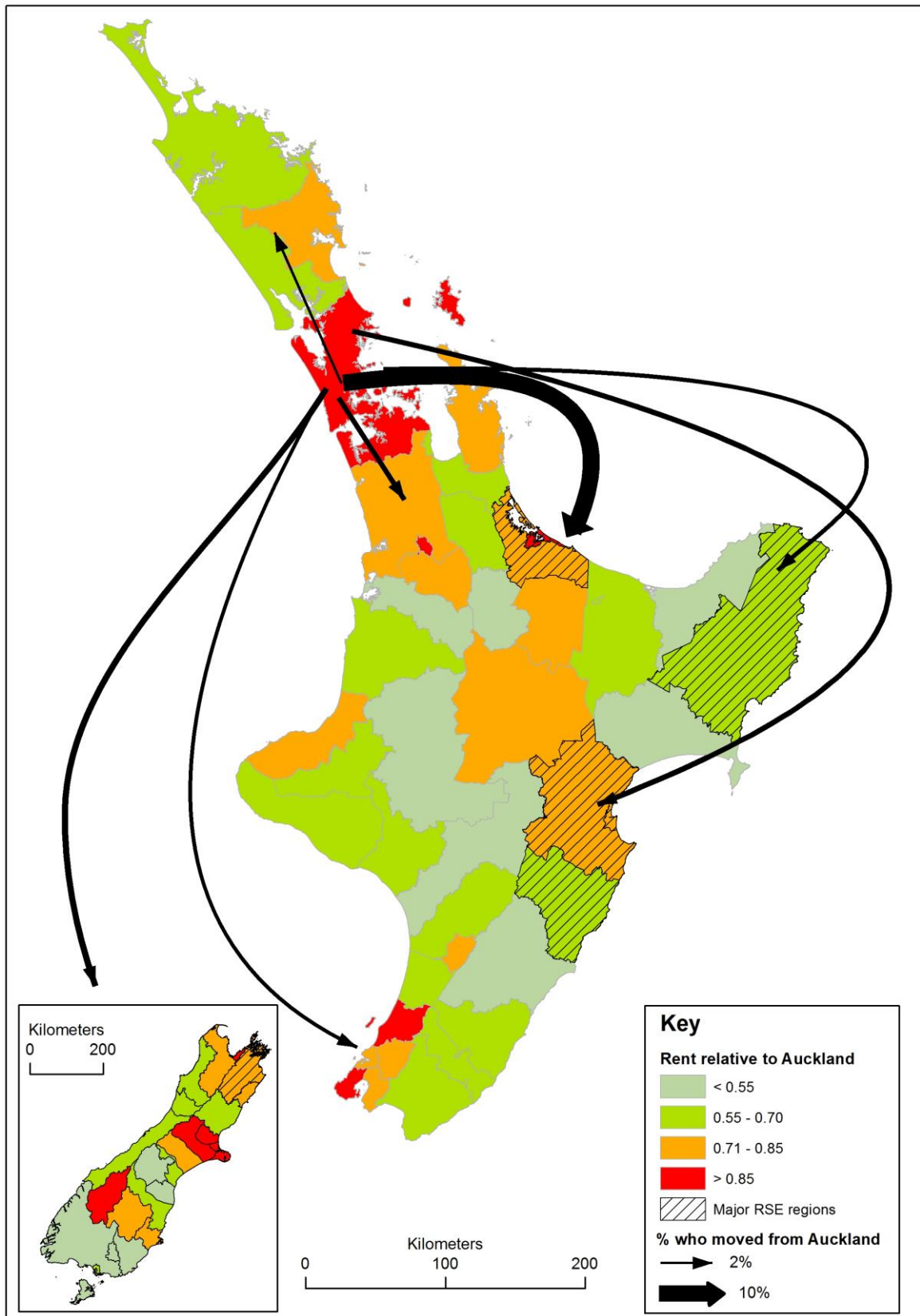
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Figure 1: Sampling Frame



Notes: numbers in parentheses show population numbers. The survey attempted to interview all individuals who migrated to New Zealand by late 2012 when the sample frame was provided; therefore the interview success rate is 64% (194/307). A random sample of ballot losers and non-compliers (winners who do not migrate) was obtained through village-based sampling. See text for details.

Figure 2: Movement of Migrants Out of Auckland Over the Decade



Source: own elaboration based on survey reports

Figure 3: The “reverse J-shaped” pattern of occupational decline for immigrants

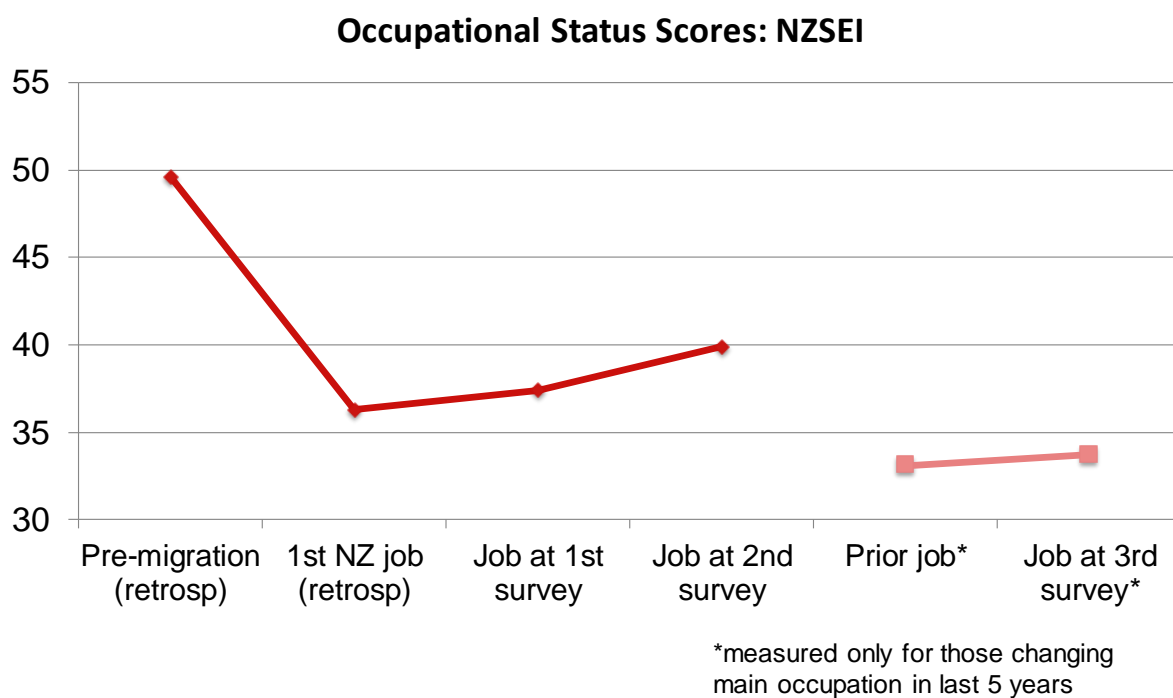


Table 1: Pre-determined Characteristics

	Ballot Winners	Ballot Losers	P-value
Age	40.11	41.80	0.045
Male	0.66	0.67	0.814
Born in Outer Islands	0.23	0.24	0.973
Sample Size	203	182	
Joint orthogonality test p-value			0.306

Table 2: Impact on Income Gain

	ITT	ITT	ITT	LATE	LATE	LATE
Panel A: Impact on Income Gain in New Zealand Dollars						
Ballot winner	246.9*** (32.8)	240.0*** (35.8)	220.9*** (36.7)			
Migrate				340.0*** (24.5)	334.1*** (31.0)	328.1*** (33.9)
Weighting used:	w1	w2	w3	w1	w2	w3
Sample Size	385	385	385	385	385	385
Control Mean	125.6	125.6	125.6	125.6	125.6	125.6
Panel B: Impact on Income Gain in PPP-adjusted New Zealand Dollars						
Ballot winner	260.5*** (34.1)	252.8*** (37.0)	233.3*** (37.8)			
Migrate				358.7*** (24.8)	351.9*** (31.2)	346.5*** (34.0)
Weighting used:	w1	w2	w3	w1	w2	w3
Sample Size	385	385	385	385	385	385
Control Mean	126.1	126.1	126.1	126.1	126.1	126.1

Notes:

Robust standard errors in parentheses, *, **, *** indicate significance at the 10, 5, and 1 percent levels respectively.

All regressions include controls for age, gender, island of birth, ballot years entered, and survey form (long or short).

Weights: w1 weights for population proportions of compliers versus non-compliers, w2 also weights migrants for observed movements out of New Zealand, w3 additionally allows ballot losers who migrate to have twice the weight of those who remain in Tonga.

Table 3: Impact on Outcomes for the Migrant

	Currently Employed	Changed Occupation in last 5 years	Change in occupation score	New occupation score	Old occupation score	Has Tertiary Education	Currently Studying	Subjective Welfare Ladder	Social Respect Ladder	Mental Health MHI-5	Health disruption in 6 months	Currently Smokes
Panel A: ITT Impact												
Ballot Winner	0.217*** (0.070)	0.093* (0.052)	17.100*** (5.486)	11.935** (4.604)	-5.164 (3.541)	0.146** (0.066)	0.078** (0.031)	-0.011 (0.084)	-0.035 (0.115)	0.687*** (0.259)	-0.005 (0.031)	0.027 (0.064)
Panel B: LATE Impact												
Migrate	0.299*** (0.085)	0.128* (0.066)	21.908*** (6.655)	15.292*** (5.293)	-6.616 (4.687)	0.201** (0.091)	0.103*** (0.038)	-0.016 (0.115)	-0.048 (0.159)	0.871** (0.371)	-0.007 (0.042)	0.037 (0.088)
Sample Size	385	385	70	70	70	385	282	385	384	279	384	385
Control Mean	0.659	0.121	-16.952	23.143	40.095	0.181	0.000	5.852	6.352	17.475	0.082	0.440

Notes:

Robust standard errors in parentheses, *, **, *** indicate significance at the 10, 5, and 1 percent levels respectively.

All regressions include controls for age, gender, island of birth, ballot years entered, and survey form (long or short).

Regressions weighted for population proportions of compliers and non-compliers.

New and old occupation scores are only available for those who changed occupation in the last 5 years.

Table 4: Impact on Household Level Outcomes

Outcome	Sample Size	Control Mean	ITT Impact	LATE Impact
Log Household Income	282	9.488	0.850*** (0.124)	1.149*** (0.138)
Log Household Income per capita	282	7.987	0.799*** (0.124)	1.080*** (0.132)
Log Household Expenditure	282	9.185	1.023*** (0.119)	1.383*** (0.122)
Log Expenditure per capita	282	7.684	0.972*** (0.119)	1.314*** (0.112)
Household Size	385	5.264	0.174 (0.180)	0.307 (0.322)
Household Earned Income	385	6829	16595*** (1933)	29220*** (2419)
Remittances sent to Tonga	385	118	938*** (140)	1651*** (204)
Number of Vehicles	385	0.797	0.509*** (0.069)	0.896*** (0.129)
Household has a Cellphone	385	0.511	-0.079 (0.069)	-0.139 (0.119)
Household has a Computer	385	0.181	0.360*** (0.064)	0.633*** (0.128)
Household has a DVD player	385	0.104	0.161*** (0.038)	0.284*** (0.072)
Household has a Microwave	385	0.082	0.573*** (0.063)	1.008*** (0.081)
Household has a Washing Machine	385	0.385	0.355*** (0.069)	0.626*** (0.125)
Household has a Bank Account	282	0.986	0.020 (0.016)	0.027 (0.021)
Household has an ATM card	282	0.986	0.020 (0.016)	0.027 (0.021)
Total Savings	282	428	5838*** (1020)	7892*** (1083)
Number of Foods in Diet	282	7.385	1.561*** (0.249)	2.110*** (0.306)

Notes:

Robust standard errors in parentheses, *, **, *** indicate significance at the 10, 5, and 1 percent levels respectively.

All regressions include controls for age, gender, island of birth, ballot years entered, and survey form (long or short).

Regressions weighted for population proportions of compliers and non-compliers.

Table 5: Impact on Partner Household Level Outcomes

Outcome	Sample Size	Control Mean	ITT Impact	LATE Impact
Log Household Income	282	9.447	-0.077 (0.097)	-0.109 (0.140)
Log Household Income per capita	282	8.213	0.030 (0.101)	0.043 (0.144)
Log Household Expenditure	282	9.126	-0.018 (0.097)	-0.025 (0.137)
Log Expenditure per capita	282	7.892	0.090 (0.115)	0.126 (0.165)
Household Size	282	3.720	-0.295 (0.234)	-0.415 (0.354)
Household Earned Income	282	7809	155 (1098)	218 (1542)
Remittances received	282	466	153* (78)	215** (97)
Number of Vehicles	282	0.678	0.052 (0.082)	0.073 (0.119)
Household has a Cellphone	282	0.364	-0.053 (0.085)	-0.075 (0.119)
Household has a Computer	282	0.119	0.032 (0.062)	0.045 (0.088)
Household has a DVD player	282	0.028	-0.005 (0.015)	-0.007 (0.021)
Household has a Microwave	282	0.063	-0.020 (0.024)	-0.029 (0.035)
Household has a Washing Machine	282	0.287	0.076 (0.081)	0.107 (0.118)
Household has a Bank Account	282	0.951	0.060** (0.026)	0.084** (0.036)
Household has an ATM card	282	0.951	0.062** (0.027)	0.087** (0.038)
Total Savings	282	545	194 (201)	273 (286)
Number of Foods in Diet	282	7.308	-0.269 (0.194)	-0.378 (0.282)

Notes:

Robust standard errors in parentheses, *, **, *** indicate significance at the 10, 5, and 1 percent levels respectively.

All regressions include controls for age, gender, island of birth, ballot years entered, type of relative of the PAC applicant, and for whether the partner co-resided with the applicant. Regressions weighted for population proportions of compliers and non-compliers.