Experimental Evidence on the Impact of Immigration on Child Health

Steven Stillman[1]
Motu Research

John Gibson
University of Waikato

David McKenzie
World Bank

Introduction

Does migration have a positive or negative impact on the health of the children of migrants? Identifying the causal impact of migration on child health requires comparing the current health of migrant children to what their health would have been had they stayed in their home country.

Most previous papers instead settle for comparing migrant children to other children in either the host or destination country. This approach is not very convincing because migrant families are likely to differ from non-migrant families along a host of unobserved dimensions, some of which are likely to be correlated with both child health and migration.

We use a unique random selection mechanism to overcome this selection problem. This mechanism is based on the Pacific Access Category (PAC) under New Zealand's immigration policy. The PAC allows a quota of about 70 Tongan families to immigrate each year, with a ballot used to choose amongst the excess number of applicants. Comparing the children of ballot winners and losers provides the only known experimental measure of the impact of migration on child health.

Methods

Detailed surveys of three random samples of Tongan households were conducted by the authors in 2005:

1) 65 migrant households who came to New Zealand through the 2002/03 and 2003/04 PAC ballots (a 70% sampling rate)
2) 55 households whose members had successful ballots but who had not yet migrated to New Zealand – these are non-compliers to the migration "treatment" (a 30% sampling rate), and
3) 78 households with unsuccessful ballots who were still in Tonga (a 3% sampling rate)

Height and weight are directly measured by trained interviewers for all individuals in the sample and self-reported health-status is also collected. Results are reported here for a subset of the nine measures of child health available:

1) Height standardised for age in months and gender (z-score)
2) BMI (weight/height^2) standardised for age and gender (z-score)
3) Stunting: standardised height < 5th percentile in reference population
4) Obese: BMI ≥ 95th percentile in reference population

Z-scores show how many standard deviations each child is away from the age- and gender-specific median outcome in a reference population of well nourished children in the UK in 1990. All analysis in the paper is stratified by the child's age, with separate results for 0-2, 3-5, 6-12 and 13-18 year-olds.

Regression analysis is used to estimate the impact of immigration. If ballot winners randomly choose to migrate, an unbiased estimate of the impact comes from comparing the mean of each health outcome among children of ballot winners to those among children of ballot losers (Group 1 vs 3). However, this simple experimental estimator is biased if PAC applicants whose names are drawn in the ballot fail to migrate to New Zealand (dropout bias). This is a relevant concern as only 56% of ballot winners (weighted by the number of their children) had migrated to New Zealand at the time of our survey.

However, instrumental variables (IV) provide an unbiased method for estimating the impact of migration on child health in the presence of dropout bias (Angrist, et. al, 1996). The ballot outcome is strongly correlated with migration and is a valid instrument because randomization (see Table 1) ensures that ballot success is uncorrelated with unobserved attributes that might also affect child health.

Table 1: Evidence for Randomization

	Sample Means APPLICANTS		T-test of equality of means
	Successful Ballots	Unsuccessful Ballots	p-value
Age in Months	104.2	99.0	0.52
Proportion Female	0.46	0.46	0.89
Proportion Live with Both Parents	0.97	0.93	0.32
Number of Children in Household	4.1	4.4	0.55
Father's Age	39.7	37.9	0.08
Father's Years of Education	11.6	11.3	0.35
Father's Height	165	165	0.99
Mother's Age	37.9	36.2	0.17
Mother's Years of Education	11.4	11.0	0.41
Mother's Height	163	163	0.83
Proportion in NZ	0.56		
Months in New Zealand	9.9		
Total Sample Size	**208**	**169**	

t-tests account for clustering at the household level and survey stratification and weighting

Experimental results

Figure 1 shows mean height for age and BMI for age among children of ballot losers in each of the four age-groups and the estimated impact of migration on these outcomes for each age-group (controlling for other covariates). We find that migration leads to a significant 3.91 standard deviation increase in height for 0-2 year-olds and a marginally significant 2.24 standard deviation increase in BMI for 3-5 year-olds. No other significant impacts are found on these outcomes for other age-groups.

Figure 1: Impact of Migration on Height for Age and BMI for Age

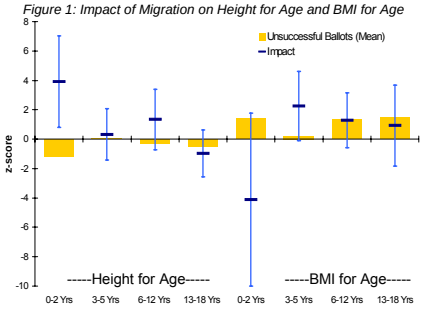
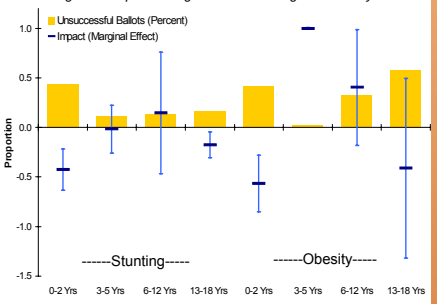


Figure 2 shows the proportion stunted and obese among children of ballot losers and the estimated impact of migration on these outcomes (controlling for other covariates). Migration leads to a significant 43% decline in the likelihood of being stunted among 0-2 year-olds, a 18% decline in stunting among 13-18 year-olds, a significant 57% decrease in the likelihood of being obese among 0-2 year-olds, and a 100% increase in obesity among 3-5 year-olds.

Figure 2: Impact of Migration on Stunting and Obesity



Migration has complex effects on children. The stature of infants and toddlers increases and the likelihood that they are obese falls. Among 3-5 year-olds, migration increases weight and BMI and leads to large increases in the likelihood of being above the obesity threshold. Migration also increases the weight of pre-teens, but has an insignificant impact on BMI. Little impact is found for teenagers.

The contrasting results for 0-2 year-olds and 3-5 year-olds are particularly interesting. These results are consistent with migration leading to higher calorie diets for all young children, but translating to an increase in stature for 0-2 year-olds and an increase in weight for 3-5 year-olds.

Interpreting the results

What are the channels for the complex effects of migration on child health? In general, health outcomes may change as a result of changes in material inputs, time inputs, and health knowledge. Here, we examine whether changes in material inputs can explain the observed changes in child health.

We first consider whether changes in **Income** can explain our findings. Migrating to New Zealand leads to NZ$15,725 increase in annual total household cash income relative to an average annual total household cash income of NZ$12,100 among unsuccessful ballot applicants in Tonga.

Table 2 shows the the cross-sectional relationship between income and child health among all households in Tonga and NZ (controlling for child and household characteristics).

Table 2: Relationship between Income and Child Health

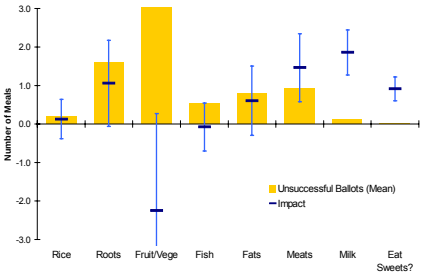
In Tonga	Height for Age	BMI for Age	Stunted	Obese
Log Total Household Cash Income	0.179**	-0.356***	-0.024	-0.0596*
	(0.085)	(0.097)	(0.021)	(0.036)
In New Zealand	Height for Age	BMI for Age	Stunted	Obese
Change in Total Household Earnings	-0.021	0.004	No One	-0.002
('00s NZ$)	(0.021)	(0.041)		(0.014)

Even with the large income gains experienced by migrant households, these results suggest only a limited role for income changes in explaining the estimated impact of migration on child health. While income is positively related to child stature in Tonga, the magnitude of the relationship is not strong enough to explain more than a tiny amount of the impact of migration on the stature of infants and toddlers. Even more strikingly, while wealthier households in Tonga are less likely to have heavier children, we find that migration has a large positive impact on the weight of pre-teens.

We next consider whether changes in **Diet** are likely to be related to the estimated impacts of migration on child health. Figure 3 shows the mean number of meals in which eight particular foods are consumed in unsuccessful ballot households and the estimated impact of migration on diet composition among migrant households (controlling for other covariates).

The results indicate that migration leads to a significant increase in the consumption of meats, milk, and sweets. These changes in diet are large; consumption of meats increases by 50-70%, consumption of milk goes up almost fifteen-fold, and the likelihood of consuming sweets increases by 91%.

Figure 3: Impact of Migration on Household Diet



We cannot directly relate changes in diet to changes in child health since we do not know which household members are consuming which food but these results suggest that dietary change is an important factor. Increased consumption of meats and milk would lead to increased protein and other micronutrient intake, which have been shown to increase the stature of infants and toddlers. On the other hand, increased consumption of these goods along with sweets would lead to increase in overall calorie and fat intakes, which is directly related to weight gain.

Several factors may contribute to changing diets. Relative food prices are quite different in NZ and Tonga. While most migrant households experienced large increases in income we find low cash income elasticities of demand for most foods in Tonga. Perhaps, more importantly, the marketing of foods and the availability of different foods is likely to be vastly different between these countries.

Overall, these results suggest that dietary change is an important channel through which migration impacts child health and that changes in income, both the direct effect of these changes and their impact on diet, are less important.

Conclusion

Experimental evidence from a migrant lottery program shows that migration of Tongans to New Zealand has complex effects on the health of children, increasing the stature of infants and toddlers, but also increasing BMI and obesity among pre-teens. Further results suggest that dietary change is an important channel through which migration impacts child health. Changes in income, both directly and indirectly via changes in diet, are of lesser importance. Differences in relative prices may explain some of this dietary change, but it seems likely that other important mechanisms, such as changes in household structure, are also driving this.

Acknowledgements

We are grateful to the Government of the Kingdom of Tonga and the New Zealand Department of Labour (DoL) Immigration Services for the sampling frame and permission to conduct the survey, to Halahingano Rohorua and her assistant interviewers and to the survey participants. Financial support from the World Bank, Stanford University, the Waikato Management School and Marsden Fund grant UOW0503 is gratefully acknowledged. The study was approved by the multi-region ethics committee of the New Zealand Ministry of Health. The views expressed are of the authors alone and do not necessarily reflect the opinions of the World Bank, the New Zealand DoL, or the Government of Tonga.

Notes

Angrist, J.D., G.W. Imbens and D.B. Rubin (1996) "Identification of Causal Effects Using Instrumental Variables", *Journal of the American Statistical Association* 91(434): 444-455.

[1]Corresponding author: stillman@motu.org.nz