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Implications of Migration on Income and Welfare of Nationals

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Implications of Migration on Income and Welfare of Nationals

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Abstract

As labor has become more mobile in today's world, it is important to understand the income and welfare of nationals regardless of their residence. This paper develops two key concepts, gross migration-corrected product (GMP) and welfare cost of migration, and calculates them using New Zealand data. Growth performance measured by New Zealanders' income has been clearly better than suggested by the GDP. The welfare cost associated with a marginal change in the tax rate appears quite high.

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I. INTRODUCTION

In a globalized world, more people move where they find better jobs and lives. This paper studies how migration affects income and welfare of these mobile people. In this context, policy effects are also examined.

There is a considerable literature on statistical investigations of the relationship between migration flows and several policy and other variables. For example, a study by Hatton (1995) investigates emigration from the United Kingdom for 1870 to 1913 and concludes that short-term fluctuations were driven largely by changes in employment rates, while the long-term level of emigration was determined largely by the relative wage. Tokarick (1999) finds that the relative unemployment rate and the relative personal tax to GDP ratio significantly explains the emigration of professionals and managers from Canada to the United States.

The objective of this paper is to capture the economic consequences of migration to people, and thus differs from the literature in that the focus is wider and that the regression analysis employed here is based on a set of variables derived from theoretical considerations. In particular, this paper studies New Zealand as a case country with a highly mobile population.

In recent years, New Zealand has experienced large migration flows. During the 1990s, in gross terms, more than 16 percent of the population left and a similar number entered the country. Gross emigration exhibited an increasing trend throughout the 1990s, while gross immigration increased until the mid-1990s and has declined since (Figure 1). In the face of such large-scale migration flows, much has been written about whether New Zealand may be losing highly skilled people and to what extent such migration has imposed a net cost on the New Zealand economy.

However, assessing the impact of migration on GDP growth is fraught with difficulties. There are a number of competing theoretical predictions:

- *Quantity and price effect* (a general equilibrium effect): As people migrate to higher wage countries, the labor force would decline, as would GDP, and domestic wages would eventually converge to destination country levels. However, these outcomes do not seem to be readily observed as wage differences persist between destination countries and New Zealand.

- *Direct externality to productivity*: If highly skilled workers raise the productivity of the economy, their emigration causes a loss. However, empirical studies in other countries show weak and mixed evidence about the economy—or the industry-wide scale effect on output.[2]

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[2] See, for example, Basu and Fernald (1996), Jones (1998), and Klenow and Rodríguez-Clare (1997).

- *Brain gain*: When expected income in a foreign country is higher, emigration opportunities give people larger incentive to acquire skills.[3] Hence, human capital accumulation could be higher even for those who end up staying in New Zealand.

With these considerations, this paper asks the following questions: what the growth performance would have been, if the income of all New Zealanders, regardless of their location, is taken into account; and what are the welfare costs associated with a change in tax and social security transfers.

Looking at the effects of migration on GDP implies that the key policy concern is maximizing the welfare of people residing in a country. However, an alternative policy objective could be to maximize the welfare of nationals regardless of their residence.[4] Economic theory suggests that people can maximize their utility when they have freedom of choice over their residence. Even if expected incomes in a foreign country are the same as in one's own country, an individual could avoid a temporary weak labor market through migration. More generally, in dynastic economic models, an individual maximizes his dynasty's welfare, which depends on his descendants' welfare wherever descendants live. Also, in life-cycle consumption models, people care about their own consumption no matter where they live.

This paper develops two key concepts, gross migration-corrected product (GMP) and welfare cost of migration, and calculates them using New Zealand data. It consists of three main parts. Section II presents some facts on migration data. It is based on several preceding studies, in particular, Bushnell and Choy (2001) and Glass and Choy (2001), but also presents new findings. Section III provides an estimate of the GMP, defined as the gross product of New Zealanders regardless of their residence. Section IV shows an estimate of the welfare costs of migration associated with a change in tax rates and social security transfers. It is narrowly defined as the marginal change in utility of emigrants to tax and social security transfers, multiplied by number of emigrants.

Section V concludes and the main findings are:

- Growth performance measured by New Zealander's income is clearly better than the one suggested by GDP.

- Welfare costs associated with marginal changes in tax rates seem quite high, though those associated with social security transfers need further investigation.

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[3] See, for example, Mountford (1997) and Beine et al. (2001).

[4] Different measures of national income are useful for different purposes. For example, if the effect of migration on tax revenue is concerned, the focus would be on residents including immigrants.

II. Some Facts on Migration Data

Migration data is compiled by Statistics New Zealand from questionnaires filled out by all people who enter and leave New Zealand. This paper uses a cohort-based aggregate data with age and occupation entries for permanent and long-term (PLT) migrants, that is, those who have indicated their intention to stay in their destination countries for more than one year. Since the New Zealand occupational classification (NZSCO) has changed substantially in the middle of 1991 to meet the 1988 standard occupational classification of the International Labor Organization (ILO), only occupational information after 1992 is used.

New Zealand and Australia share a common labor market. This makes Australia the largest destination country for New Zealanders. Moreover, a New Zealander who has a British grandparent can move to work in the United Kingdom freely. From April 1991 to December 2000, 44 percent of emigrants moved to Australia, 23 percent to the United Kingdom, and 5 percent to the United States. These three countries account for more than 70 percent of destinations of total PLT emigrants.

However, in January 2001, Australia unilaterally terminated its preferential treatment of New Zealand emigrants in terms of income support.[5] Although it is not yet measurable, this institutional change might discourage emigration and could be one cause for the recent decline of emigrants to Australia. This paper uses data only up to end-2000.

Some papers have examined migration flows using the same data source. Bushnell and Choy (2001) and Glass and Choy (2001) (BC-GC) present a comprehensive picture of New Zealand migration flows and summary discussion of theories. Their main findings are:

- *Brain exchange*: They found no evidence of a brain drain, but rather evidence of "brain-exchange," that is, the skill composition (occupation based) of immigrants and emigrants is similar.

- *Substitutability of emigrants with immigrants*: BC-GC concludes that a typical immigrant, despite being relatively highly educated, is likely to have a lower income and lower probability of labor force participation and employment than a New Zealand born person in the first year of arrival, and needs 10-14 years to compare favorably with a New Zealand born person in terms of income earned. BC-GC call for settlement policies to facilitate better use of immigrant skills.

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[5] Previously, from 1969, newly arrived New Zealanders could receive benefits from the Australian government from the day they arrived. Following the change in January 2001 and subsequent amendments, they face the same residency requirements (meeting residency criteria and two years' residency) as other foreigners before they can claim benefits.

- *Age composition of emigrants/immigrants*: There has been a tendency for younger people to move out compared to those who move to New Zealand. Since older people typically possess higher human capital, this tendency, BC-GC argue, would support their hypothesis that there has been no brain drain. More specifically, in the last 30 years, the 20–24 year old age group has had the largest share of departures, and the 30–49 year old age group has had the largest share of arrivals.

- *Impact on labor force*: BC-GC cites the Business and Economic Research Limited (BERL) report (1999) for the New Zealand Department of Labour. Over 1992 to 1998, immigrants have increased the stock of human capital in New Zealand by 1 percent per annum overall and by 3 percent per annum in the professional category.

Although BC-GC found little evidence of "brain-drain," a closer look may be necessary. According to the data that this paper relies on, net bilateral migration flows between New Zealand and its four largest emigrants destinations—Australia, the United Kingdom, the United States, and Canada—are almost balanced except for Australia, where outflows outweigh inflows. Reported skill compositions (occupation based) are almost the same in bilateral flows between New Zealand and these four destination countries. But, the fact that the four countries pay higher wages, within the same occupation, may be prima facie evidence that emigrants have higher skill levels than average New Zealand workers.

The largest net inflows come from Asian countries. Reported skill compositions of immigrants from these countries are skewed towards high levels. However, while about half of immigrants from Australia, the United Kingdom, the United States, and Canada reported their occupations, only about 30 percent of Asian immigrants did so. Moreover, according to an independent study by the government of Auckland City (2001), immigrants from Asian countries face higher unemployment rates, and lower wages compared to native-born workers with the same qualifications. Thus, the actual skill distribution of immigrants might be lower than is reported.

More detailed data reveals a clearer picture of emigrants. Relatively higher skilled people emigrate more to the United States and United Kingdom than to Australia. However, even to the United Kingdom, the skill distribution of emigrants is skewed towards the low end compared to the skill distribution of the New Zealand population. This trend is clearer in the case of emigrants to Australia. The data for the managers and professionals (major Group 1 and 2 of NZSCO90) show that New Zealand has (i) received a net inflow in total; (ii) experienced a large net outflow to Australia; (iii) experienced almost negligible net flows to the United States, Canada, and Japan; and (iv) received a large inflow from other countries, especially from China, Hong Kong SAR, and India. As for the lowest skill level (major Group 9 of NZSCO90), New Zealand has (i) received a large net inflow in total; (ii) especially from developing countries; (iii) experienced net outflow to Australia; and (iv) experienced negligible net flows to the United States, the United Kingdom, and Canada.

The experience in New Zealand with migration is similar to that in other advanced economies such as Canada. Tokarick (1999) summarizes several studies on Canadian

migration. First, emigration of highly skilled Canadian professionals to the United States increased substantially in the 1990s. At the same time, immigration of workers with similar skills partially offset the number of emigrants to the United States. However, available evidence suggests that immigrants to Canada may be less productive because it takes some time for them to catch up with Canadian-born workers in terms of earnings. As a result, the loss of Canadian professionals to the United States is likely to have imposed a net cost on the Canadian economy. Tokarick (1999) concludes that a reduction in personal income tax rates could reduce the incentive for highly skilled Canadians to migrate to the United States.

The latest OECD Employment Outlook (2001) studies immigration issues mostly from the point of view of recipient OECD countries. Some of the main findings are: (i) foreigners have a higher tendency than nationals to occupy blue collar posts; (ii) the employment of foreigners plays a buffer role in the labor market's adjustment to cyclical fluctuations; and (iii) in some cases, foreigners fulfill the mismatch of sectoral labor market: some countries encounter labor shortage in the information technology (IT) sector workers, and others in workers with low qualification. OECD (2001) notes that a number of countries, in particular Canada, France, and Sweden, are concerned about emigration of their own high-skilled workers.

III. An Alternative Way of Measuring Income: Gross Migration-Corrected Product (GMP)

A. Definition of GMP

The first question this paper addresses is what the growth performance of New Zealanders was during 1990s if their incomes had been taken into account regardless of where they live. Since GDP is the gross product of people living in a country, it is not exactly the gross product of New Zealand nationals. Note that GNP is different from GDP only by the gap between residents' income raised in foreign countries and nonresidents' income raised in the country, and thus it does not capture the gross product of New Zealand nationals either. This paper calculates what is termed GMP, the gross migration-corrected product. GMP is estimated by adding income of New Zealanders living abroad, and subtracting income of foreigners living in New Zealand.[6] A simple definition of GMP is as follows:

$$\text{GMP} \equiv \text{GDP} + \text{income of emigrants} - \text{income of immigrants}. \quad (1)$$

[6] This is a conservative estimate for the income of New Zealand nationals, because emigrants may take their capital away and they may have capital income in foreign countries, because emigrants affect negatively on some sector products such as construction and restaurants, and because I try to be conservative in my calculations below.

To calculate GMP, four factors are taken into account: the number of immigrants and emigrants, the proportion of migrants who are employed,[7] their skill composition, and wage differentials among countries. To simplify the calculation, this paper assumes the emigrants' income in countries other than Australia, the United Kingdom, and the United States is the same as they earn in New Zealand. Since Canada and Japan are also important emigrant destinations, and wages are higher there than in New Zealand, this assumption probably underestimates GMP. Also, based on BC-GC and Auckland City Report (2001), this paper assumes earnings of immigrants from industrial countries are the same as the New Zealand workers, but earnings of immigrants from developing countries are the same as those of Pacific Islanders and Others categories in the New Zealand labor market data.[8] The labor force participation rate and unemployment rate of immigrants are treated similarly.

With these assumptions, GMP is now defined as:[9]

GMP ≡ GDP

+ income of emigrants in Australia, the United Kingdom, and the United States

+ income of emigrants in other countries

– income of immigrants from developing countries

– income of immigrants from industrial countries. (2)

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[7] This paper assumes emigrants in Australia, the United Kingdom, and the United States share the same labor force participation rate and unemployment rate as local people. This is a potential source for underestimating GMP. New Zealand emigrants can be expected to have higher employment rates (and probably incomes) in the United Kingdom and the United States, because employment is the key criteria for long-term residency in these countries. Even in Australia, with free access and lower skill profiles, emigrant New Zealanders are said to have higher employment rates than Australians or New Zealand residents.

[8] Immigrants from developing countries have more dependents—41 percent are below 20 years old and 5 percent are above 60 years old. These numbers for immigrants from industrial countries are 22 percent and 4 percent, respectively. The NZ Household Labor Force Survey (2000) shows that the labor force participation rate of Pacific Islanders and Others is 58 percent, and their unemployment rate is 11 percent. In contrast, the overall labor force participation rate is 65 percent and the overall average unemployment rate is 6 percent. Also, according to Income Survey (2000), Pacific Islanders and Others earn only 80 percent of the average income. These numbers are used for GMP estimates.

[9] See the appendix for a detailed discussion of the methodology used to calculate GMP.

Before calculating GMP, emigrants' hourly earnings in foreign countries are estimated for high-, middle-, and low-skilled occupations.[10] Figure 2 shows the estimates in the 1990s, which can be summarized as follows:

- Low-skilled New Zealand workers earned about half of comparable U.S. workers, while comparable Australian and U.K. workers earned about 80-95 percent of U.S. workers' earnings.

- While the highly skilled New Zealanders earned less than double that of low-skilled individuals, the highly skilled U.S. (U.K.) workers earned five (four) times more than the New Zealand low-skilled workers.

- Although the United States and the United Kingdom's relative wages seem to have fluctuated against New Zealand wages, those for Australia and New Zealand have been relatively stable.

B. GMP Estimate and Policy Issues

Table 1 shows the GMP estimate in the 1990s. Salient features are:

- In spite of low real GDP growth, GMP—New Zealand nationals' income—growth was impressive, especially in the latter half. The average growth of GMP from 1993 to 2000 is 4.0 percent, compared to the average growth of GDP 3.6 percent.[11] This is because a sizable population resided in high-growth countries, and this population has also grown over the last decade.

- GMP growth is also less volatile than GDP growth. While the variance for 1993 to 2000 of GDP growth is 3.4, that of GMP is 1.9.

- In per capita terms, the difference between real GMP growth and real GDP growth is less, but still the average growth of per capita real GMP from 1993 to 2000 is 2.7 percent, better than that of per capita real GDP, 2.5 percent.[12] The variance of per

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[10] All figures are based on market exchange rates. For calculations of real values in other parts of this paper, these wage data are transformed to real New Zealand dollar terms using PPP and the New Zealand GDP deflator. In Figure 2, the suffixes H, M, and L represent hourly earnings for high-, middle-, and low-skilled workers. See the appendix for detailed data issues to calculate GMP.

[11] In the same period, the average GDP growth of Australia was 4.3 percent, that of the United Kingdom was 3.0 percent, and that of the United States was 3.7 percent.

[12] In the same period, the average per capita real GDP growth of Australia was 3.1 percent, that of the United Kingdom was 2.7 percent, and that of the United States was 2.5 percent.

capita real GMP growth is 1.8, again, much lower than that of per capita real GDP growth, 2.9.

- Although the gap between the levels of real GMP and real GDP is increasing, it is relatively stable in per capita terms. The reason is that because of migration, the growth of New Zealand's population has been much less than that of New Zealand nationals. As a sizable number of people have migrated out, New Zealand population growth was 1.1 percent on average for 1993 to 2000, and was only 0.5 percent in 1999 and 2000. On the other hand, the estimated growth of New Zealand nationals is about 1.3 percent on average.

Growth of per capita real GDP was lower than that of per capita real GMP growth in the latter half of 1990s. This implies that the GDP per capita has been diluted by the migration pattern—emigration of the young, return of the old, more children per immigrants, and low labor force participation with high unemployment rate for immigrants from developing countries. If New Zealand intends to achieve GDP per capita growth at least at the same level as GMP per capita growth, key issues are the following:

- It would be important to examine policies that could underlie the migration pattern where the old appear to be replacing the young. The design of the superannuation scheme could be a factor. Eligibility for New Zealand superannuation payments requires total residency of 10 years after the age of 20, and residency of 5 years after the age of 50. New Zealand superannuation is a pay-as-you-go system[13] in which benefits paid are independent of the contribution and the income of beneficiaries. Benefits are flat payments and depend only on average wage level of the country and the composition of the recipient family.

- It would be helpful to improve the labor force participation rate, reduce the unemployment rate, and strengthen wage performance for immigrants from developing countries. These could be accomplished by policies that better target settlement of these immigrants.[14]

IV. Welfare Cost of Migration

A. Overview

This section estimates a measure of the welfare cost of migration. The cost associated with emigration consists of monetary and nonmonetary costs. For marginal people who are

[13] Partial prefunding of the superannuation is going to be introduced in 2002.

[14] The New Zealand government, the Auckland City government, and citizens have already been involved in active discussions and started various initiatives to address these issues. See, for example, the Auckland City (2001) report.

indifferent to emigration, this cost is calculated as the difference of the net present value of incomes in both countries. If a person could earn $1,000 higher annual income in Australia than in New Zealand at current wage differentials, this $1,000 reflects the monetary and nonmonetary cost of migration. By reducing this income difference through well-articulated tax and social security policies, the New Zealand government could enhance New Zealanders' welfare.

It should be noted that only the nonmonetary cost represents a welfare cost, because the monetary cost to an emigrant represents value-added attributable to those who provide the goods and services associated with moving. The nonmonetary cost represents a utility loss, and the government cannot capture this loss as tax revenue. In this sense, the nonmonetary cost is similar to the dead-weight-loss associated with income tax in the labor market, though it is not exactly the same. This paper actually assumes that there is no change of labor supply as a result of tax or social security system, and thus assumes away any dead-weight-losses associated with them. Rather, it tries to capture only nonmonetary utility loss of emigrants. In this sense, this is a partial equilibrium analysis, and likely to underestimate the true welfare cost in a dynamic general equilibrium setting.

The wage differentials between New Zealand and emigrant destination countries are used to estimate the welfare cost. However, the wage differentials also reflect existing migration barriers among countries. Fortunately, this is not the case for the wage differential between New Zealand and Australia, except for the monetary cost of moving, because they form a common labor market with mutual income support systems (at least prior to January 2001). Thus, the sections below focus on emigrants from New Zealand to Australia.

B. Methodology

Absent other distortions, persistent wage differences between two countries can be considered as the reflection of a stronger preference for the country that pays a lower wage to its residents.[15] Emigration does not cause any welfare cost in this case, because emigrants' utility loss is compensated by higher income. However, if a newly introduced income tax distorts their decision about where to reside, it may induce people to emigrate and create welfare costs. Assuming firms compete in product markets under exogenous world prices, the introduction of a new income tax forces firms to offer lower wages than before. Marginal

[15] The analysis in this section is based on the assumption that preferences explain wage differentials. Theoretically, the wage difference can be regarded as a reflection of skill levels within the same occupation between New Zealand and Australia. However, empirically, to explain the wage difference by skill differences for the New Zealand and Australian labor markets, it is necessary to have data on skills that are not captured by occupational or educational differences. Unfortunately, the data are not available. As noted in Cardarelli (2002), the New Zealanders as a whole had slightly better educational attainment than the Australians in 1996.

people who stayed in the country before the introduction of the tax will then emigrate to the high-wage country. This emigration flow continues until the marginal emigrants become indifferent between staying and leaving the country. A similar analysis applies to a rise in the income tax rate, the corporate tax rate, and the social security burden.

Currently, both New Zealand and Australia already have well-established tax and social security systems, and thus the relevant question is how the welfare cost of migration varies with a small change of tax and social security system. To this end, it is necessary to know both the elasticities of the number of emigrants to a change in tax rates/social security payments and current income differentials corrected for monetary costs.

C. Utility Loss at Market Value

An individual i's decisions on residency and consumption are simply represented by the following life-time utility maximization, given the income stream in each location with world price fixed at one:[16]

$$\max_{c_{it} Ta_i} \sum_{t \in Tn_i} \beta^t \left(u(c_{it}) + q_i\right) + \sum_{t \in Ta_i} \beta^t u(c_{it}) + \lambda \left(k_{0i} - m + \sum_{t \in Tn_i} y_{nit} + \sum_{t \in Ta_i} y_{ait} - \sum_{t=1}^{T} c_{it} \right), \qquad (3)$$

where u denotes utility from consumption; c denotes consumption with time subscript $t \in \{1, 2, \ldots, T\}$; T denotes for the end of life; Tn (Ta) denotes periods when an individual lives in New Zealand (Australia); q denotes the utility of living in New Zealand; ko denotes the initial wealth; m denotes monetary moving cost (including the return trip with present value adjustment); y denotes income with subscript n (a) that represents income earned in New Zealand (Australia); β denotes discount rate; and λ denotes the Lagrange multiplier for the life-time budget constraint.

Assuming that the monetary cost of moving m, utility from consumption u, discount rate β, and income streams are more or less the same for all the people in the same occupational category, difference of emigration decision of each individual reflects q, his utility of living in New Zealand. Here, the wage difference represents the utility of living in New Zealand of marginal emigrants.[17] The monetary value of utility of living in New Zealand can be

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[16] The following analysis actually uses a stochastic version of this setup, but the same arguments apply.

[17] In the presence of different sized income risks between New Zealand and Australia, the wage difference could be partially explained by riskiness of the income streams, but this case seems unlikely because downside risks in both countries are likely to be a similar level owing to the mutual income support arrangement between two countries.

calculated as a present value of the wage difference for a period of living in Australia with a correction for moving costs:

Utility of living in NZ = PV of wage difference – monetary cost of moving.

This section calculates this value only for the year 2000 for working age emigrants, who account for about 70 percent of total emigrants. The interest rate is assumed to be 6 percent, which is the average of New Zealand Treasury bond rates in 2000. Information on the 2000 tax rates is taken from the 2001 Tax Review. After applying these to hourly earnings estimates, after-tax wage differences turns out to be $NZ 6.7, $NZ 5.8, and $NZ 5.3 for the high-, mid-, and low-skilled workers. The one-way cost of moving is assumed to be either $NZ 16,000 or $NZ 900; the former is the relocation payment by the New Zealand Ministry of Foreign Affairs and Trade for a single diplomat who moved out of Wellington to Canberra in 2000, and the latter is the one-way coach class airfare (full-fare ticket based on round-trip) from Auckland to Sydney in January 2002. As for the number of years that emigrants spend in Australia, there is no information, and the values are calculated for 5, 10, 15, and 20 years of residence in Australia. Since the utility loss is reported below in annualized numbers, the years of residence are relevant only to discount the price of future return tickets.

The upper part of Table 2 shows the results of these calculations. Assuming a monetary cost of moving of $NZ 16,000, the income difference increases steeply with the residency period. On the other hand, with $NZ 900 moving cost, there is only a small income difference between assumed residency periods. With a cost of moving of $NZ 900, the annualized income difference, that is, the utility of living in New Zealand, for these marginal emigrants in 2000 was about $NZ 7500.[18]

D. Elasticity of Emigration to Tax and Social Security

As shown in the individual maximization problem (3), with an assumption of fully developed financial markets, a $NZ 1 decrease in the New Zealand wage and a $NZ 1 increase in the Australian wage affects the residency decision in exactly the same way. Thus, a regression analysis of the log change of emigration flows on the difference of after-tax wage[19] between New Zealand and Australia would capture the elasticity of emigration to a tax rate change (an exogenous change in income).

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[18] Multiplying this figure by the number of emigrants, the price to stop their emigration decision is calculated about $NZ 170 million. The total cost to bring back all emigrants who live in Australia in 2000 is about $NZ 1.3 billion, if one price is paid for all emigrants.

[19] In the following regression analysis, after-tax wages are corrected for chance of employed (i.e., one minus unemployment rate).

However, three problems can be pointed out in this simple regression analysis of emigration:

- *Simultaneity problem*: In theory, the idea would be to measure the effect of an exogenous change in tax rates (or in the after-tax income) on emigration. In practice, however, the coefficient on the change in income differential captures the factor that more migration outflow implies less number of workers, and thus causes an increase of New Zealand wage.

- *Stationarity*: The regression equation having the change of emigrant flows as the dependent variable and a wage difference as a regressor is consistent with the view that the same number of people would migrate out every year if the wage difference is persistent. This phenomenon would happen only with a homogeneous population, and, in this case, everyone must emigrate or the wage difference must vanish eventually. In other words, the regression equation does not describe equilibrium phenomenon. On the other hand, if a heterogeneous population in terms of preference or skills is assumed, a different equilibrium exists for each wage difference. In this case, given a certain wage difference, marginal emigrants become indifferent between staying and leaving the country.[20] From this more realistic point of view, the dependent variable must not be the change in emigration flows but the change in emigration stocks.[21]

- *Self-selection bias*: If the utility level of living in New Zealand is correlated with its wage level, the coefficient of the change in the New Zealand income (or its difference from Australia) is affected by marginal distribution of the utility level. In other words, the number of marginal emigrants at a given New Zealand wage level may be increasing or decreasing with the wage. This effect would exacerbate or mitigate the effect of tax on the emigration decision.

In the absence of microeconomic data, these problems can only partially be overcome by making several adjustments. First, as argued above, the Australian wage affects the emigration decision exactly the same way (with the opposite sign) as the New Zealand wage. Besides, with the large labor market in Australia relative to New Zealand emigrants, there is unlikely to be a major simultaneity bias, or self-selection bias. Second, any remaining concern about the self-selection bias is likely to be mitigated by including the stock of

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[20] Here, to be more precise, new inflow and outflow to working age population should be corrected.

[21] In the following regression analysis, the gross emigration stock is estimated by adding eight years of gross flows to the 1986 net emigrants stock estimate, and adding the gross flows to this value in the following years. Moreover, the relationship between this gross emigration stock and its growth rate is assumed to be linear. This is a specific assumption, but necessary one to escape from one of difficulties associated with small sample size.

emigrants in the regression. With these corrections, the coefficient of the change in the Australian wage on the change in emigration will capture the effect of marginal change in the New Zealand tax on emigration.

The benchmark regression equation is now written as follows:

$$d\ln L_t = \alpha_0 + \alpha_1 d\ln y_{nt} + \alpha_2 d\ln y_{at} + \alpha_3 d\ln s_{nt} + \alpha_4 d\ln r_{nt} + \alpha_5 I_t + \varepsilon_t, \qquad (4)$$

where t denotes the time subscript; n (a) denotes the location subscript, New Zealand (Australia); L denotes the gross emigration stock; y denotes real hourly earnings after corrected for tax rate and unemployment rate; s denotes the ratio of social security benefits to income (i.e., social security transfer from central government to households divided by GDP); r denotes the interest rate (on 10-year treasury bonds), and I denotes the relative size of net emigration stock.[22] Note that the interest rate is included as a proxy for the discount rate.

In estimation, fourteen years of data from 1986 to 1999 are used. This small sample restricts the number of variables, and affects the hypothesis testing.[23] The tax variable is defined as the direct tax revenue of the central government from households divided by GDP. The social security variable is defined as transfers from the central government to households divided by GDP. Note that the New Zealand pension system has been pay-as-you-go (i.e., social security benefits are paid from the budget each year). This implies that the tax variable is related to social security transfers, leading possible biased estimation of the coefficient of the tax variable. Hence, regressions are also conducted without the social security variable.

Moreover, another transfer variable is constructed to isolate the part of income transfers that is correlated with fluctuations in the unemployment rate. First, the social security variable is regressed on the unemployment rate. Then, the residual of this regression is used as a proxy for the social transfer variable and named as the pension variable.

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[22] Assuming the same relative distribution of preference, a relative size of stock of emigrants in Australia—net stock of emigrants in Australia divided by the number of New Zealand citizens living in New Zealand and Australia—is used as a regressor, to ensure the variable not to explode.

[23] In Table 3, simple t-statistics are reported in parentheses, and robust (heteroskedasticity-corrected) t-statistics are reported in square brackets. Their significance levels are determined using the Student t-distribution, not the normal distribution. The robust t-statistics are based on 5000 simulations of parametric bootstrap (Boot 3 method in Cribari-Neto and Zarkos (1999), originally from Wu (1986)), because White's estimation method for robust standard errors is inaccurate in small samples.

Table 3 shows results of regressions, which are summarized as follows:

- As expected, the coefficients of the emigrants' stock variable are often significantly different from zero, when a constant term is included. Statistical insignificance of a constant term implies absence of time trend.

- Also, as expected, the coefficients of the New Zealand income variable are not significantly different from zero, but their signs are consistent with a view that the higher New Zealand income is a negative factor for emigration.

- Coefficients of Australian income variables are always significantly different from zero. Their values are quite robust to different specifications for the regressions, broadly around 0.2 percent.

- Coefficients of the interest rate are not always significantly different from zero, but, even when not, they are close to 10 percent level of significance. With higher interest rate, the marginal migrants discount future income more, and hence the income difference becomes smaller, when sizable moving costs exist. This suppresses emigration.

- Though the sign of the coefficient suggests that large transfers discourage emigration, both New Zealand transfer and pension variables are not significant in explaining emigration. This result, however, is somewhat expected. Since the population consists of contributors and beneficiaries, more transfers should discourage beneficiaries from moving out of the country, and encourage contributors. In aggregate, the effect can be expected to be mixed.[24]

E. Calibration of Welfare Cost of Migration and Policy Implication

True welfare cost[25] is only created by distortion of incentives to emigrate. Since these distortions may be already present, this section presents estimates of the marginal change of

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[24] Further analysis with more detailed data may be needed to further pin down this composition effect of social transfer on emigration.

[25] Apart from purely economic costs, there are also fiscal costs of migration. The main concern is a free rider problem. As noted by BC-GC, "There is a risk that New Zealanders will go overseas and avoid the tax that could be expected to fund these costs, and return to New Zealand for health care or for superannuation at the cost of the New Zealand taxpayer." Although this should not be viewed as a component of the welfare cost, clearly some taxpayers see it as an undisputable cost levied by their contemporary member of the society. BC-GC also argue that there is a free rider problem on education, because the emigrants received highly subsidized New Zealand education service. However, this argument is not so

true welfare cost for a 1 percent reduction of income tax. Actually, cross-country data (Table 4), show that New Zealand levies the highest level of direct tax in terms of its GDP ratio among OECD countries, along with Denmark and Sweden. While New Zealand collected about 20-22 percent of its GDP in direct tax in the 1990s, popular destination countries for emigrants collected substantially less. Australia and Canada's number is about 15-18 percent of GDP, while the United States and the United Kingdom collected about 12-14 percent.

Let D denote the income differential and M denote the number of emigrants (stock number). A hat denotes current values and an asterisk denotes values under a new policy. Variables without a hat or an asterisk represent hypothetical values when there is no distortion. With these notations, the current welfare cost is written[26] as $(\hat{M} - M)\hat{D}/2$, and the welfare cost after the new tax rate is $(M^* - M)D^*/2$. Then, the change in the welfare cost by a new policy is given as:

$$\hat{D}(\hat{M} - M^*)/2 + (\hat{D} - D^*)(M^* - M)/2. \tag{5}$$

Here, all variables can be computed except for the original, undistorted, level of emigrants, number M. Parameterizing the last parentheses as

$$\theta M^* = (M^* - M), \tag{6}$$

the change of welfare costs are reported under three scenarios, $\theta=1$, $\frac{1}{2}$, and $\frac{1}{4}$. This parameter represents how many people have decided to emigrate because of policy distortions. For example, the last case ($\theta=\frac{1}{4}$) represents the situation where three quarters of all emigrants in Australia under the new policy would still have migrated if New Zealand slashed the income tax to zero.

The lower part of Table 2 shows these calculations. Although the results vary with moving costs, the number of planned years abroad, and the number of emigrants with distorted decisions, the parameter θ is the one that has the largest influence on the results. With $\theta=1$, about 30 percent of the revenue loss from a 1 percent income tax reduction[27] would be

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clear as in the case of pension system. To the extent that there is an expectation that recipients of subsidized education should be future taxpayers, emigrants could entail some notional fiscal costs. In contrast, there is much less of a free rider problem, because the decision to emigrate is not directly affected by availability of subsidized education.

[26] By the same argument of the Harberger triangle, these are divided by 2.

[27] A 1 percent direct tax on households (OECD data) is about $NZ 163 million.

compensated as the welfare gain of migration. With $\theta=\frac{1}{2}$, the number is about 14–15¾ percent, and with $\theta=\frac{1}{4}$, 7½–9 percent.[28]

V. Conclusion

Free labor mobility does not adversely affect people. The income level of New Zealand nationals has been considerably higher than that suggested by the GDP. Moreover, New Zealand nationals have experienced significant income growth during 1990s, which has exceeded the growth of per capita GDP, and which has been comparable to that achieved by residents of the United States and the United Kingdom.

However, emigration induced by the tax and social security system involves true economic waste. In an economy with highly mobile labor, the welfare cost of migration should be taken into consideration when reforming tax and social security systems. In particular, a high income tax burden could have strongly negative effects on GDP and the welfare of the nation. As much as 7 percent to 30 percent of tax cuts will be offset by the reduction of the welfare cost of migration in the case of New Zealand.

Though further investigation is needed to assess the effects of the social security system on migration, it is likely the case that the current pay-as-you-go system contributes to retaining beneficiaries in New Zealand and providing incentives for contributors to move out New Zealand. Future studies could also be conducted to compare the income and the welfare before and after policy changes that New Zealand is experimenting. Those include: the proposed introduction of Talent Visa, with which employers will be able to recruit high-skilled foreign individuals easily; tax incentives for specific immigrants, though there could be a concern about tax competition;[29] and ongoing efforts to better integrate immigrants into productive society.

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[28] As mentioned above, the calculated welfare cost captures only the partial ones, even without considering the deadweight loss of labor market participation. In a dynamic general equilibrium setting, the long-run effect of policy distortion would be much larger. In this sense, it may be surprising to have this large effect of welfare loss (gain) associated with the tax rate.

[29] OECD (2001) concludes that the integration of labor markets within the OECD member countries appears to be proceeding via competition among host countries rather than through cooperation.

Table 1. Gross Migration-Corrected Product

	1992	1993	1994	1995	1996	1997	1998	1999	2000	*1992-2000 Average*	*1992-2000 Variance*
					(In billions of New Zealand dollars)						
Nominal											
GMP	87.7	93.5	99.9	105.5	111.0	114.8	118.4	124.0	133.4	*109.8*	...
GDP	74.1	79.8	85.7	91.2	96.4	99.3	100.0	103.2	109.1	*93.2*	...
Quantity effect	9.8	10.3	10.7	10.8	10.9	11.5	12.7	14.3	17.0	*12.0*	...
Wage effect	3.8	3.4	3.5	3.5	3.7	4.0	5.7	6.4	7.2	*4.6*	...
Real											
GMP	92.7	96.8	102.2	106.1	109.4	112.1	114.2	120.1	126.4	*108.9*	...
GDP	79.0	83.1	88.0	91.7	95.0	97.1	97.0	100.7	104.5	*92.9*	...
Quantity effect	10.4	10.7	11.0	10.9	10.8	11.2	12.3	14.0	16.3	*11.9*	...
Wage effect	3.2	3.1	3.3	3.4	3.6	3.8	4.9	5.4	5.7	*4.1*	...
					(In thousands of New Zealand dollars)						
Real per capita											
GMP	24.0	24.8	25.9	26.6	27.1	27.5	27.6	28.6	29.6	*26.9*	...
GDP	22.4	23.3	24.3	25.0	25.5	25.8	25.5	26.4	27.2	*25.1*	...
					(Growth rate, in percentage point)						
Nominal											
GMP	n.a.	6.5	6.9	5.6	5.2	3.4	3.2	4.7	7.6	*5.4*	*2.5*
GDP	n.a.	7.7	7.4	6.5	5.7	3.0	0.7	3.2	5.7	*5.0*	*5.9*
Real											
GMP	n.a.	4.5	5.5	3.8	3.1	2.5	1.9	5.2	5.2	*4.0*	*1.9*
GDP	n.a.	5.2	5.8	4.3	3.6	2.2	-0.1	3.8	3.7	*3.6*	*3.4*
Real per capita											
GMP	n.a.	3.4	4.4	2.6	2.0	1.3	0.5	3.7	3.4	*2.7*	*1.8*
GDP	n.a.	3.9	4.4	2.7	2.0	1.0	-0.9	3.3	3.2	*2.5*	*2.9*
Memorandum items:											
Nationals growth	n.a.	1.1	1.1	1.1	1.1	1.2	1.4	1.4	1.8	*1.3*	*0.1*
Population growth	n.a.	1.2	1.4	1.6	1.5	1.2	0.7	0.5	0.5	*1.1*	*0.2*
GMP-a 1/											
Real growth	n.a.	4.5	5.5	3.8	3.1	2.5	1.9	5.2	5.2	*4.0*	*1.9*
Real per capita growth	n.a.	3.4	4.4	2.6	2.0	1.3	0.5	3.7	3.4	*2.7*	*1.8*
GMP-b 1/											
Real growth	n.a.	4.5	5.5	3.8	3.1	2.5	1.8	5.2	5.2	*4.0*	*1.9*
Real per capita growth	n.a.	3.4	4.4	2.6	2.0	1.3	0.5	3.7	3.4	*2.7*	*1.8*

Source: Author's estimates.

1/ While benchmark GMP is calculated under the assumption that half of the unknown-occupation immigrants from developing countries are low-skilled, and the other half has the same occupational distribution as the known ones, GMP-a is calculated under the assumption that they are all low-skilled, and GMP-b under the assumption that all of them have the same occupational distribution as the known ones.

Table 2. Welfare Cost for New Zealand Emigrants in 2000

Expected Period of Residency in Australia	$16000 Moving Cost				$900 Moving Cost			
	5-Year	10-Year	15-Year	20-Year	5-Year	10-Year	15-Year	20-Year
Gross market-valued cost								
	(In New Zealand dollars)							
Cost per emigrant who left for Australia in 2000	2404	4716	5556	5977	7344	7474	7521	7545
	(In millions of New Zealand dollars)							
Total cost for emigrants who left for Australia in 2000	54.9	107.6	126.9	136.4	167.6	170.6	171.7	172.2
Total cost for all emigrants who live in Australia in 2000	422.2	836.9	987.6	1063.2	1308.2	1331.6	1340	1344.3
Welfare gain by 1 percent income tax reduction								
(i) Gain for all emigrants with elasticity to AUS income 0.18	44.9	46.0	46.5	46.7	47.4	47.4	47.4	47.5
Ratio to 1 percent tax reduction (percentage point)	*27.5*	*28.2*	*28.5*	*28.6*	*29.1*	*29.1*	*29.1*	*29.1*
(ii) Gain for half of emigrants with elasticity to AUS income 0.18	23.0	24.2	24.6	24.8	25.5	25.6	25.6	25.6
Ratio to 1 percent tax reduction (percentage point)	*14.1*	*14.8*	*15.1*	*15.2*	*15.7*	*15.7*	*15.7*	*15.7*
(iii) Gain for quarter of emigrants with elasticity to AUS income 0.18	12.1	13.3	13.7	13.9	14.6	14.7	14.7	14.7
Ratio to 1 percent tax reduction (percentage point)	*7.4*	*8.2*	*8.4*	*8.5*	*9.0*	*9.0*	*9.0*	*9.0*

Source: Author's estimates.

Table 3. Regression Results 1/

	Constant	NZ Income	AU Income	NZ Transfer	NZ Pension	NZ Interest	NZ Emigrant Stock	*Adj. R^2*
(i)	-0.50	-0.02	0.18	n.a.	n.a.	-0.14	3.47	*0.91*
	(-2.09*)	(-0.42)	(3.81**)	n.a.	n.a.	(-1.73)	(2.18*)	
	[-1.56]	[-0.29]	[4.38**]	n.a.	n.a.	[-1.57]	[1.63]	
(ii)	-0.44	0.01	0.17	0.22	n.a.	-0.17	3.00	*0.92*
	(-1.70)	(-0.15)	(3.68**)	(0.88)	n.a.	(1.88)	-1.77	
	[-1.65]	[0.11]	[3.25**]	[0.77]	n.a.	[-2.02*]	[1.72]	
(iii)	-0.49	-0.02	0.18	n.a.	0.06	-0.15	3.41	*0.91*
	(-1.91*)	(-0.36)	(3.58**)	n.a.	(0.22)	(-1.60)	(1.99*)	
	[-1.59]	[-0.27]	[3.77**]	n.a.	[0.20]	[-1.72]	[1.65]	
(iv)	n.a.	-0.05	0.19	n.a.	n.a.	-0.15	0.15	*0.87*
	n.a.	(-0.79)	(3.58**)	n.a.	n.a.	(-1.58)	(1.89*)	
	n.a.	[-0.63]	[3.60**]	n.a.	n.a.	[-1.72]	[2.80**]	
(v)	n.a.	-0.01	0.18	0.35	n.a.	-0.19	0.11	*0.89*
	n.a.	(0.12)	(3.54**)	(1.30)	n.a.	(-1.92*)	(1.32)	
	n.a.	[0.09]	[2.82**]	[0.96]	n.a.	[-1.90*]	[1.37]	
(vi)	n.a.	-0.04	0.19	n.a.	0.14	-0.17	-0.14	*0.87*
	n.a.	(-0.65)	(3.42**)	n.a.	(0.42)	(-1.56)	(1.66)	
	n.a.	[-0.53]	[3.13**]	n.a.	[0.55]	[-1.94*]	[2.31**]	

	Constant	NZ Unemployment Rate	*R^2*
Memorandum item:			
First Stage Regression of NZ transfer on NZ unemployment rate	0.00	0.13	*0.46*
	(0.41)	(2.85**)	
	[0.41]	[3.00**]	

Source: Author's estimates.

1/ Numbers reported in parentheses are standard t-statistics, and those in square brackets are t-statistics, corrected for heteroskedasticity using parametric bootstrap.
Two stars ** mean more than 5 percent significance level, and one star * means more than 10 percent.

Table 4. General Government: Taxes on Income, Profits, and Capital Gains for OECD Countries, 1990-99

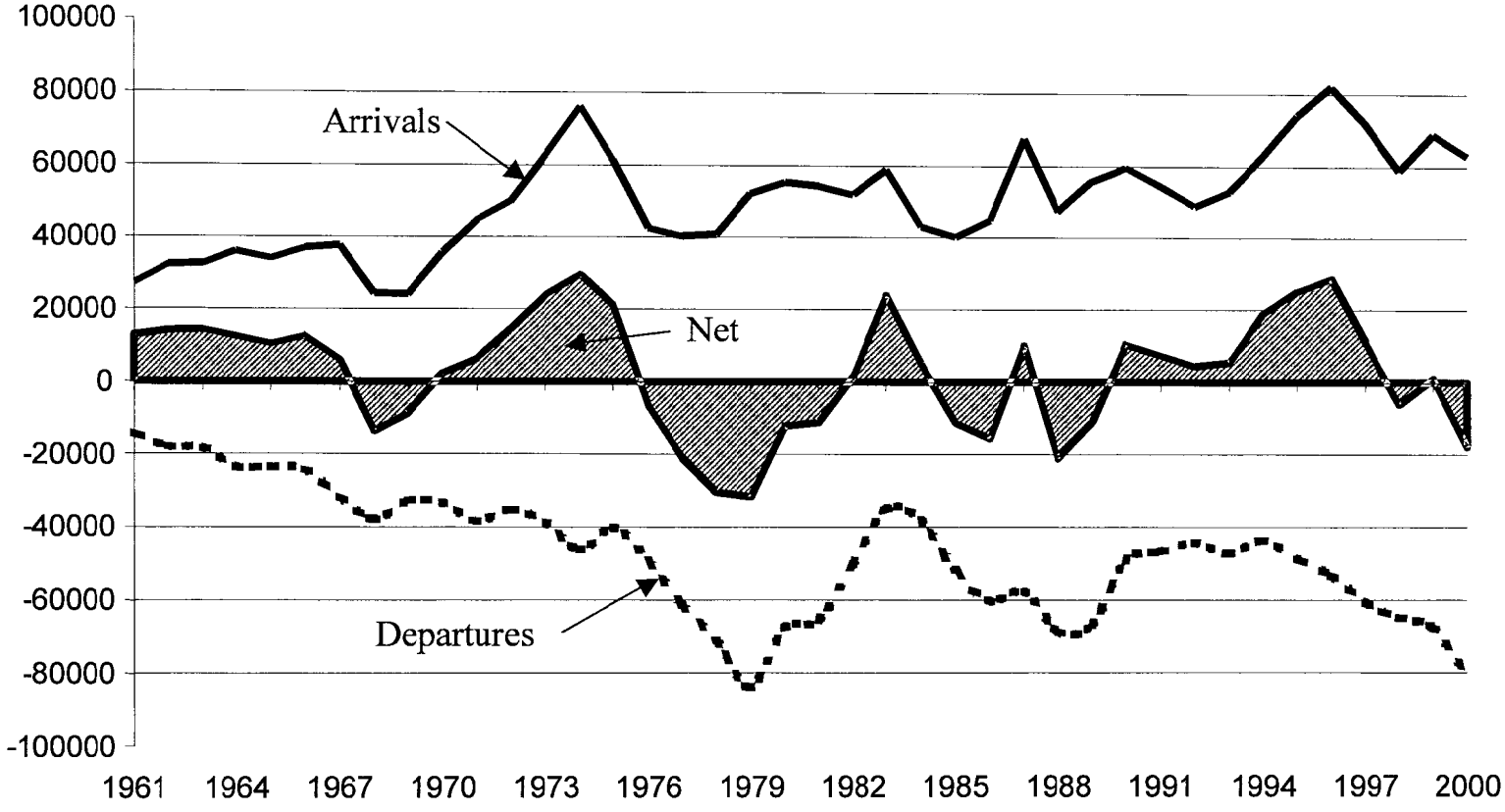
(In percent of GDP)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	16.8	15.5	15.0	14.8	15.6	16.3	16.9	16.9	17.5	...
Austria 1/	10.3	10.8	11.3	11.5	10.5	11.1	12.1	12.7	13.0	12.7
Belgium 1/	16.2	15.9	15.8	15.7	17.1	17.3	17.4	17.8	18.0	17.6
Canada	17.5	17.2	16.1	15.7	15.8	16.5	16.9	18.0	18.2	...
Czech Republic	...	...	...	10.9	10.3	9.9	9.2	8.5	8.9	8.4
Denmark 1/	27.6	27.8	28.3	29.4	30.4	30.0	30.2	30.1	29.3	29.8
Finland 1/	19.3	19.1	19.6	17.1	18.9	18.0	19.7	19.1	19.1	19.1
France 1/	6.9	7.3	6.9	7.1	7.1	7.1	7.6	8.2	10.5	11.0
Germany 1/	10.6	11.7	12.1	11.7	11.3	11.6	10.7	10.4	10.9	11.2
Greece 1/	5.8	5.9	5.8	5.9	6.8	7.2	7.1	7.7	...	...
Hungary	...	12.7	10.0	9.6	9.2	8.9	9.0	8.5	8.7	8.6
Iceland	9.2	9.1	9.5	10.2	10.3	10.6	11.2	11.3	13.0	13.8
Ireland 1/	12.4	13.1	13.4	13.9	14.3	13.0	13.5	13.6	13.4	13.7
Italy 1/	14.2	14.2	15.7	16.3	14.4	14.5	14.8	15.7	13.9	15.5
Japan	15.0	14.2	12.3	11.6	10.5	10.4	10.3	10.2	9.1	8.2
Korea	6.2	5.4	6.1	5.9	6.2	6.5	6.5	5.9	6.9	6.3
Luxembourg 1/	16.0	14.8	13.5	15.2	16.1	16.2	16.9	16.3	15.9	15.2
Mexico	4.7	4.7	5.2	5.5	5.2	4.1	4.0	4.6	4.7	4.9
Netherlands 1/	13.8	15.1	14.1	14.7	12.0	11.1	11.2	10.9	10.6	...
New Zealand	22.0	20.4	20.8	21.4	22.0	22.8	21.0	21.4	20.2	...
Norway	14.7	15.0	13.4	13.5	14.3	14.6	15.0	16.1	16.2	15.0
Poland	...	8.3	12.3	13.5	12.5	12.2	11.7	11.4	11.2	...
Portugal 1/	7.6	8.5	9.5	8.6	8.4	8.6	9.3	9.6	9.9	10.0
Spain 1/	10.1	10.3	10.3	10.0	9.5	9.6	9.4	10.0	9.6	9.9
Sweden 1/	22.4	19.2	18.8	19.8	20.7	19.7	20.4	21.2	21.2	21.4
Switzerland	12.8	12.6	13.0	12.6	13.2	12.6	13.0	12.6	13.3	12.8
Turkey	6.7	7.3	7.3	7.3	6.6	6.4	6.7	7.6	9.4	9.8
United Kingdom 1/	14.2	13.4	12.3	11.6	12.0	12.8	12.8	13.1	14.3	14.3
United States	12.1	11.9	11.6	12.0	12.2	12.6	13.2	13.7	14.3	...
Unweighted average	13.3	12.9	12.9	12.9	12.9	12.8	13.0	13.2	13.6	13.1

Source: Revenue Statistics Database (OECD).

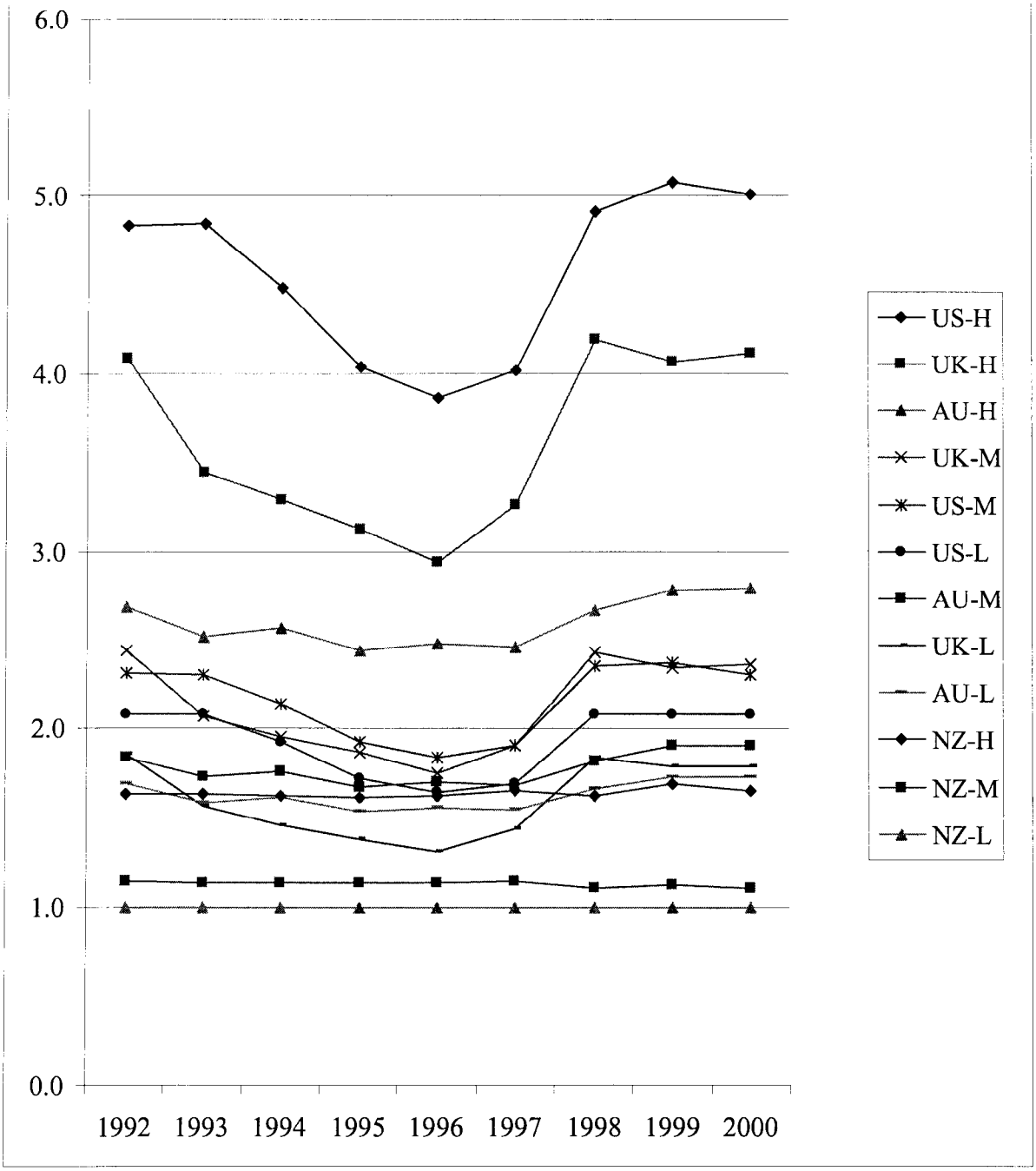
1/ European Union countries.

Figure 1. Total Arrivals, Departures and Net Migration
(Years to September, adjusted data)



Source: Bushnell and Choy (2001).

Figure 2: Hourly Earning Index Estimates (NZ Low-Skilled = 1.0)



METHODOLOGY AND DATA ISSUES TO CALCULATE GMP

To simplify the calculation of GMP further from the definition (2) in the main text, this paper ignores the difference of demography, the labor force participation and the unemployment rate for emigrants in countries other than Australia, the United Kingdom, and the United States, and for immigrants from industrial countries. This assumption changes (2) to

GMP = GDP

+ income of emigrants in Australia, the United Kingdom, and the United States

+ GDP per capita × emigrants in other countries

– income of immigrants from developing countries

– GDP per capita × immigrants from industrial countries. (A1)

Income of each emigrant worker in Australia, the United Kingdom, the United States can be written as sum of New Zealand's GDP per worker and the wage difference between New Zealand and these three countries. Total income of emigrants in Australia, the United Kingdom, and the United States is defined by multiplying the number of emigrant workers by the income of each emigrant worker. Similarly, income of each immigrant from developing countries can be represented as sum of GDP per worker and wage differences. Hence, equation (A1) is now written as

GMP = GDP

+ GDP per capita × total number of emigrants

– correction for workers population for emigrants in Australia, the United Kingdom and the United States

+ wage difference × emigrants in Australia, the United Kingdom and the United States

– GDP per capita × total number of immigrants

+ correction for workers population for immigrants from developing countries

– wage difference × immigrants from developing countries (A2)

It is also useful for analytical purposes to decompose the difference between GMP and GDP into quantity and wage effects:

GMP = GDP + Quantity Effect + Wage Effect, (A3)

where

Quantity effect ≡ GDP per capita × total number of emigrants

– correction for workers population for emigrants in Australia, the United Kingdom and the United States

– GDP per capita × total number of immigrants

+ correction for workers population for immigrants from developing countries, (A4)

and

Wage effect ≡ wage difference × emigrants in Australia, the United Kingdom and the United States

– wage difference × immigrants from developing countries. (A5)

Since GMP is a variant of GDP with correction terms, compensation for employees[30] in the national accounts is the income concept suitable for this paper's analysis. However, there are several difficulties in obtaining suitable earnings data:

- The occupational breakdown of the compensation is not available for the relevant countries.
- Although the labor cost index by occupation is available, statistics are not completely comparable due to definitional differences. Moreover, it is often the case that only index numbers, not underlying level data, are available.
- International Labor Organization (ILO) had a major revision of occupational classification in 1988 from its 1968 version. Under the revised one, occupations are supposed to be classified according to skills. Each country has been adopting this classification gradually over time. New Zealand has adopted it partially in 1990, and last updated 1996. Australia has adopted it in 1996, and the United Kingdom in 1991. The United States has not, but provides detailed data. However, detailed data from other countries are not usually available, and subcategories are sometimes defined slightly different ways, even though their names are the same.

Although labor costs are not available for all occupational categories, the U.S. Bureau of Labor Statistics (BLS) does provide a comparable data on international labor costs for

[30] Compensation for employees is calculated based on labor costs in a broad sense, not only wage, but also benefits such as employers' payment of social security contribution for their employees.

production workers from 1975-1999 using market exchange rates. For GMP calculation in this paper, occupations are classified into three categories based on required skills/educations in the ILO 1988 classification—high-skilled for category 1 (managers and legislators) and category 2 (professionals), low-skilled for category 8 (production workers) and category 9 (elementary workers), and medium-skilled for the remaining categories. BLS data is used as hourly earnings for low-skilled workers, and then the hourly earnings data for high- and middle-skilled workers are constructed using individual country data.[31]

Another component to calculate GMP is the emigrants (immigrants) who currently live in foreign countries (New Zealand). Since only flow data is available, the stock numbers of migrants needs to be estimated. According to an estimate of Statistic New Zealand, which is reported in Bushnell and Choy (2001), about 15 percent of New Zealand population lived outside of the country in 2000—10 percent in Australia, 1.5 percent in the United Kingdom, and 0.5 percent in the United States and Canada. Using this stock estimate, the number of emigrants living in each country in each year is "back cast" using each year's flow. The occupational composition at the end of 2000 is assumed to be the same as average of occupational composition of emigration flows from 1992-2000. There is no information about the naturalization rate of emigrants in destination countries. However, with the presence of a pay-as-you-go pension system, together with Australia's admission of dual citizenship, and the United Kingdom's granting work permit for those with British grandparents, naturalization rates should be quite low. Indeed, the assumption of a very low naturalization rate is needed to generate emigration stock estimates that are consistent with the recent surge of emigration flows. Thus, this paper assumes zero naturalization rate of emigrants.

All immigrants are able to apply for New Zealand citizenship after three years of residency. As is the case with emigrants, there is no information available about how many of them apply after three years. Immigrants from developing countries, however, are likely to apply for it to have access to the same benefits that New Zealand nationals receive.[32] Hence, this paper assumes all immigrants become New Zealand citizens three year after they arrive. Note that GMP will be underestimated if some immigrants do not apply for citizenship after three years.

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[31] In some cases, either interpolation or extrapolation is needed for missing values with additional information. Tables A.1 and A.2 summarize the data sources and occupational codes for each country.

[32] Immigrants can have access to compulsory education and student loans immediately after they arrive, and to welfare benefits after two years of legal residency. The only effective change that comes with citizenship is a New Zealand passport, which includes free entry to Australia.

As noted above, there are a number of people who do not report about their occupation. For the purpose of calculating GMP, assumptions need to be made about the occupations of the large unreported group. This paper assigns the same distribution of occupations as those who report to the half of the unreported immigrants from developing countries. The other half are all assumed to be low-skilled. For all unreported emigrants to Australia, the United Kingdom, and the United States, their occupations are assumed to have the same distribution as those who do report. To check its robustness, two alternative cases are reported: (i) half of the emigrants to Australia, the United Kingdom, and the United States are assumed to be low-skilled; and (ii) all immigrants from developing countries have the same distribution of occupations as those who report. As it turned out, the assumed distributions make almost no difference to the empirical results.

Table A1. Classifications of Occupations

Name of Classification System	Skill 1/	ILO ISSCO88	New Zealand NZSCO90 (Minor update in 95 and 99)	Australia ASCO Second Edition (Introduced in 1996, major change from the first edition)	United Kingdom SOC1990 (Minor update to SOC2000)	United States NCS-SOC 4/
Major Group 1	n.a.	Legislators, Senior Officials and Managers	Legislators, Administrators and Managers	Managers and Administrators	Managers and Administrators	Executive, Administrative, and Managerial
Major Group 2	4	Professionals	Professionals	Professionals	Professional Occupations	Professional Specialty 4/
Major Group 3	3	Technicians and Associate Professionals	Technicians and Associate Professionals	Associate Professionals	Associate Professional and Technical Occupations	Technical
Major Group 4	2	Clerks	Clerks	Advanced Clerical and Service Workers 2/	Clerical and Secretarial Occupations	Administrative Support including Clerical
Major Group 5	2	Service Workers and Shop and Market Sales Workers	Service and Sales Workers	Intermediate Clerical, Sales and Service Workers 2/; Elementary Clerical, Sales and Service Workers 2/	Personal and Protective Service Occupations 3/; Sales Occupations 3/	Sales; Service
Major Group 6	2	Skilled Agricultural and Fishery Workers	Agriculture and Fishery Workers	Omitted. (Farmers and Farm Managers are included in Major Group 1, and Skilled Agricultural and Horticultural Workes are in Major Group 7.)	Omitted. (Farmers and Farm Managers are included in Major Group 1, and other workes are in Major Group 9.)	Farmers are excluded. (Nonfarm agricultural workers and their supervisors are included in major group 9.)
Major Group 7	2	Craft and Related Trades Workers	Trades Workers	Trades Persons and Related workers	Craft and Related Occupations	Precision Production, Craft, and Repair
Major Group 8	2	Plant and Machine Operators and Assemblers	Plant and Machine Operators and Assemblers	Intermediate Production and Transport Workers	Plant and Machine Operatives	Machine Operators, Assemblers, and Insectors; Transportation and Material Moving
Major Group 9	1	Elementary Occupations	Elementary Occupations (Elementary laboreres in agricultural and manufacturing, if any, are included in Major Group 6 and 8 (or 7), respectively.)	Labourers and Related Workers	Other Occupations	Handlers, Equipment Cleaners, Helpers, and Laborers (Street vendors are included in Major Group 5, and cleaning and building services worker are included in Major Group 5.)
Major Group 0	n.a.	Armed Forces	Omitted. (Armed Forces are included in Major Group 5.)	Omitted. (Armed Forces are basically classified together with their civillian equivalents.)	Omitted. (Armed Forces are included in Major Group 1.)	Excluded.

Sources: *International Standard Classification of Occupations*, ILO, 1990: "Establishment of Community-Wide Occupational Statistics," Peter Elias and Margaret Birch, IER, University of Warwick, (The Statistical Office of the European Communities), 1994; "New Zealand Standard Classification of Occupations *(1999)," www.stats.govt.nz.; Australian Standard Classification of Occupations Second Edition*, W. McLennan, Australian Bureau of Statistics, 1997; U.K. Standard Occupational Classification Codes 1995 and 2000, available at www.statistics.gov.uk; and U.S. National Compensation Survey home page, www.bls.gov/ncs, and private correpondence from BLS.

1/ According to ILO (1990), basically, 1 stands for elementary school education, 2 for some level of high school education, 3 for higher than high school but not equivalent to university degree, and 4 for university degree or higher. Major group 1 and 0 are not assigned their skill level. See further discussions in ILO (1990) and Elias and Birch (the Statisical Office of the European Communities, 1994).

2/ ASCO Second Edition does not distingush between ISCO88's Major Group 4 and 5. Instead, ASCO has three different skill-based classification: Advanced Clerk and Service Workers; Intermediate Clerk, Sales and Service Workers; and Elemetary Clerk, Sales and Service Workers.

3/ SOC1990 distinguishes these two occupations.

4/ U.S. classsification system is quite different from ISCO88, but has detailed classifications. Each survey has slightly different grouping, and this table follows the classification used in the National Compensation Survey. It excludes farmers and armed forces. Professional speciality includes some of associate professionals. One of the big difference lies in Major Group 9. It includes agricultural workers together with their supervisors. However, it does not include typical cleaning and building service occupations, which are included in Major Group 5 together with their supervisors. This classification system gives downward bias on wages of skill level 4, 3, and 2, and upward bias on 1.

Table A2. Data for Estimates of Occupational Earnings Curve

	International	New Zealand	Australia	United Kingdom	United States
Estimation Method	BLS data is used to compare hourly compensation of production workers in manufacturing. Among countries, it is better to compare on compensation rather than wage, because fringe benefits are systematically different among countries (but not within a country)	Income Survey data is used for relative earnings after 1997. Before 1997, earnings changes are assumed to be the same as Labour Cost Index. Each year's number of employed data is used to calculate weighted average for each year.	Labour Statistics data is used for relative earnings in 1996. After 1996, earnings changes are assumed to be the same as Wage Cost Index. Number of employed data of 1996 is used to calculate weighted average before 1996, and 1999 for 2000 calculation.	Straightfoward from the data	National Compensation Survey data is used for relative earnings after 1997. Before 1997, earnings changes are assumed to be the same as Employment Cost Index. Each year's number of employed data is used to calculate weighted average for each year.
Earnings Level Data					
Data Name	n.a.	Income Survey	Employee Earnings and Hours	New Earnings Survey	National Compensation Survey
Periods available		Annually, 1997-present	Annually, 1996-present 2/	Annually, 1991-present	Annually, 1997-present
Data series used for this paper	n.a.	Total mean hourly earnings from wage and salaried jobs	Total average weekly earnings, full-time employee 3/	Total mean hourly earnings	Mean hourly earnings, private industry and State and local government 5/
Earnings Change Data					
Data Name	BLS 1/	Labour Cost Index	Wage Cost Index	n.a.	Employment Cost Index
Periods available	1975-1999	Quarterly, March 1991-present	Quarterly, September 1997-present	n.a.	Annually, 1986-present
Data series used for this paper	Hourly compensation	Salary and ordinary wage	Total hourly wage, excluding bonuses	n.a.	Hourly compensation
Employment Data					
Data Name	n.a.	Household Labour Force Survey	ILO database 4/	Labour Force Survey	ILO database 4/
Periods available		Quarterly, March 1991-present	1996-1999 2/	Annually, 1985-present	1990-1999 6/
Data series used for this paper	n.a.	Number of employed	Number of employed	Number of employed	Number of employed

1/ International Comparisons of Hourly Compensation Costs for Production Workers in Manufacturing, 1975-1999. Supplementary Tables for BLS News Release USDL00-25, September 7, 2000.
2/ Data before 1996 are also available, but they use older and quite different version of classification of occupation--ASCO first edition or ISCO68.
3/ Part-time workers' weekly earnings are available, but substantially lower than full-timers'. Part-timers' hours worked data are not available in each occupation. Weekly earnings data are corrected to hourly earnings data using hours worked data for each occupation.
4/ Data is submitted from national authorities. Data is available at www.ilo.org.
5/ Excludes tips and overtime pay. Also excludes farmers and federal government employees such as armed forces.
By excluding tips, earnings of service workers (skill level 2) is under-estimated.
6/ National Compensation Survey gives 2000 number of employed. This 2000 NCS's relative sizes between professional and technical, and among crafts, machine operators, and transportation are applied for the previous years, where ILO data does not provide these breakdowns due to ISCO68 classification.

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