Skilled Immigration And Wages In Australia

Asadul Islam*

Dietrich K Fausten

Department of Economics
Monash University

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Abstract:

The skill intensity of cross-border migration flows has been increasing in recent decades. Yet there has been relatively little systematic exploration of the implications of this secular change for labour market outcomes in host countries. In this paper we investigate the impact of migrants' skill enhancement on domestic wages in Australia over the last quarter century (1980-2006). We use instrumental variable (IV) estimation techniques to deal with the potential endogeneity of immigration and small sample bias (Jackknife IV). Various specification and validity tests support the choice of instruments. Our basic finding challenges popular presumptions about adverse wage implications of immigration but support the many findings in the literature. Our specific recognition of the skill composition of migration flows complements the prevailing analytical consensus that immigration need not cause labour market outcomes to deteriorate. Specifically, we do not find any robust evidence that arrivals of skilled immigrants exert discernible adverse consequences on wages in Australia.

JEL Classification: J61, J31, C31, C59

Key Words: Immigration, Australia, wage, instrumental variable, JIVE.

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1. Introduction

Almost 200 million people are living in a country different from their place of birth. Australia is one of the world's major host nations for immigrants. One out of every four people currently living in Australia was born abroad. Immigrants have rendered an important contribution to the country's economic performance and overall development. However, supports for immigration, and the determination of its appropriate magnitude, are matters of continuing public debate. One prominent issue sustaining the debate is the widespread concern in host countries that immigration harms the labour market prospects of their native-born workers. That concern is not restricted to Australia but lies at the heart of the debate about immigration in many countries - including most European nations, the U.S and Canada (Bauer, Lofstrom, and Zimmermann 2000, Scheve and Slaughter 2001). Accordingly, better understanding of the Australian experience may prove useful in clarifying the issues elsewhere.

The domestic labour market implications of immigration have been investigated intensively. Prominent issues include immigrant assimilation (Baker and Benjamin 1994a; Borjas 1995), labour market participation and unemployment (Altonji and Card 1991; Cobb-Clark 2003; Islam 2007a, 2007b), employment and wages (Card 1990, 2001), language and earnings (Chiswick and Miller 1995). The effects on welfare participation have been examined by Baker and Benjamin (1994b) and Hansen and Lofstrom (2003) *inter alia*. The usefulness and explanatory power of such aggregative investigations, i.e., investigations which treat immigrants as a homogeneous factor, are circumscribed by the fact that immigrant flows are intrinsically heterogeneous. Migrants differ by gender, culture and language, education and training, vocational skill and in terms of many other attributes. These characteristics may influence the direction of their entry into the labour market of the host country, their performance in the various submarkets, and also the wage and employment consequences for relevant groups of native workers. In recognition of that heterogeneity, the empirical immigration literature has increasingly concentrated on the composition of immigrant and on their differential effects on the host country. For instance, Borjas (2003, 2006) examines the implications of immigrant skill level on the labour market prospects of native workers. The growing interest and applied work in this general area has been heavily oriented towards the U.S. and, more recently, Canada and the European Union.

The main immigrant-receiving countries - Australia, Canada and New Zealand - have continued to record positive net in-migration flows (Figure 1). While in the

U.S, family (re)unification flows constitute a significant component of immigrant flows, the immigration programs of Australia and Canada are increasingly focused on migrant skill as reflected in the points system adopted by both countries. The skill composition of immigrant flows reflects the demand in Australia for particular occupational skills, outsourcing talents or business skills. The skill visa category is also the main avenue by which overseas students gain permanent residence in Australia. Skilled migration accounted for approximately 65 percent of the migration visas to Australia granted in 2004-05, with approximately one third of these accruing to foreign students.. The trend towards skilled immigration is also noticeable in Canada and New Zealand (Table 1).

While skilled immigration may not erode the overall employment prospects of the native labour force, it may well affect the relative position of skilled workers. *A priori*, changes in the wages of skilled workers are likely to dominate changes in the wage differential between skilled and unskilled labour. Unskilled wages are relatively unresponsive to market forces and, hence, to immigration by virtue of the minimum wage setting practice in Australia that relies on union-negotiated increases. Skilled wages are not so restricted, and typically respond to the changing labour market situation. Hence, native skilled workers are potentially more exposed to competition from skilled migrants than are native unskilled workers. It follows that skill-targeted immigration policy like Australia's may influence not only domestic wage levels but also the domestic wage structure. Given the relative inertia of unskilled wages, it is plausible to hypothesize that changes in average domestic wages reflect comparable movements in the wages of skilled workers and, hence, in the skilled-unskilled wage differential.

Empirical work on the differential effect of skilled and unskilled migration on wages of domestic workers is quite recent. Investigations of aggregate employment and labour market outcomes for Australian-born workers dispel the popular notion that immigrants reduce domestic real wages. For instance, Parasnis, Fausten and Smyth (2006) find that an increase in the proportion of immigrants in the domestic workforce has a significant positive effect on labour market outcomes for native workers. Addison and Worswick (2002), examining cross-sectional Australian data for 1982-1996, do not find that disaggregating the native labour force by skill group changes their aggregate results. Chang (2004) shows that immigration cannot explain the variation in the skilled-unskilled wage differential in Australia during the 1990s.

The vast empirical literature for the U.S. suggests, in general, that employment effects of immigration are negligible while there may be some negative wage effects of recent immigrants. Exploring the role of skill in U.S. immigration, Borjas (2003) finds that an immigrant influx that increases the size of a particular skill group by ten percent reduces the wages of native workers in that group by about three to four percent. He corroborates this finding in a subsequent examination of US high-skill labour markets (Borjas 2006). Increases in the number of foreign-born students in a particular doctoral field at a particular time had significant and adverse effects on the earnings of doctorates in that field who graduated at roughly the same time. Symmetric labour market outcomes are observed in response to unskilled migration. Card (1990, 2001, 2005), on the other hand, finds no such negative effects. Using data on occupation and metropolitan area to define the relevant labor markets Card (2001) observes a slight adverse impact of an immigration-induced supply increase. Card (2005) reviews the recent evidence on U.S immigration and concludes that there is scant overall evidence that immigrants have adversely affected natives' labour market outcomes.

Similarly, Friedberg (2001) observes that immigration has little impact on the wage structure in Israel after correcting for endogeneity of occupational choice. Dustmann *et al.* (2005) find no strong evidence of immigration on aggregate employment or wages for the U.K. The evidence for Germany is mixed. De New and Zimmermann (1994) identify detrimental effects while Pischke and Velling (1997) find no such effect of migration on employment. It appears that empirical evidence of negative effects of immigration is typically generated by aggergate factor proportions analysis (Borjas) while studies based on local labour markets or "natural experiments" such as political developments in sending countries (Card) find no significant effect of immigration on native outcomes. Studies exploiting geographic variation by correlating immigration with changes in native outcomes across cities or regions find less sizable effects (Altonji and Card 1991) or no effect (Pischke and Velling 1997).

Most previous studies of the wage effects of immigration use cross-section data. There is a limited time series literature that examines the co-integration and causality patterns between immigration and unemployment. Some studies explore the short-run and long-run relationship between immigration and job market prospects (Islam 2007a). A few cross-section studies find mixed evidence on the effect of immigration within skill groups (Card 2001; Friedberg 2001; Borjas 2003). Cohen and Tai-Hsieh (2000) use time series data for Israel and find that immigration-induced changes in wages are reversed eventually. Islam (2007a), also

using time series, detects a long-run positive relationship between the immigration rate and real wages in Canada.

Thus, the popular preconception that immigrants threaten the wages and employment prospects of native workers finds no robust support either in the empirical literature on aggregate migration flows or on disaggregated flows. But it persists nonetheless. Economic theory is equivocal on this issue, and empirical estimates using a variety of approaches in a variety of settings have mostly shown that the effects of immigration on labour market outcomes are either very small or that they yield conflicting results. This inconclusive state warrants more work. The most interesting time span of analysis is the long run during which wages and aggregate demand can adjust. Given the weak correlation between wages and immigration, time series analysis is required to examine trends in relative wages associated with inflows of migrants (Borjas, Freeman and Katz 1996, 1997; Borjas 2003). Accordingly, the present paper employs time series analysis to investigate the impact of skilled immigration on wages in Australia. A complete analysis of the trends of the relevant identifying characteristics of the various cohorts of immigrants is beyond the scope of the present paper. At the same time, we provide an empirical strategy that recognizes immigrant heterogeneity but does not require the use of complete aggregate data (see section 3).

A major problem in studying the impact of immigration is that the choice of host country may be endogenous. Immigrants may self-select to join labor markets in those industrial countries which are booming. We address this potential problem of endogeneity by exploiting the fact that Australia's immigration policy and previous labor market outcomes may serve as the basis for the immigrants' choice to seek admission to the Australian labor market. Using different variants of the instrumental variable (IV) methods we estimate the effect of immigration on Australian wages. To address the problem of small sample bias in the IV estimator, we check the robustness of the IV results with Jackknife Instrumental Variable Estimation (JIVE) (Angrist, Imbens and Krueger 1999; Blomquist and Dahlberg 1999), validating the choice of instruments by different tests for the validity and specification of the instruments. We use quarterly time series data covering the period 1980-2006. The start of the observation period is fixed by the earliest date for which data for different skill categories of immigrants is available for Australia. Our fundamental result is that neither skilled nor unskilled immigration exerts discernible adverse effects on wages in the Australian labour market. In fact, our evidence suggests that immigration may exert positive effects on wages.

The rest of the paper is organized as follows: Analytical approaches to modeling the impact of immigration on labor market outcomes are reviewed in the next section. Sections 3 & 4 delineate the empirical strategy and specification of our model and describe the data, resp. Section 5 presents the estimation results, followed by robustness checks of the results in section 6. Concluding remarks are given in section 7.

2. Theoretical Considerations

The effects of immigration on labour market outcomes can be examined with alternative models such as Heckscher-Ohlin (HO), area analysis, production theory approach (PTA) and factor proportion analyses (FPA). Area analysis (e.g., Card 1990; Altonji and Card 1991; Lalonde and Topel 1997) exploits the high concentration of immigrants in gateway cities or states, assuming that geographically segmented markets exist within a country. Each local market has its own equilibrium wages determined by local labour market conditions. On the other hand, the HO model focuses on trade as an indirect source of supply of particular skills. In specifications with many factors and many commodities net migration flows can disturb national labour market equilibria. The resulting factor price adjustments then affect different skill groups and labour market participants, including migrants and indigenous workers, differentially. The PTA (Grossman, 1982; Borjas 1983, 1987; Card 2001; Islam 2007b) distinguishes between immigrant and native workers, and treats both kinds of labour along with other factors of production as separate inputs into the production process. This analytical perspective directs attention to the substitution possibilities between immigrants and other factors of production, including native labour. The FPA (Borjas, Freeman and Katz 1996, 1997, Borjas 2003) emphasises skill groups rather than national origin of labour, considering immigrants a source of exogenous labour supply shift. This approach focuses on the wage adjustments that are necessitated by the immigration-induced labour supply shocks. Given independent information about labour demand elasticities, it determines the wage consequences of immigration.

In this paper we use an analytical framework that combines elements of the production theory approach (PTA) and factor proportions analysis (FPA). An inflow of skilled labour, *ceteris paribus*, puts downward pressure on wages of skilled workers. But skilled immigration may also cause an outward shift in the labour demand curve through aggregate demand effects. In addition, native workers who are complementary with immigrant labour could experience a rise in wages or employment. Unskilled workers' wages may go up or down depending on

the substitution possibilities between the two types of labour and the scale effect of immigration. In the typical textbook case, immigrants and natives are assumed to be perfect substitutes with little or no change in relative demand. There is another dimension to the substitutability/complementarity relationship. If, for example, labour and capital are the only two factors of production, and labour of the same quality flows into the country, then immigrants compete directly with the native-born exerting downward pressure on wages and raising returns to owners of capital. Lastly, if skilled workers are close substitutes for capital then inflows of skilled immigrants would result in higher national wages by increasing the productivity of unskilled labour. Similarly assume that capital and either type of labour are complements, while the two types of labour are imperfect substitutes. An increase in skilled labour will then (1) reduce the skilled-unskilled wage differential due to scale effect (shift in labour supply); (2) increase the skilled-unskilled wage differential due to substitution effect. The net effect is ambiguous - depending on which effect dominates.

Consider adding dynamics to these comparative-static considerations in the setting of a Solow-type growth model with a constant saving rate, or in a Ramsey-Casss-Koopman-type model with an endogenous saving rate. A permanent inflow of labour reduces the per capita endowment of capital, increasing the marginal productivity per capita of capital in the host country. In the steady state, where immigrants are endowed with higher levels of embodied human capital compared to the average native, the physical capital stock, output and consumption per capita of the total population may increase.

Now assume that wages of unskilled workers are fixed above the equilibrium level, say by trade unions or, for that matter, for political reasons. In that situation, inflows of skilled workers may reduce employment of native skilled workers and depress their wages. The ultimate result depends on the wage setting. In the most extreme case, employment does not respond at all. Alternatively, employment of the skilled workers increases as the inflow if skilled immigrants depress their wages. In this case, employment of native skilled workers may decline depending on their reservation wage level. However, if employers had been paying efficiency wages then it is possible that the adjustment will involve only a decrease in the skilled wage without any change in the aggregate employment level. In these cases welfare of native workers falls since there is an absolute decline in the wage level of the skilled worker.

There are, however, scenarios where skilled migrants exert only a small and possibly positive effect on native wages. For instance, if migrants' spending

patterns generate an increase in the relative output that utilizes skilled workers relatively intensively, then the immigration-induced change in output mix dissipates the downward pressure on skilled wages. Similarly, if there is an increase in skill-biased technological change in the host country, or if skilled immigrants are not close substitutes for skilled natives, then there is little reason to expect changes in the relative wage among native workers. Since workers with different levels of education perform different tasks and fill different roles in production, the majority of the native born workers can benefit from immigration.

The inflow of workers with a unique array of skills also introduces a new set of opportunities for companies and investors in the host country. A large augmentation of domestic labour supply increases the productivity of the existing capital stock, inducing new investment in response to higher returns. A relatively large inflow of highly skilled immigrants such as scientists, engineers, or medical practitioners also offers potentially significant dynamic gains for creative, innovative and complex professions. Technological and scientific innovation enhances the productivity of workers, promoting economic growth. The effect of innovation on productivity, however, accrues over time and is fully realized only in the long run. Many skilled immigrants also bring capital to the economy and engage in setting up firms and promote job creation. They also bring entrepreneurial skill and often create linkages to do business with their country of origin. These dynamic adjustments are likely to benefit labour. Lastly, from the perspective of the stylized Heckscher-Ohlin model, immigration cannot change relative factor rewards by changing the mix of factor supplies since factor prices depend on the prices of traded goods and not on domestic factor endowments. An influx of labour is completely absorbed by decreasing imports of labour intensive goods, declining exports of capital-intensive goods and by a shift in the output-mix towards labour-intensive goods (the so-called Rybczynski-effect). Thus, as long as immigration is not sufficiently large to change the pattern of specialisation, relative wages in the host country will not deteriorate.

Even though they may not affect wage determination immediately it is worth noting that new skilled immigrants are typically relatively young and that they become readily innvolved in the job market. They contribute to the host economy by paying taxes while claiming relatively little income support from the social security system.[1] This fact has prompted many observers to note that promoting

[1] For example, Baker and Benjamin (1994b) find those immigrants' participation rates in Canada's unemployment insurance and social assistance schemes are lower than the Canadian-born population.

immigration is an increasingly prominent element of any strategy to protect the solvency of social security systems (Angrist and Kugler 2003).

In short, immigration affects a host country in many varied and complex ways.[2] Comparative static wage adjustments are merely a one-off realignment that may well be dominated by longer-term dynamic adjustments. But even the net effect of immigration on the host country's labour market outcomes is difficult to determine *a priori*. The relationship between wages, employment and immigration is likely to vary across countries according to regulatory provisions and institutional arrangements such as employment laws, replacement laws, wage-setting, labour market flexibility, industrial structure and business entry costs (Angrist and Kugler 2003). These are matters for empirical investigation and resolution. "Without empirical test, predictions of theoretical models remain at best well-reasoned speculation, and are not suited to guide policy" (Dustmann, Fabbri and Preston 2005, p. F324). Cross-country evidence indicates that effects of immigration depend on the flexibility of the labour market of the host country. Differences between host countries in the immigrants they receive and in the structure of their labour markets means that the impact of immigration for the Australia must be analysed on Australian data rather than being inferred for other countries.

3. Empirical Strategy

Assume firm output is produced by two types of workers immigrants and native born (e.g., Borjas 1987, Islam 2007b), then we can present a functional form of the production function as:[3]

$$W_t = f(I/P)_t \qquad (1)$$

[2] Immigrants' children, second generation immigrants, are a growing fraction of the Australian population . They are likely to spend their entire lives in Australia and will pay taxes and receive income support payments. These intergenerational consequences constitute important components of the long-run costs and benefits of immigration. Card (2005) finds that second generation children will catch up with the children of natives. They also have above average levels of educational attainment, even for children whose fathers had much lower schooling than native-born fathers.

[3] For example, Borjas (1987) and Islam (2007b) consider the generalized Leontief production function of the form $f(.) = \sum_j \sum_i \gamma_{ij} (L_i L_j)^{1/2}$ where the production function *f(.)* is linearly homogenous and possesses the standard neoclassical properties, and L_i is the amount of labour input from the *ith* category of labour. If firms in the labour market operate in a perfectly competitive industry then we get the following system of labour demand functions: $W_i = \gamma_{ii} + \sum_{i \neq j} \gamma_{ij} (R_j / R_i)^{1/2}$ where W_i is the wage rate and R_i is the proportion of the *ith* category of worker (such as immigrant) in the total labour force. For more details see Islam (2007b). See also Grossman (1982) and Card (2001) for similar analyses based on translog and CES-type production functions, respectively.

where I is the stock of immigrants in the Australian labour market, P is the entire domestic workforce, and W_t is the wage at time t. $(I/P)_t$ is the immigrant share at time t, and the dependent variable is the average weekly wage of workers. Ideally, we would like to specify the wages of natives as dependent variable but data limitations restrict us to aggregate wages (representing the composite average wage of immigrants and natives). Similar specifications are used e.g., by Altonji and Card (1991), Butcher and Card (1991), Pischke and Velling (1997) to compare aggregate labour market outcomes with differing immigration rates. Equation (1) can be interpreted as approximating the first-order condition determining the level of wages or as a general reduced-form relationship between the domestic wage level and the immigrant share.

Estimation of equation (1) raises potential omitted variable problems imparting an upward bias to parameter estimates. One obvious omission is a term depicting the state of the labour market. The unemployment rate is typically captured by invoking some variant of the Phillips curve, efficiency wage models or bargaining models of wages. Higher unemployment rates weaken the bargaining position of employees and reduce the rate of wage increase. The Philips curve has been the dominant approach to modelling wage determination as it immediately reflects the influence of the long-run equilibrium rate of unemployment on a fixed growth path. This pins down the equilibrium level of labour utilization in the economy without recourse to any other behavioural equation. We can then estimate the relationship between wages and immigration using the following equation

$$W_t = \alpha_0 + \alpha_1 (I/P)_t + \alpha_2 U_t + \alpha_3 X + \xi_t \qquad (2)$$

where we also add vector X which captures the observable time invariant determinants of wages (such as region, cohort effects). U is the unemployment rate, ξ is the innovation error and α_0 is a constant that captures effects other than those associated directly with the variables in the model. It may include some unobservable policy shift parameters that are not reflected explicitly in the model.

Both theory and empirical evidence suggest a positive association between wages and productivity. In a perfectly competitive market, the wage is determined by the productivity of the marginal worker. Hence, an increase in the labour force due to immigration should affect the wage. We need, therefore, to include a variable that can capture the time-varying productivity in the determination of the aggregate trend in wages. Productivity can be defined as output per man-hour at time t. We don't know exactly what drives productivity. It can be due to workers working

harder or to workers becoming more skilled. At the level of the plant or firm, improvements in labour productivity may come from using better quality of cooperating inputs such as raw materials or capital, or they may reflect technological change. Any one of these drivers could cause this increase, and usually more than one factor will be involved. Inclusion of the productivity measure also controls for the capacity of the host country (Australia) to harness her human and physical resources. We, therefore, model productivity ($prod_t$ is the level of labour productivity at time t) as exogenous in our wage determination system (equation 2a)

$$W_t = \alpha_0 + \alpha_1 (I/P)_t + \alpha_2 U_t + \alpha_3 X + \alpha_4 \times prod_t + \varepsilon_t \qquad (2a)$$

After differencing over successive time periods the estimating equation assumes the form

$$\Delta W_t = \beta_1 \Delta(I/P)_t + \beta_2 \Delta U_t + \beta_3 \times \Delta prod_t + \Delta\varepsilon_t \qquad (3)$$

where $\Delta prod_t$ is the growth in labour productivity defined as the change in GDP per hour labour worked and $\Delta(I/P)$ is the net immigration rate. The differencing has purged the equation of the fixed effects and any potential biases arising from them. It also effectively removes the time invariant variables that could possibly be included in vector X.

The estimated value of β_1 in equation (3) measures the impact of immigrant inflows on wage growth and should not reflect any simultaneous causality in the opposite direction. However, important endogeneity problems may be created by the choice of destination country. Immigrants are, typically, ambitious, aggressive, and entrepreneurial. They, especially skilled migrants, move from one place of work and residence across international boundaries to another in order to exploit the economic opportunities that are accessible to them. At the same time, it is likely that the Australian government bases its immigration policy on past immigration rates. These considerations imply that the current immigration rate is not exogenous. This endogeneity issue has been recognised in studies of local labour markets (Altonji and Card 1991, Friedberg 2001) but not in the context of cross-border migration. In terms of equation (3), if the migrant flow is not independent of $\Delta\varepsilon$, then the conditional correlation between wages growth and immigrant share will confound the two directions of causality and the estimate of β_1 will be biased. If, for example, immigrants are more skilled, and if they choose high-skilled jobs that have better prospects of high wage growth in Australia, then

the estimate of β_1 will be biased upward. Conversely, if immigrants are concentrated in relatively low-paying jobs with little or no prospect of wage growth - possibly due to lack of recognition of foreign qualifications, language barrier, or a dip in the earnings just after arrival - then the estimate of β_1 will be biased downward, leading to underestimation of immigration's effect.

In order to resolve the endogeneity problem, a source of exogenous variation in immigration flows must be found. In the present time series context, such instruments must be correlated with the inflow of immigrants over time, but uncorrelated with the unobserved component of wages growth subsequent to their arrival.[4] We follow Altonji and Card (2001), Card (2001), Friedberg (2001) and use the lagged share of immigrants in the labour force as an instrument. The argument here is that the lagged value of the immigration share acts as information to potential immigrants about Australia's policy towards immigration. We assume that the selection process or the immigrants' decision to enter Australia is governed by the following relationship:

$$\Delta(I/P)_t = \gamma\Delta(I/P)_{t-j} + \mu_t \qquad (4a)$$

where j is the lag between the decision to apply to immigrate or setting the immigration policy for time t and actual entry at time t.

One problem with our choice of instrument could be that it does not capture the decision of every immigrant and, hence, that it explains only a part of the variation of the proportion of immigrants at time t. It follows that our instrumental variable should be interpreted as reflecting an estimate of a specific group – viz., those migrants whose behaviour is influenced by the instrument. "This specificity of estimates is endemic to empirical research. All statistical methods … have elements of this limitation when used to analyse phenomena with heterogeneous responses" (Angrist and Krueger, 2001, p.78). In the present context, that subset of migrants is likely to be dominated by relatively skilled workers if the acquisition of skill is an indication of a worker's inclination and ability to acquire and process job-relevant information. However, our IV estimates constitute an improvement over simple OLS as we also tackle the potential problem of omitted variables that are correlated with both the migration decision and the determination of wages.[5]

[4] The instrumentation is also useful if the error term in equation (3) is correlated over time.
[5] This interpretation of IV is adopted in many studies (Imbens and Angrist, 1994; Angrist, Imbens and Rubin 1996).

The use of time series data at the national level avoids any bias toward zero due to factor price equalization and endogenous regional choice of migrants. However, it induces a different bias toward zero: Immigrants tend to come to countries when labour market outcomes are favourable (Friedberg and Hunt, 1995). So we could also look for other potential instruments that can affect the migration decision and that are related to labour market outcomes. The unemployment rate could be particularly relevant for those migrants who are desperately looking for jobs while labour market conditions may capture salient aspects of Australia's immigration policy. Australia is a growing and thriving economy. It has skill shortages in many areas. In order to alleviate the skill shortages the government may select immigrants on the basis of local labour market conditions. Under those conditions the selection process is governed by the following relationship

$$\Delta(I/P)_t = \gamma\omega U_{t-j} + \upsilon_t \qquad (4b)$$

U is, as before, the unemployment rate and ωU_{t-j} is the weighted average of antecedent unemployment rates (preceding time t-j). Since the immigration process from the time of the decision to migrate until the time of arrival takes considerable time, we select j=6 in our quarterly data. The weight is taken over the six-quarter period (time t-j is the weighted average of the t-j-1, t-j-2,.... t-j-6 period). We use the same specification for the other instrument, past immigration rates, because the government or the potential applicants consider, at time t-j, a series of previous quarter trend of labour market conditions before actually setting the policy or applying for immigration. This specification is similar to Pischke and Velling (1997), Dustmann, Fabbri and Preston (2005).

It is possible and, indeed, plausible that the pull of family or of the "diaspora" influences the choice of destination country. Immigrants may apply to Australia because their family and friends already live here or because of the presence of individuals with similar cultural and linguistic background. Therefore, a possible solution to the endogeneity problem is to use measures of historic settlement patterns as instruments for immigration inflows. Our use of the lagged immigrant share as an IV should partly address this concern. As can be seen from Table 2 and Figure-2, family and "diaspora" are not prominent drivers of immigration flows to Australia. Rather, the overwhelming impression from these data is the considerable change over the years in the pattern of immigration by source country and region. Moreover, skilled immigrants enter Australia after satisfying the points system, and they tend to prefer countries that offer better job prospects or more favourable immigration policies and labour market conditions.

Thus we use the past immigration rate and the past unemployment rate as a source of exogenous variation of the current immigration rate. The decision of skilled immigrants to migrate is based on past Australian immigration policy and on their prospects for success in the Australian labor market. Schematically, the decision path looks as follows:

> (Potential) Immigrant → Decision to leave home country →look at unemployment rates and/or immigration policies in potential host countries → apply to Australia for immigration (→ get visa →come to Australia →look for job → earn wage).

The exclusion restriction implied by our instrumental variable regression is that, conditional on the controls included in the regression equation (3), the past unemployment rate and past immigration rate have no effect on today's earnings growth other than through their effects on immigration. One concern with this exclusion restriction is that the historical (past) unemployment rate may have a direct effect on the current wage rate which may attract immigrants to Australia. To capture this effect we should include among the explanatory variables a measure of the effect of the past unemployment rate on the wage level received by immigrants. However, note that we are measuring the growth of wages, as opposed to the level of wages at time *t*. We consider it unlikely that the historical unemployment rate exerts a prominent influence on current wage increases. The same considerations apply to the policy variable - the past immigration rate. Therefore, our exclusion restrictions are quite plausible. Since we are dealing with aggregate time series data for Australia we do not need to worry about internal migration by natives in response to immigration inflows and subsequent changes in labor market outcomes. This is usually the case when one is dealing with single cross-section data or local labor market situation (Pischke and Velling 1997, Dustmann, Fabbri and Preston 2005, Borjas 2006).[6]

Figure 3 shows a strong positive relationship between the past (6-quarter lagged) immigration rate and its current level. The visual impression is confirmed by a statistically significant positive coefficient obtained from regressing current on past immigration rates.[7] This strong association corroborates our conjecture that the relationship between wages and the immigration rate is influenced by the antecedent immigration policy and labour market. Without consideration of such

[6] One assumption we maintain here is that native skilled workers are not emigrating from Australia in response to arrival of skilled immigration. It is, however, possible that the overall gain in skilled workers to Australia from international movement may be obscuring significant losses amongst highly educated workers (especially who are emigrating out).

[7] In the following section we try to justify the validity of the instrument in different routes.

endogeneity the relationship between wage growth and the immigration rate might be obscured by changes in the immigration policy.

With two instruments for our single endogenous regressor we estimate equation (3) using two stage least squares (2SLS).[8] It is expected that the 2SLS estimates improve efficiency relative to OLS and provide better control for earnings growth. We account for possible serial correlation by computing Huber-White standard errors. In the presence of overidentifying restrictions it is sometimes useful to obtain a more efficient estimator when serial correlation may be present by applying the Generalized Method of Moments (GMM) conditions (Hansen 1982). Since our 2SLS with robust standard errors is *de facto* a GMM estimator we need not conduct separate GMM estimation as this may generate only small additional gains. Moreover, GMM suffers from small sample bias. Given that we are dealing with a small sample, using GMM would not seem appropriate.

4. Data and Descriptive Statistics

Quarterly skilled-based immigration data for the period 1980-2006 were obtained by special request from the ABS. The net immigration rate is expressed as the total number of immigrants in a given quarter per one thousand adult (15-64 years of age) Australians in that quarter. It represents the movement of nationals who have been granted the right to live permanently in Australia.[9] Measuring skilled migrant flows is problematic because immigration Australia (DIAMA) measures inflows by visa type, which may not reflect the usually defined general skills. DIAMA defines skilled migrant workers as those people who have skills in particular occupations that are *required* in Australia. These occupations attracting certain points are identified in the skilled occupation list. The demand list contains a list of domestic occupations and specialisations for which there is an ongoing national shortage. Unlike immigration Australia, we measure skill by the occupation of immigrants as stated in the landing card of the permanent visa category of immigrants at their first entry in Australia. Since most of the visas granted by immigration Australia under the skilled category fall under the general skill stream there is substantial agreement between the two definitions. Our practice reflects a preference for defining skill in terms of generic attributes of

[8] In this paper the term IV and 2SLS are not interchangeable. We refer to 2SLS estimate when we use multiple instruments and IV estimate in case of single instrument.

[9] This definition usually applies to persons born outside Australia but may also apply to a small number of persons born inside Australia to parents who are foreign nationals. Note that the migration rate used here differs from the 'net migration' rate as the data did not include individuals departing Australia. However, that departure rate is very low in Australia and, therefore, use of the 'gross migration rate' is unlikely to distort the results.

migrants rather than temporary labour market requirements in the host country. The migrant attributes provide a better guide to the extent of human capital inflow into the host country. See Appendix note on the definition of the skilled immigration in our data.

The unemployment rate is the percentage of the labour force that actively seeks work but is unable to find work in a particular quarter. Nominal wage data include average weekly compensation paid during the calendar quarter to all employees in Australia, regardless of when the services were performed. Since we do not have time series data for wages of native skilled and unskilled workers (such quarterly data is not available for Australia), we use aggregate wages as the dependent variable in our regression. Labour productivity is defined as GDP (at constant prices) per hour worked. The measures of labour productivity we use are presented as indices and as rates of change.

Table 3 provides descriptive statistics for the key variables of interest. The first two columns provide the mean and standard deviation of the whole sample. Average weekly wages of all workers have increased significantly over the observation period. The average unemployment rate in recent years (2000-2006) is lower than the corresponding average over the entire observation period. The average change in the unemployment rate from its immediate preceding quarter is negative. Productivity is increasing over time. However, the average change in productivity, or productivity growth, of a given quarter compared to its immediate preceding quarter has slowed down in 2000-06 compared to the period 1990-99. The immigration rate is relatively volatile (see also Figure 4). It declined from a relatively high level of 2.5 in the initial period to 1.8 in the period 1990-99. However, the number and proportion of new immigrants has increased again in recent years to an average rate of 2.0 though the rate is yet to match its 1980 level. The proportion of skilled migrants has increased continuously over the observation period. On average Australia received 2.3 skilled migrants for every unskilled migrant. However, that ratio has increased almost threefold over the observation period, rising from 1.4 in the 1980s to 3.4 in the 1990s and to 4.1 in the most recent period. Immigrants who were not of working age or did not adequately describe their occupational status at the time of arrival were not classified as either skilled or unskilled but were included in the total immigration rate.

We depict the relationship between earnings growth in Australia and the immigration rate in Figure 5. The relationship appears to be positive, though it is not strong. Bi-variate regression analysis confirms that it is statistically

insignificant. Finally, before running the regression, we check if there is any trend component in the dependent and independent variables. Since we are dealing with time series data, we need to ensure that our specification is not contaminated by spurious relationships. Figure 6 plots all the variables that are of interest in our regressions. It is apparent that there is no time trend in the data that can potentially harm the results. By differencing the variables we have, in fact, removed any drift or time trend.

5. Estimation Results

5.1 Ordinary Least Squares Regression

Table 4 reports the ordinary least-squares (OLS) results from regressing growth of weekly wages on the immigration rate with and without changes in the unemployment rate and productivity growth as controls. The results indicate that the immigration rate has a consistently significant positive effect on wages, irrespective of specification. The first three columns show that immigrants exert a highly significant (1% level) impact on wages in the Australian labour market. The following two sets of three columns show that this qualitative finding applies to both component groups, skilled and unskilled migrants. The magnitude of the effect is consistently larger (approximately double) for skilled migrants than for all migrants, but the level of significance is lower (columns 4-6). The effect is even stronger in the case of unskilled migrants, and statistically as significant as for all migrants (columns 7-9). Note also that in all three alternative specifications the magnitude of the coefficient of the immigration rate diminishes as we control for both changes in the unemployment rate and productivity growth. But the coefficients and the sign of the relationship remain stable and significant.

5.2 First-stage Estimation

We examine the first-stage of IV regressions with the immigration rate as the dependent variable. Equation (5) describes the relationship between the current and past immigration rates (immigration policy) and the past unemployment (labour market outcomes) rate in reduced form.

$$\Delta(I_t / P_t) = \phi_0 + \phi_1 \Delta(I / P)_{t-6} + \phi_2\, \omega U_t + \phi_3\, \omega U_{t-6} + \phi_4 \times \Delta prod_t + \vartheta_t \qquad (5)$$

Table 5 reports the OLS results for the above equation with different specifications. Columns 1-4 show that both instruments, the past immigration rate and past unemployment rate, are statistically significant at the one percent level. Columns 5 and 6 indicate that both instruments are also statistically significant

individually. Thus, both the past immigration rate and past unemployment rate appear to carry good explanatory power for the current immigration rate. This suggests that the selected instruments are not weak, and that their use carries no potential bias. Although these findings are not conclusive they are indicative and corroborate the usefulness of our instruments.

5.3 Reduced Form Estimates

The reduced form estimation illustrates the causal effect of the instrumental variable(s) on the outcome of interest - growth of average weekly earnings. Concerns about weak instruments can be readily mitigated by looking at the reduced form equations. These estimates are unbiased, even if the instruments are weak (Angrist and Krueger 2001). The results presented in Table 6 suggest that the past immigration rate and past unemployment rate have each statistically significant effects on wages growth, and that the instruments are not weak. Since the reduced form estimates are significantly different from zero, they support the presumption that the immigration rate does exert a systematic influence on changes in wages in Australia.

5.4 Instrumental Variable Estimates

Instead of treating the immigration rate as exogenous we now assume that it is endogenous. Table 7 reports the results of IV estimations when the past immigration rate – a proxy for the policy variable - is used as an instrument. The identification strategy here is that the past immigration rate does not directly influence the current growth of weekly wages in the Australian labour market. Since we are using the six-quarter lagged immigration rate as the past immigration rate there is no *a priori* reason to think that such lagged immigration is likely to cause the growth of current wages. However, we allow the past immigration rate to affect current wages growth through its effects on the current immigration rate.

The IV estimates presented in Table 7 display some qualitative similarities with the OLS estimates in Table 4. One notable quantitative difference is that the magnitude of the coefficient of the immigration rate is significantly larger in the IV estimations (columns 1-3, Table 7). The current immigration rate has a positive and statistically significant (at the 5% significance level) impact on current wages growth as does the rate of unskilled immigrants. However, the explanatory power of the IV estimates deteriorates sharply when the effect of skilled immigration on wages growth is estimated. None of the three specifications shows a significant effect of the rate of skilled immigrants on domestic wages growth. Overall, the

evidence suggests that skilled immigration does not exert a robust influence on wages growth in the Australian labour market. This result also indicates that we need to take the endogeneity of immigration rate into account.

5.5 Two Stage Least Squares Estimates

We now consider both instruments, the past immigration rate and past unemployment rate, simultaneously. The first stage involves regressing the immigration rate on all predetermined variables (equation 5). The estimates are presented in Table 8. The exclusion restriction is that the instruments do not appear in equation (3).

2SLS estimates do not generate any sound evidence that the immigrant flows exert a systematic effect on domestic wages growth. The current total immigration rate is significant (at the 10% level) in the first two specifications (columns 1 & 2). But its explanatory power vanishes in the full covariate specification of the wage equation, i.e. when both, the change in the unemployment rate and in productivity growth, are included in the estimation. Estimates with the unskilled immigration rate display a statistically significant effect on wage change while none of the skilled immigration rate specifications generate any statistically significant effects.

IV and 2SLS estimators are popular and have been used extensively in the literature. Even though they may be consistent, several recent studies (e.g.,Bound *et al.* 1995; Staiger and Stock 1997) point out that the finite sample properties of both estimators can be very poor especially when the sample size is very small or the instruments are weak. Often very large samples are needed for the asymptotic properties to yield good approximations. Both IV and 2SLS estimates are biased towards the probability limit of OLS estimates. This bias is due to the use of the *i-th* observation in constructing the optimal instrument for the *i-th* observation and therefore can generate misleading results (Angrist, Imbens and Krueger 1999).

6. Robustness Check

6.1 Jackknife Instrumental Variable Estimates (JIVE)

The 2SLS estimator can also suffer from bias that is exacerbated when the instruments are only weakly correlated with the endogenous variables and when many instruments are used. In such situations JIVE (proposed initially by Angrist, Imbens and Krueger 1999) performs better than 2SLS. JIVE estimators eliminate the correlation between the first-stage fitted values and the structural error term that causes the traditional two-stage least-squares estimator to be biased. Though

it has the same finite sample properties as limited information maximum likelihood (LIML), Angrist *et al.* have shown that under certain forms of misspecification the JIVE estimator may have less bias. It is also a useful alternative in applications when there is concern about the number of instruments.

The computational requirements for JIVE are of the order of those required for weighted least squares. Suppose we have the following relationship:

$$y = \beta x + \varepsilon$$
$$x = \pi' Z + \nu$$

In the case of 2SLS, the instrument for x is $Z'\hat{\pi}$ and the ith row of the estimated instrument can be written as

$$Z_i'\hat{\pi} = Z_i(Z'Z)^{-1}(Z'x)$$

JIVE removes the dependence of the constructed instrument $Z_i'\hat{\pi}$ on the endogenous regressor for observation i by using $\tilde{\pi}_i$, which is calculated from the sample with the *i-th* observation omitted.

The constructed instrument for JIVE turns out to be

$$Z_i\tilde{\pi}(i) = Z_i \frac{(Z'Z)^{-1}}{1 - Z_i'(Z'Z)^{-1}Z_i}(Z'x - Z'x_i)$$

$$= \frac{Z_i\hat{\pi} - h_i x_i}{1 - h_i} \quad (\because h_i = Z_i'(Z'Z)^{-1}Z)$$

Thus JIVE can be estimated with two passes through the data.[10] It involves computing $\hat{\pi}$ and the leverage, which we denote by h_i, in the first stage. The second-stage involves removing the influence of the ith observation. Then we calculate (using $\tilde{\pi}_i Z$ as an instrument)

$$\hat{\beta}_{JIVE} = (\hat{X}'_{JIVE}X)^{-1}\hat{X}'_{JIVE}y$$

where

$$\hat{X}'_{JIVE,i} = Z_i\tilde{\pi}(i)$$

[10] Angrist, Imbens and Krueger (1999) propose two types of JIVE: JIVE1 and JIVE2. Monte Carlo simulations suggest both estimators typically perform similarly. Our results also confirm this. We therefore report the JIVE1 estimator here. Blomquist and Dahlberg (1999) suggest two other JIVE estimators. Again Monte Carlo evidence indicates that Angrist *et al.* JIVE estimators are preferable.

Table 9 shows the results obtained with JIVE. We do not see any statistically significant relationship (in any specification) between the immigration rate and the growth in earnings. While the signs of the immigration rate in all three variants are similar to that of 2SLS estimates, the overall immigration variables lack explanatory power. The coefficient estimates corresponding to the skilled and total immigration rates are statistically insignificant. The results from *JIVE* estimators indicate that there is no robust evidence that skilled immigration affects wage growth in Australia, positively or adversely. Unskilled workers continue to play a statistically significant positive effect on wage growth while the skilled immigration rate does not have a robust influence on wage growth. From Table 9 we also observe that the magnitude of the JIVE estimator is greater than the 2SLS estimator.

6.2 Tests for Validity of Instruments

An important concern with an IV approach is the possible use of weak instruments, which tends to bias 2SLS estimates toward OLS estimates and may weaken standard tests for endogeneity. The exiting econometric literature defines weak instrument based on the strength of the first-stage equation (e.g., Staiger and Stock, Stock and. Yogo 2004). So we test the relevance and validity of the instruments. Specifically, we test whether the IVs are correlated with the endogenous regressor and orthogonal to the error process. We test the first condition by examining the fit of the first stage reduced form regression of the immigration rate on the full set of instruments - both included and excluded instruments for the two-stage least squares. We use the F-test of the joint significance of the excluded instruments in the first stage regression. The F-test rejects the null that the instruments are jointly insignificant (See Table 5). This implies that, according to tests for weak instruments, our first stage has good power and our instruments are not weak. The instruments are both individually significant as is evident from the reduced form regression coefficient estimates and the corresponding standard errors shown in Table 5. The strong reduced form estimates give an indication of the robustness of the use of the instruments.[11]

We further check a "partial R^2" measure proposed by Shea (1997) that takes intercorrelations among the instruments into account. We also use a commonly used statistic (recommended, e.g., by Bound *et al.,* 1995), the partial R^2 of the regression of endogenous variables on the excluded set of instruments. When we

[11] In general, there need not be any relationship between significance of the reduced form and the significance for 2SLS estimates (see Lochner and Moretti 2004 for formal proof).

have a single instrument Shea's partial R^2 and the usual partial R^2 measure are the same.[12] Shea's partial R^2 ranges from 0.25 to 0.31 in our four models. Thus, our instruments pass both the criteria recommended by Bound *et al.* (1995) and Shea (1997).

It is possible that there are weak instruments even if, in the first stage, each instrument is significant at the conventional level of significance. Staiger and Stock (1997) suggest a rule of thumb which applies to our single endogenous variable case, that an *F*-statistic below 10 is a cause for concern. All of our four models pass this operational criterion as well since the values of the *F*-statistics are well above 10 in all cases (see Table 5).

We now ascertain instrument independence from the observable error process. Since there are more instruments than the number of endogenous variables the equation is overidentified. We can test the orthogonality conditions of instruments with that of the error process. We test the overidentification problem through the common *J*-statistic of Hansen (1982). Under the null hypothesis of orthogonality we cannot reject it in all cases (see Table 5). This confirms that the instruments are truly exogenous. The results are also confirmed by Sargan's (1958) statistic which is a special case of Hansen's *J* under the assumption of conditional homoskedasticity. We also adopt the general Hausman (1978) test of endogeneity. Under the null hypothesis that OLS is an appropriate estimation technique, we reject the null and conclude that the immigration rate is truly endogenous (Table 5).

7. Conclusion

The large and growing scale of cross-border migration imparts a crucial role to immigration policy in potential host countries which are predominantly the developed countries of the world. National policymakers need to resolve the potential conflict between improvements in national growth and economic performance on the one hand and deterioration in labour market outcomes for native workers on the other. Neither economic theory nor empirical investigation provide consistent support for the widespread perception that immigrants take jobs or wages, or both, from native workers. Even if the general proposition about the unharmful labour market outcomes is conceded concern about adverse sectoral labour market effects remains in the public domain. The general presumption is that the inevitable mismatch between the composition of the native labour force

[12] For multiple endogenous variables, the two statistics will be different (see Baum, Schaffer and Stillman 2003).

and immigrant flows creates sectoral market imbalances which can be removed only through price (wage) and quantity (employment) adjustments. The progressive reorientation of Australia's immigration policy from family unification to skill acquisition tends to fuel those apprehensions of native workers.

Accordingly, the present paper explores systematically the impact of immigration on labour market opportunities and the assimilation of immigrants into the domestic labour market in Australia. Specifically, we recognize the heterogeneous nature of the pool of immigrants and the recent thrust of Australian immigration policy. From the many differentiating characteristics of migrants we emphasize the distinction between skilled and unskilled labour qualifications. Not only does that distinction capture the thrust about Australia's immigration policy, it also recognizes, albeit in a qualitative way, the augmentation of the host country's stock of human capital that is generated from the influx of migrants.

The concrete empirical exercise involves estimating the impact of skilled immigrants on wages in the host country, Australia. In order to address the potential problem of endogeneity due to selection and self-selection of immigrants we use various instrumental variable approaches by exploiting the antecedent immigration policy and labour market outcomes. The basic instrumental variable estimates suggest that the immigration rate is endogenous, and that this endogeneity needs to be taken into account. The multiple instrument 2SLS estimates capture both the Australian government immigration policy and self-selection by immigrants. Given the smallness of the present sample, the robustness of the results of the 2SLS estimation is verified by JIVE. The JIVE estimator can simultaneously take care of the small sample bias problems in 2SLS. JIVE is also better suited if weak instruments are used. We have demonstrated the validity of the selected instruments on the basis of theoretical considerations and subjected this choice to empirical testing. These tests support the suitability of the instruments and, hence, the analytical soundness of our results.

The core finding is that there is no robust evidence that immigration exerts discernible adverse consequence on wages in the Australian labour market. This basic finding holds whether the immigration rate is specified in aggregate form or whether it is decomposed into the two main subsets of skilled and unskilled immigrants. In fact, there is some evidence that overall immigration may exert positive effects on wages in Australia.

One obvious limitation of the present investigation is the failure to explicitly allow for international movements of capital. Australia is a small open economy (SOE).

Insofar as immigration affects relative factor returns it will elicit a capital account response. Typically, in simple aggregate SOE models, the induced capital flows will tend to re-establish relative factor returns with the net result that both the stock of the domestic labour force and capital have been augmented in response to immigration. The capital flow response becomes significantly more complex as multiple categories of labour and capital are recognized with potential complementarity and substitutability relations between the various components of each group of factors. The consequence of this increasing complexity is that analytical results become more equivocal while the available data for empirical testing cease to match the analytical constructs. Furthermore, there is little evidence to suggest that any labour market disturbances that may be induced by migrant flows are likely to create relative factor price changes of sufficient magnitude to drive large-scale cross-border capital movements. The analytical limitation of the present study is, therefore, unlikely to be empirically debilitating.

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Table 1: Permanent immigrants entering settlement countries under skilled categories (Per cent of all immigrants)

Country	1991	1999	2001	2005
Australia	37	42	60	65
Canada	18	47	55	
New Zealand	-	47	68	
United States	18	22	17	

Source: IOM (2005).

Table 2: Main Sources of Australian Immigrants (% of total)

Countries of origin	1949-50	1959-60	1969-70	1979-80	1989-90	1999-00
New Zealand	1.9	1.3	2.7	16.3	9.2	23.7
UK and Ireland	28.2	36.1	41.6	21.5	21.1	10.8
China*	0.8	0.4	0.2	1.6	2.5	7.4
South Africa	0.3	0.4	0.5	3.4	2	6.2
India	0.7	0.4	2.1	1	2.5	5
Former Yugoslavia	0.8	6	14.2	2.1	1.6	4.6
Philippines	n.a.	n.a.	0.1	2.5	5	3.5
Malaysia	0.4	0.2	0.5	2	5.3	1.9
Viet Nam	n.a.	n.a.	n.a.	16	9.2	1.6
Hong Kong +	0.3	0	0.2	1	6.6	1.6
Germany	34.6	9	2.2	1.5	0.9	0.8
Netherlands	1.7	8.9	1.5	1.5	0.4	0.5
Poland	3	1.8	0.3	1.7	1.4	0.2
Italy	9.3	15.4	5.6	1.3	0.3	0.2
Austria	3.7	1.9	0.5	0.3	0.2	0.1
Greece	1.1	5.9	5.9	1.1	0.3	0.1
Other	13.3	12.2	21.9	25.4	31.5	31.7

Notes: *China (excludes SARs and Taiwan Province), +Hong Kong (SAR of China)
Source: Australian Bureau of Statistics

Table 3: Descriptive Statistics of the Key Variables

	1980-2006		1980-1990		1991-1999		2000-2006	
Variables	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Average weekly wages per quarter	683.4	208.3	457.5	71.2	694.5	68.0	956.4	84.9
Quarterly Unemployment Rate	7.71	1.58	7.84	1.28	8.80	1.23	5.99	0.61
Immigration rate per 1000 Australian	2.1093	0.5166	2.505	0.5822	1.8235	0.343	2.0144	0.2705
Skilled immigration rate	0.666	0.162	0.641	0.197	0.611	0.106	0.772	0.101
Unskilled immigration rate	0.294	0.162	0.458	0.132	0.179	0.023	0.187	0.040
Productivity	83.87	10.19	73.28	1.69	83.68	5.05	97.70	2.86
Growth of weekly wage of all	8.21	3.21	7.92	1.89	6.19	2.47	11.48	2.87
change in unemployment rate	-0.038	0.288	-0.032	0.355	-0.026	0.294	-0.061	0.166
Change in productivity	0.342	0.424	0.194	0.451	0.492	0.316	0.316	0.467

Table 4: Ordinary Least squares Estimates (OLS):

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total immigrants			Skilled immigrants			Unskilled immigrants		
Net (total) immigration rate	1.66	1.67	1.55						
	(0.39)*	(0.39)*	(0.40)*						
Change in unemployment rate		-0.093	0.011		0.116	0.23		0.572	0.635
		(0.970)	(0.963)		(1.038)	(1.017)		(0.877)	(0.875)
Change in productivity			-0.477			-0.566			-0.537
			(0.297)			(0.297)+			(0.312)+
Net skilled immigration rate				3.6	3.55	3.18			
				(1.77)**	(1.78)**	(1.75)+			
Net unskilled immigration rate							4.22	4.27	3.89
							(1.30)*	(1.30)*	(1.38)*
Constant	2.66	2.633	3.054	3.884	3.916	4.356	5.038	5.033	5.319
	(0.929)*	(0.936)*	(0.981)*	(1.216)*	(1.237)*	(1.213)*	(0.540)*	(0.545)*	(0.589)*
R-squared	0.1	0.1	0.12	0.04	0.04	0.07	0.06	0.06	0.08

Notes: Huber-White standard errors in parentheses, + significant at 10%; ** significant at 5%; * significant at 1%

Table 5: First-Stage Regression: Immigration Decision

	(1)	(2)	(3)	(4)	(5)	(6)
Change in unemployment rate		0.000023		0.000166	0.00017	0.000514
		-0.000161		-0.000146	-0.00016	(0.000133)*
Change in productivity			-0.000376	-0.000399	-0.000419	-0.00048
			(0.000097)*	(0.000095)*	(0.000096)*	(0.000114)*
Past immigration rate	0.53895	0.534253	0.518427	0.48298	0.388635	
	(0.076193)*	(0.099027)*	(0.071606)*	(0.089941)*	(0.090035)*	
Past unemployment rate	0.000116	0.000116	0.000112	0.000113		0.000056
	(0.000038)*	(0.000038)*	(0.000035)*	(0.000035)*		(0.000030)+
Constant	0.000052	0.000062	0.00025	0.000337	0.001449	0.001852
	-0.000386	-0.000417	-0.00036	-0.00039	(0.000181)*	(0.000226)*
Hansen's J-Statistic (Overidentification Test)	[p=0.31]	[p=0.281]	[p=0.260]	[p= 0.33]		
F-test of Joint Significance of Instrument Set	[p=0.00]	[p=0.00]	[p=0.00]	[p=0.00]		
Shea's Partial R2	0.2983	0.27	0.313	0.259		
Wu-Hausman F test	[p=0.061]	[p=0.076]	[p=0.109]	[p=0.092]		
Durbin-Wu-Hausman chi-sq test	[p=0.059]	[p=0.071]	[p=0.103]	[p=0.085]		
Sargan statistic (overidentification test of all instruments)	[p=0.368]	[p=0.358]	[p= 0.351]	[p=0.434]		
Value of F-statistic (for instruments)	24.3	14.5	25.7	13.9		
R-squared	0.3	0.3	0.39	0.4	0.33	0.21

Notes: Huber-White standard errors in parentheses,
+ significant at 10%; ** significant at 5%; * significant at 1%

Table 6: Reduced Form Estimates

	(1)	(2)	(3)
Change in unemployment rate	-0.338	-0.084	-0.484
	(0.921)	(0.848)	(0.838)
Change in productivity	-0.613	-0.631	-0.594
	(0.294)**	(0.287)**	(0.279)**
Past immigration rate	1.205		0.576
	(0.431)*		(0.399)
past unemployment rate		-0.892	-0.827
		(0.150)*	(0.158)*
Constant	3.874	13.296	11.524
	(1.035)*	(1.247)*	(1.790)*
R-squared	0.08	0.22	0.22

Notes: Huber-White standard errors in parentheses

+ significant at 10%; ** significant at 5%; * significant at 1%

Table 7: Instrumental Variable (IV) Estimates: Past immigration Rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total immigrants			Skilled immigrants			Unskilled immigrants		
Net (total) immigration rate	2.65	2.98	2.91						
	(1.08)**	(1.23)**	(1.29)**						
Change in unemployment rate		-0.543	-0.476		-0.151	-0.096		0.61	0.668
		(1.134)	(1.147)		(1.193)	(1.191)		(0.860)	(0.856)
Change in productivity			-0.32			-0.48			-0.479
			(0.345)			(0.334)			(0.319)
Net skilled immigration rate				5.97	6.15	6.24			
				(3.66)	(3.89)	(3.78)			
Net unskilled immigration rate							6.66	6.06	5.81
							(1.97)*	(1.61)*	(1.71)*
Constant	0.507	-0.222	0.036	2.309	2.184	2.285	4.319	4.504	4.737
	(2.346)	(2.697)	(2.868)	(2.412)	(2.593)	(2.560)	(0.711)*	(0.639)*	(0.691)*

Notes: Huber-White standard errors in parentheses

+ significant at 10%; ** significant at 5%; * significant at 1%

Table 8: Two Stage Least Squares Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total immigrants			Skilled immigrants			Unskilled immigrants		
Net (total) immigration rate	1.82	1.9	1.75						
	(1.00)+	(1.02)+	(1.07)						
Change in unemployment rate		-0.171	-0.062		0.688	0.775		0.593	0.653
		(1.005)	(1.007)		(0.934)	(0.919)		(0.856)	(0.848)
Change in productivity			-0.453			-0.711			-0.505
			(0.319)			(0.314)**			(0.311)
Net skilled immigration rate				-0.49	-2	-1.94			
				(3.61)	(3.98)	(3.80)			
Net unskilled immigration rate							5.14	5.23	4.95
							(1.98)*	(1.62)*	(1.70)*
Constant	2.308	2.139	2.602	6.608	7.623	7.817	4.768	4.75	4.998
	(2.219)	(2.278)	(2.441)	(2.409)*	(2.654)*	(2.554)*	(0.723)*	(0.644)*	(0.688)*
Observations	106	106	106	106	106	106	106	106	106

Notes: Huber-White standard errors in parentheses

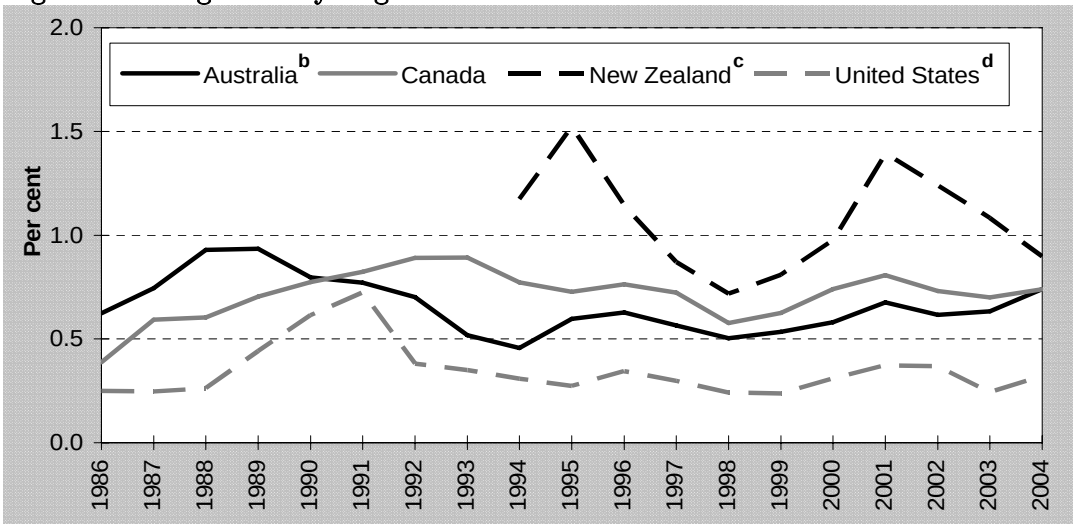
+ significant at 10%; ** significant at 5%; * significant at 1%

Table 9: Jackknife Instrumental Variable Estimates (JIVE)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total immigrants			Skilled immigrants			Unskilled immigrants		
Net (total) immigration rate	1.86	2.15	2.05						
	(1.14)	(1.32)	(1.52)						
Change in unemployment rate		-0.258	-0.168		0.787	0.916		0.594	0.654
		(1.066)	(1.102)		((0.966)	((0.969)		((0.856)	((0.848)
Change in productivity			-0.419			-0.748			-0.503
			(0.345)			((0.332)**			((0.311)
Net skilled immigration rate				-1.3	-2.97	-3.26			
				((4.13)	((4.99)	((5.20)			
Net unskilled immigration rate							5.2	5.28	5.02
							((2.03)**	((1.65)*	((1.74)*
Constant	2.218	1.583	1.947	7.145	8.267	8.711	4.749	4.736	4.976
	(2.510)	(2.937)	(3.432)	((2.752)**	((3.328)**	((3.502)**	((0.737)*	((0.651)*	((0.698)*
Observations	106	106	106	106	106	106	106	106	106
R-squared	0.1	0.09	0.11	0.02	0.02	0.03	0.05	0.05	0.07

Notes: Huber-White standard errors in parentheses
+ significant at 10%; ** significant at 5%; * significant at 1%

Figure-1: Immigration by Region of Birth

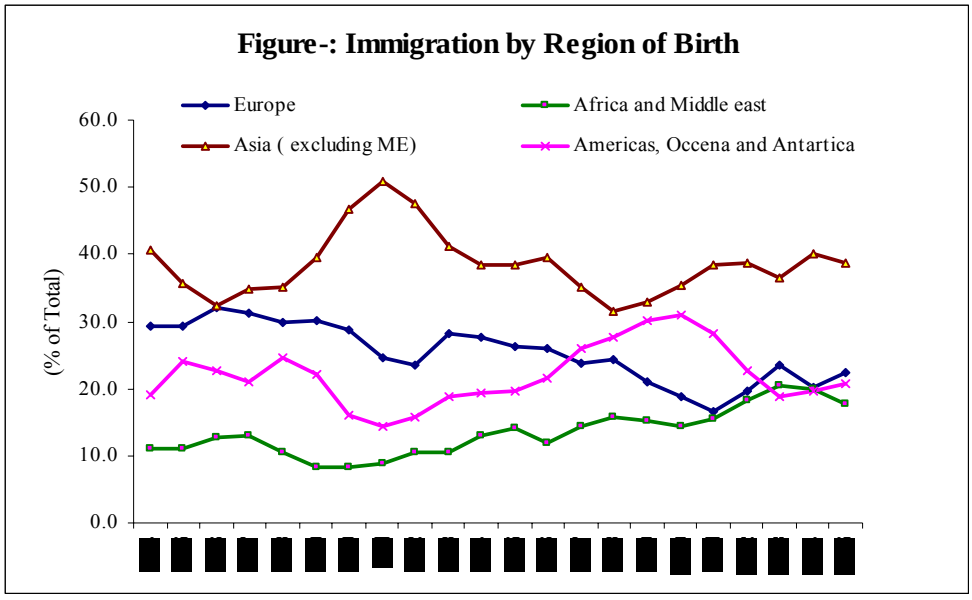


[a] Data include settler arrivals as well as permanent residency visas granted onshore. Comparability across countries is limited by data collection processes, as detailed in appendix B. [b] Data refer to financial years (July to June of the year shown). [c] Data not available before 1994. [d] Data refer to financial years (October to September of the year shown).

Sources: Productivity Commission Research Report, Australia, 2006.

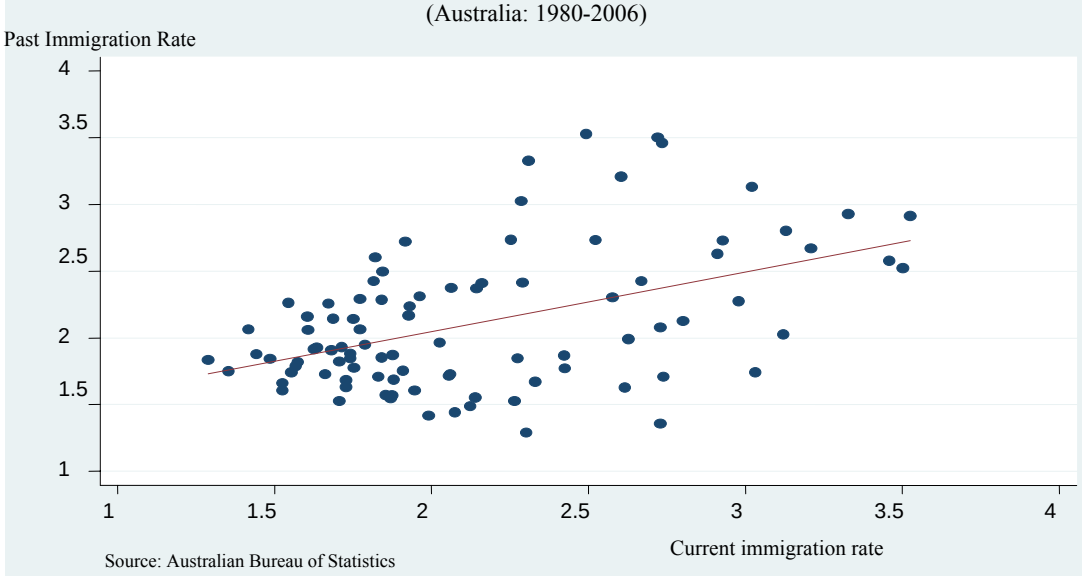
Figure-2: Flows of Permanent Immigrants to Australia

(Percentage of total population, 1986 to 2004)[a]



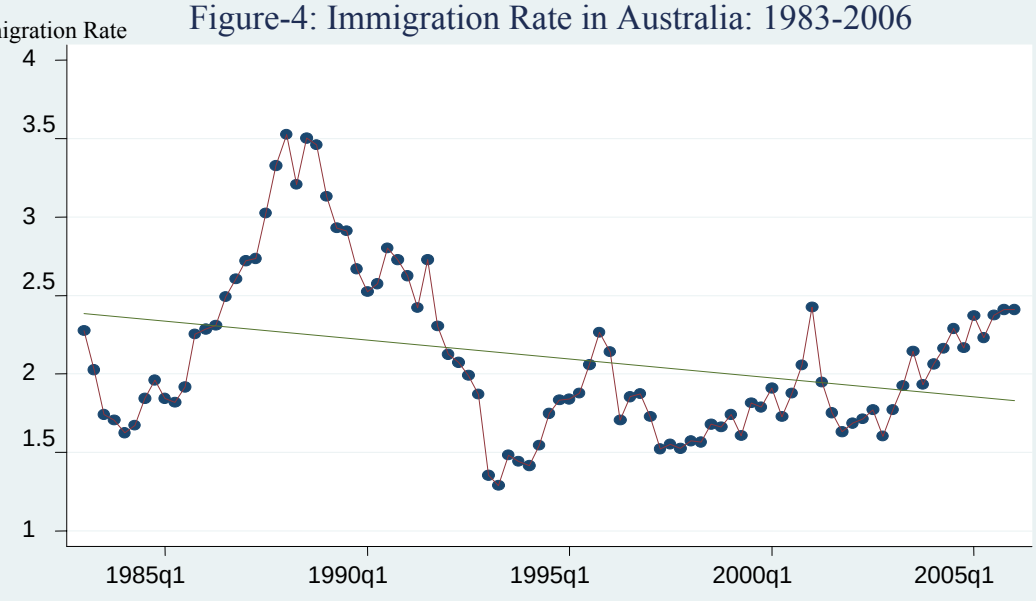
Source: Australian Bureau of Statistics

Figure-3: Relationship between Past and Current Immigration Rate
(Australia: 1980-2006)



Source: Australian Bureau of Statistics

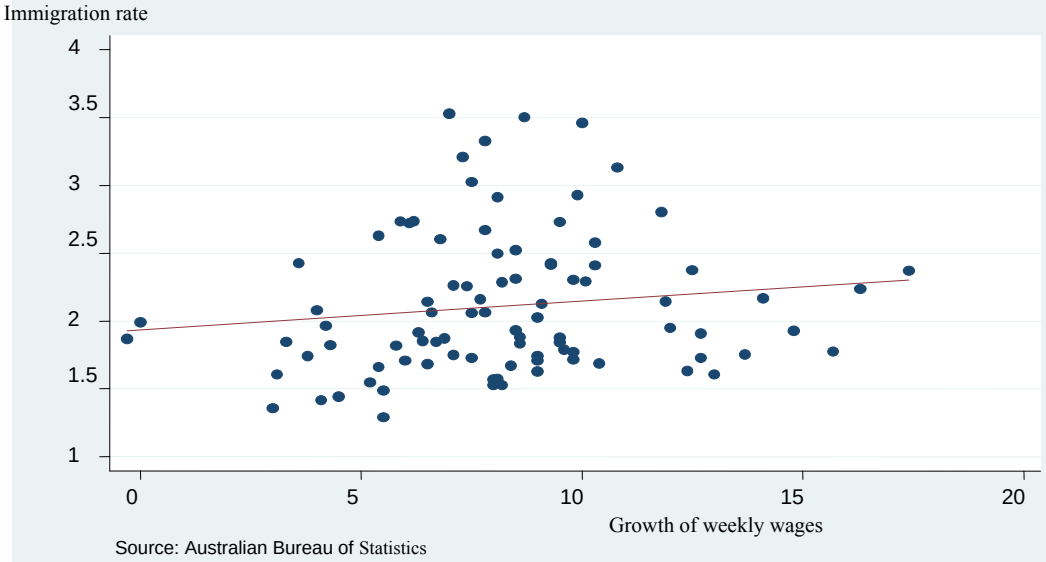
Figure-4: Immigration Rate in Australia: 1983-2006



Source: Australian Bureau of Statistics

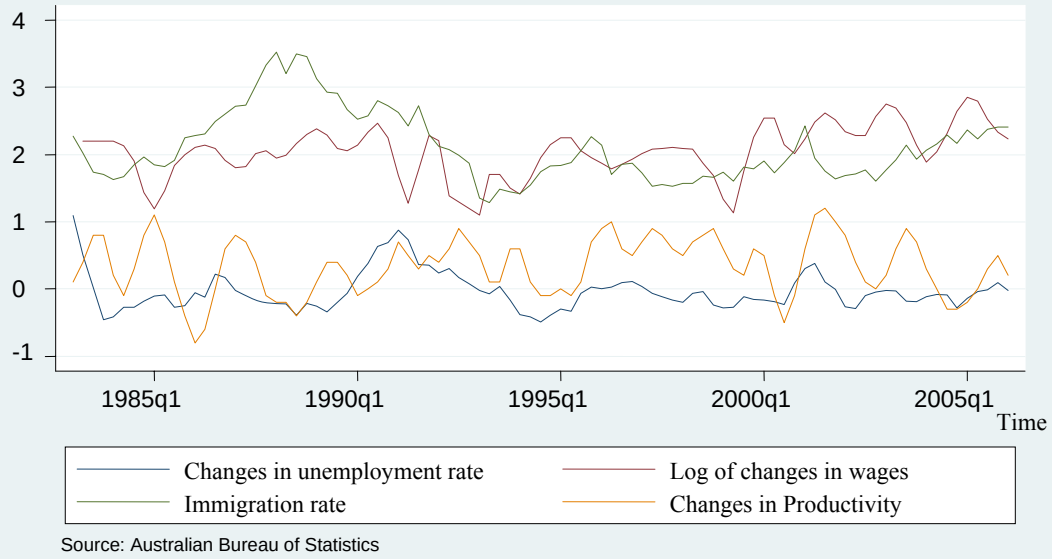
Figure-5: Relationship between Wage and Immigration Rate

Australia: 1983-2006



Source: Australian Bureau of Statistics

Figure-6: Trends of Key Variables, Australia: 1983-2006



Source: Australian Bureau of Statistics

Appendix:

Notes for Immigration Data:

Skill characteristics of the Permanent immigrants data are recorded when immigrants landed first through Australian airports (or sea ports), which have been recorded on Incoming Passenger Cards.

There are five different skill levels defined in the Australian Standard Classification of Occupations 2nd edition. They are based on the formal education, training and previous experience usually required for entry to the occupation.

Level 1
1 Manager and Administrators
2 Professionals
Most occupations in Major Groups 1 and 2 have a level of skill commensurate with a bachelor degree or higher qualification or at least 5 years relevant experience. In some instances relevant experience is required in addition
to the formal qualification.

Level 2
3 Associate Professionals
Most occupations in Major Group 3 have a level of skill commensurate with an Australian Qualifications Framework (AQF) Diploma or Advanced Diploma or at least 3 years relevant experience. In some instances relevant experience is required in addition to the formal qualification.

Level 3
4 Tradespersons and Related Workers
5 Advanced Clerical and Service Workers
Most occupations in Major Groups 4 and 5 have a level of skill commensurate with an AQF Certificate III or IV or at least 3 years relevant experience. In some instances relevant experience is required in addition to the formal qualification.

Level 4
6 Intermediate Clerical, Sales and Service Workers
7 Intermediate Production and Transport Workers
Most occupations in Major Groups 6 and 7 have a level of skill commensurate with an AQF Certificate II or at least one years relevant experience. In some instances relevant experience is required in addition to the formal qualification.

Level 5
8 Elementary Clerical, Sales and Service Workers
9 Labourers and Related Workers
Most occupations in Major Groups 8 and 9 have a level of skill commensurate with completion of compulsory secondary education or an AQF Certificate I qualification.

For the permanent arrivals data, according to ABS, Levels 1, 2 and 3are "skilled" and Levels 4 and 5 are "unskilled".