Neighborhood Effects, Preference Heterogeneity and Immigrant Educational Attainment[a]

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Abstract

This paper investigates differences between the educational attainment immigrants and native born individuals in Australia by using Australian Youth Survey (AYS) data combined with aggregate Australian Census data. We decompose differences in educational attainment into: (i) typical demographic and socio-economic sources common to all ethnic groups, (ii) unobserved region of residence and region of origin effects, and (iii) neighborhood effects such as degree and ethnic concentration of particular ethnic groups in different neighborhoods. A theoretical model incorporating these effects is proposed but structural estimation is not possible for lack of appropriate data. Instead, a reduced form methodology is proposed and employed. The empirical results identify positive ethnic neighborhood effects in high school completion and university enrollment for some immigrants to Australia, in particular first and second generation immigrants from Asia. The results indicate that it is not just the size of the ethnic network but the 'quality' of the network that is important.

JEL Classification: C10, I20, J15, R23.

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1 Introduction

Policy makers in the main immigrant recipient countries of Canada, the United States and Australia are particularly interested in the social and economic assimilation of immigrants in their new countries. There is no doubt that education plays a critical role in a young person's subsequent labor market success – in terms of wages, hours, unemployment and use of social assistance, job satisfaction and many other aspects. Low levels of educational attainment, particularly in today's competitive labor market, can seriously inhibit future employment prospects, while high education levels are likely to lead to significantly better labor market outcomes in turn leading to higher taxes paid and less reliance on government transfers. Thus an important determinant of the success of immigration policy in general is the education levels of recent immigrants. In analyzing the educational attainment of immigrants, it is important to recognize that an immigrant's social and economic assimilation, including the decision to invest in human capital, may be determined in part by characteristics of the immigrant's 'ethnic network' – people in the same geographic area who are of similar ethnic background, culture and language. The ethnic neighborhood can be a source of financial or personal support, information and guidance, and social mores.

This paper investigates differences in educational attainment of immigrants and native-born individuals in Australia, with a particular focus on the role of ethnic networks in the educational outcomes of first and second generation immigrants.[1] Specifically, we decompose ethnic group differences in educational attainment into: (i) typical demographic and socio-economic sources common to all ethnic groups, (ii) unobserved region of residence and region of origin effects, and (iii) neighborhood

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[1] Hereafter, we use the term 'immigrant' to denote both first and second generation immigrants.

effects such as degree and ethnic concentration of particular ethnic groups in different neighborhoods. This allows us to determine the effects of the formation of large ethnic communities on subsequent generations and if particular ethnic groups do have different attitudes towards or preferences for education. The data underpinning the study are drawn from the Australian Youth Survey (AYS) combined with data from the Australian Census.

The theoretical foundations of our study are primarily the work of Chiswick (1988), Borjas (1992, 1995) and Benabou (1996a, b). We construct a static, general equilibrium model where the key determinants of educational attainment include ethnic concentration, average economy wide education levels and individual family characteristics. We also include ethnicity based preference heterogeneity as a source of ethnic group differences in education expenditure and attainment. In order to directly test if preferences for education are heterogeneous, we require data on education expenditure, which our data-set does not provide. As a result, we estimate a reduced form model where we control for socio-economic factors and neighborhood effects and suggest that that region of origin variables will reflect, in part, ethnic group heterogeneity in preferences for education.

Our methodology considers both the size and the 'quality' of the ethnic group in a student's neighborhood as sources of differences in educational attainment, and is closely related to that of Borjas (1995) and Bertrand *et al* (2000). Since our focus is on educational attainment, ethnic group quality is defined to be the educational attainment of the ethnic group, measured by degree concentration within that group. Ethnic group and neighborhood fixed effects are used to control for unobserved group specific and local factors. We find evidence that demographic factors, ethnic network effects, and unobserved ethnic-group specific factors each play a significant role in an immigrant's education decisions. In particular, we find empirical support for the

contention that both the quantity and quality of ethnic networks help determine the educational outcomes of immigrants from Asia and continental Europe.

The paper proceeds with a discussion of the literature and theories of group differences in immigrant educational attainment in Section 2. A model that explains differences in educational attainment based on preference heterogeneity, neighborhood effects and socio-economic variables is proposed and solved in Section 3, where a reduced form model is also proposed due to data limitations. In Section 4, the data are described and the sample to be used in estimation is specified. The results of the estimation of marginal probabilities of high school completion and university enrolment are presented in Section 5, with the main conclusions of the paper summarized in Section 6.

2 Theory and Literature

The focus of this paper is on the educational attainment of immigrants compared to native-born individuals. Our goal is to identify differences in the educational attainment of broad ethnic groups and identify the sources of these differences. Group differences in educational attainment, earnings and rates of return to schooling by ethnicity and race are studied in Chiswick (1988), who surveys both empirical and theoretical work in order to explain these differences, in particular from native born US citizens.[2] Hypothesized explanations of these differences include group specific tastes, discrimination and productivity of schooling. It is found that some minority groups, including Chinese, Japanese, Jews and immigrant blacks, have high educational attainment and earnings while others, such as native blacks, Mexican-Americans, American Indians and Filipinos have low levels of education and earnings. Chiswick discredits the tastes and discrimination arguments using the

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[2] See also Betts and Lofstrom (2000) who examine trends in educational attainment of immigrants to the US, with a particular focus on the importance of years since migration and years since arrival to affect immigrants' educational attainment.

observed rates of return to education of the various groups.[3] The focus is on the trade off between the quantity and quality of children, which incorporates the concept of differing productivity of schooling. The idea is that the cost of attaining the same amount of human capital varies across groups of different ethnicity. As a result, some groups focus on number of children while others invest heavily in the quality of a small number of children in order to maximize returns.

This literature is further developed in Borjas (1992, 1995) who focuses on local spillovers or externalities based on ethnic origin. The idea is that higher ethnic group average earnings and stronger networks based on ethnicity will drive differences in educational attainment, earnings and intergenerational mobility. This is tested in Borjas (1992) using the General Social Surveys (GSS) and National Longitudinal Surveys of Youth (NLSY) data sets for the US. The focus is not only on the ethnic capital of immigrant groups but also on black Americans and the effects of their ethnic capital on intergenerational income mobility. Borjas finds that ethnic capital is statistically significant in explaining intergenerational mobility of different ethnic groups and that its effects are persistent over several generations.

In Borjas (1995), mechanism through which ethnic capital operates is investigated further using a combination of data similar to ours, the 1970 US Census and the NLSY.[4] One of Borjas' main findings is that much of the ethic capital effects identified in Borjas (1992) can be attributed to neighborhood effects arising from the clustering of ethnic groups. This is part of the motivation for our investigation the impact of neighborhood characteristics on the educational attainment of immigrants. The incorporation of both the size and quality of ethnic group interaction is also raised in Borjas (1995). This idea is further pursued in the study of ethnic network effects in

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[3] The AYS data-set does not contain a large enough number of individuals who are participating in the labour market, hence preventing us from considering rates of return to education. This is an important and interesting avenue for future research with the aid of a richer data-set.
[4] Borjas' data comprises a much larger sample than ours and allows for a more disaggregated analysis. The data are discussed in more detail in section 4 of the paper.

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welfare participation in Bertrand *et al* (2000), where ethnic group is identified by language spoken. It is found that ethnic group network quality plays an important role in welfare participation.[5]

Local and economy-wide spillovers are further investigated in Benabou (1996a,b), though without a particular focus on ethnicity or ethnic capital. In his work, heterogeneity of preferences is also suggested as a possible source of differences in educational attainment.[6] Our model and estimation procedures will encompass these ideas in that we consider specific neighborhood effects and ethnic group effects as sources of group differences in educational attainment.

One study that investigates similar issues for the case of Germany is Gang and Zimmermann (2000), where the educational attainment of second generation immigrants is compared to the native born population.[7] The focus is on the trade-off between market income and home production, which amounts to educating children. The results indicate differences in educational attainment between the native born German population and second generation immigrants. Second generation immigrant status reduces educational attainment in Germany though the effect is smaller than for the first generation, indicating some assimilation. These results for Germany are in contrast with the findings for the US in Chiswick (1988) and Borjas (1992, 1995), where it is found that at least some immigrant groups outperform native born individuals in terms of educational attainment. The German results also contrast with the Australian evidence in Miller and Volker (1989) and Prior and Beggs (1989) who

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[5] Ethic group quality in this case is the incidence of welfare participation interacted with ethnic group concentration within a neighborhood.

[6] Heterogeneous preferences for education are also studied in an overlapping generations model of human capital accumulation in Cardak (1999).

[7] Gang (1999) studies the educational attainment of immigrants in Germany, Hungary and the former Soviet Union, finding significant differences based on ethnicity which can be interpreted as ethnic preference heterogeneity for schooling or eduction.

both find that immigrants tend to outperform native born Australians in their educational attainment. [8]

These differences between the US, Australian and German data may be related to differences in the delivery of education in these countries. European education systems tend to stream students by ability or achievement relatively early in the students' education, usually in primary school. The typical immigrant in Germany has less human capital than a native parent and thus an immigrant's child enters school with less home produced human capital and is less likely to succeed because of the earlier streaming relative to the US or Australia. It may be related to the attitude to education of native born parents in these different countries. Potentially, US and Australian families may not place a high importance on education relative to Germans leading to the relative plights of immigrants in the different nations. Alternately, the types of immigrants in Germany may be very different, and potentially less permanent than in the US and Australia, making educational attainment in the host country less important than the accumulation of other forms of wealth and capital.

Given the interest in the immigrant experience both in the US and Germany, and the range of possible explanations for group differences in educational attainment among ethnic and racial groups, our focus is to identify differences in the educational attainment of first and second generation immigrants in Australia. We control for non-ethnicity based factors and try to identify the effects of ethnicity and spillover effects such as neighborhood education levels and ethnic concentration on educational attainment.

3 Model

The model incorporates neighborhood effects, ethnicity based neighborhood effects along with preference heterogeneity as sources of variation in educational

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[8] Post-migration human capital investments by adult immigrants to Australia are studied in Chiswick

attainment. The model comprises a continuum of single parent households in each of a finite number of neighborhoods. All households have one child and the population of each neighborhood is normalized to unity.[9] Households are heterogeneous and identified by an index $\iota \in [0,1]$, while each agent ι can be placed in a category or class $\varphi \in \{1,2,..,\vartheta\} \equiv \mathbf{J}$, where for our purposes, the different values of φ denote ethnicity. A further index, $\kappa \in \{1,2,..,K\} \equiv \mathbf{K}$, identifies the neighborhood in which any particular individual resides. These agents have individual specific endowment income, $\psi^{\iota\varphi\kappa}$, which they allocate between private consumption, $\chi^{\iota\varphi\kappa}$, and the education of their child, $\varepsilon^{\iota\varphi\kappa}$. The preferences of household ι of ethnicity φ living in neighborhood κ are given by:

$$U^i = u\left(c^{ijk}\right) + v^j\left(h^{ijk}\right) \tag{1}$$

Preferences are assumed to be separable over consumption and child's human capital, $\eta^{\iota\varphi\kappa}$, in order to isolate the effects of heterogeneous preferences for education. The standard concavity assumptions are maintained, $\upsilon_\chi, v_h^j > 0$ and $\upsilon_{\chi\chi}, v_{hh}^j < 0$, $\forall \varphi$. The φ superscript on the utility from educational attainment reflects the assumption of preference heterogeneity for education, based on ethnicity. The implication is that otherwise identical agents of differing ethnicity will derive different marginal utility from the same amount of educational attainment by their child; that is $v_h^a(\eta) \neq v_h^b(\eta)$ where $\alpha \neq \beta$ and $\alpha, \beta \in \mathbf{J}$.[10]

The individual budget constraint of a household is given by:

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and Miller (1994), who find differences in post migration investment in education based on ethnicity.

[9] In our theoretical discussion, we focus on a model of constant fertility, thereby ignoring the trade-off between the quality and quantity of children, though we do include number of siblings as an explanatory variable in the reduced form estimation below.

[10] This assumption suggests that immigrant parents place a different value on education than native born parents and that they may like to borrow to improve educational attainment. We maintain the assumption of imperfect credit markets for human capital investment and that this form of ethnicity based heterogeneity in the valuation of eductaional attainment manifests in different degrees of encouragement and motivation to acheive and in other non-market forms. Credit market imperfections are not of critical importance in respect of university education but can operate through their effects on high school attainment, which is the main determinant of university entry.

$$y^{ijk} = c^{ijk} + e^{ijk} \qquad (2)$$

and implies that no credit markets exist and that the transformation technology between consumption and education is one for one.

The educational attainment of the household's child is given by:

$$h^{ijk} = f\left(e^{ijk}; \mathbf{x}^i, \mathbf{x}^k, \mathbf{x}^{jk}\right) \qquad (3)$$

and depends on education expenditure by the parent, $\varepsilon^{\iota \varphi \kappa}$, along with a range of household specific characteristics, represented by the vector $\mathbf{x}^\iota$. It is assumed that education expenditure contributes positively to educational attainment, $\phi_\varepsilon > 0$. It is assumed that the human capital production function does not contain ethnic biases. This means that two students with identical inputs but of differing ethnicity with attain the same human capital. However, ethnic differences will manifest themselves in the inputs to the human capital production function, and lead to ethnicity driven variation in human capital attainment.

The family's neighborhood characteristics, such as the average level of human capital and income in the neighbourhood, are represented by the vector $\mathbf{x}^\kappa$. These factors are modeled theoretically in Benabou (1996a, b) and studied empirically in Borjas (1995). The characteristics of the family's ethnic group within their neighborhood, such as the proportion of own ethnicity, the average level of human capital and the level of within ethnicity interaction, all within the neighbourhood, are factors represented by the vector $\mathbf{x}^{\varphi \kappa}$, considered in Bertrand et al (2000), while Borjas (1992) considers similar factors but at the aggregate rather than the local or neighbourhood level.

The direction of the effects of factors such as $\mathbf{x}^\kappa$ and $\mathbf{x}^{\varphi \kappa}$ are one of the purposes of our study and can be expected to have various signs. We expect neighbourhood quality, as measured by $\mathbf{x}^\kappa$, to have a positive effect on educational attainment, while the effects of ethnic concentration and within ethnic group interaction can have either

a positive or negative effect on educational attainment, consistent with a positive role model effect or a *ghetto* effect which discourages educational attainment. We attempt to further decompose $\mathbf{x}^{\varphi\kappa}$ into measures of the quality and quantity of within ethnicity interaction within a neighbourhood, as in Bertrand et al (2000), this is discussed further below.

3.1 Equilibrium

Each household's economic problem is to maximise (1) subject to the constraints given by (2) and (3) by choosing optimal levels of consumption, $\chi^{\iota\varphi\kappa}$, and educaction expenditure, $\varepsilon^{\iota\varphi\kappa}$. The equilibrium of the structural model is determined once the parent's consumption and education expenditures for its child are identified. The first order condition is given by:

$$u_c = v_h^j f_e \qquad (4)$$

which implies two sources of ethnicity based heterogeneity in educational attainment. First is the allocation of income between consumption and education, determined by equation (4), which depends on the family's preference for human capital, in turn determined by ethnicity. This means that otherwise identical families will choose different education expenditures if they are of different ethnicity.

The second source of ethnicity-based heterogeneity is in terms of the effects of neighborhood ethnic group characteristics on the production of human capital, given by $\mathbf{x}^{\varphi\kappa}$ in equation (3). In terms of the first order condition in (4), both ϕ_ε and consequently educational attainment, $\eta^{\iota\varphi\kappa}$, are affected by within neighborhood, ethnic group characteristics. Further sources of heterogeneity in educational attainment include family characteristics, $\mathbf{x}^{\iota}$, and average neighborhood characteristics, given by $\mathbf{x}^{\kappa}$, as described by equation (3).

3.2 Reduced Form Model

Our objective is to identify the sources of differences in the educational attainment of immigrants relative to native born individuals. This in turn, according to our model, can be attributed to individual household socioeconomic characteristics, within- neighbourhood ethnic group characteristics, average neighborhood characteristics, and ethnic preference heterogeneity. We argue that variation in secondary and tertiary education in Australia is driven by parent's demand and that supply is passive, in the sense that all parents have access to all schools.[11] If a parent cannot afford to move to a wealthier neighborhood with a better public school or if they cannot afford private school fees or university fees and expenses, we consider the problem one of credit market imperfections or wealth/income effects, rather than a problem of supply restrictions or imperfections. In the empirical analysis, these effects will appear in the coefficients on the variables that we use to proxy for income.

While we have data on ethnicity, neighborhood and household socioeconomic characteristics, information on education expenditure is not available and as a result, structural estimation is not possible.[12] Instead, we use reduced form models to identify the importance of the various factors identified in the model discussed above. A useful framework for modeling ethnic network and neighborhood effects in a reduced form context is provided by Bertrand *et al* (2000), in their analysis of ethnic network effects on welfare use in the United States. They distinguish between the 'quantity' of ethnic networks – measured by the proportion of the local population that belong to a particular ethnic group – and the 'quality' of ethnic networks – measured by the welfare knowledge and attitudes of others from the same ethnic

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[11] Immigrants who are permanent residents of Australia incur the same costs as citizens when accessing the public education system, while temporary residents must pay substantial fees. Residency status is not reported in the data, although given that our sample is composed of second generation immigrants and first generation immigrants who migrated as children, we expect the vast majority of immigrants to be permanent residents or Australian citizens.
[12] More details on the data and estimating sample are provided below.

group in the same local area.[13] The important measure of the role of ethnic networks on welfare use in their analysis is the interaction of the quantity and quality variables. This interaction term reflects the number of people an individual interacts with in combination with the attitudes and knowledge of these people toward welfare. The authors also emphasize the importance of including ethnic group and neighborhood fixed effects to control for unobserved or omitted variables.

Given that we are interested in educational attainment, we measure ethnic network 'quality' as the proportion of the ethnic group within a particular local area that has a university degree. Thus our reduced form estimating equations include the following terms to control for the possible impact of ethnic networks on educational attainment: density of the ethnic group in the local area population (EN), and the proportion of the local ethnic group with a degree multiplied by the density of the local ethnic group (ENED).[14] Both of these variables enter the reduced form through $\mathbf{x}^{jk}$. A set of regional or neighborhood dummy variables, D_k, are included to control for broad based neighborhood effects such as systematic school quality variation by neighborhood and average education levels within neighborhoods.[15] A set of ethnic group dummy variables is also included, D_j. Controlling for both ethnic and neighborhood fixed effects goes some way to addressing the issue of omitted variables that underlies the 'reflection problem' analyzed in Manski (1993). From the earlier discussion, these ethnic group dummy variables are assumed to reflect differences across ethnic groups in preferences for education.   However, we emphasize that the reduced form nature of the econometric analysis implies that

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[13] Bertrand et al (2000) use language rather than ancestry as their measure of 'ethnicity'. Although language is available in the AYS dataset and the Australian Census, it is characterized in the former by a relatively large number of missing values. For this reason, we use country of birth as our measure of ethnicity. One sensitivity test we conduct is to use language fluency in the Australian census (rather than country of birth) to construct our measures of ethnic networks that are then assigned to individuals in the AYS on the basis of their country of origin.

[14] The ethnic network variables EN and ENED are set to zero for the native born population.

[15] These controls will reflect, among other things, the proportion of the local native born population that have university degrees.

unobserved ethnic group specific factors other than preferences may also be captured by the ethnic dummy variables. Thus we use caution in interpreting the implications of the empirical results on preference heterogeneity and discuss alternative interpretations in the results section below.

We estimate a probit model for two levels of educational attainment, high school completion and enrolment in university, with the reduced forms given by:

$$P\left[h^{ijk} = \text{educationa l attainment }\right] = \mathbf{x}^i \boldsymbol{a} + \sum_j \mathbf{x}^{jk} \boldsymbol{g}_j + \sum_k D_k \boldsymbol{b}_k + \sum_j D_j \boldsymbol{d}_j + \boldsymbol{e}^{ijk} \qquad (5)$$

The $\mathbf{x}^i$ captures individual specific socioeconomic factors including educational attainment of each parent, father's occupation, number of siblings, and state and size of residence at age 14. According to the model outlined above and previous studies, we are uncertain as to the sign of $\boldsymbol{g}_j$. As $\mathbf{x}^{jk}$ contains both ethnic density (EN) and quality adjusted ethnic density (ENED), we expect that higher ENED will have a positive effect on educational attainment and that the coefficient will be positive, however the coefficient on EN need not be positive and may be capturing effects other than education that may be passed via the ethnic network, possibly business links or other cultural factors, the educational effects of which we have no definitive *a-priori* prediction. In the next section, we outline the data sources and variable specification that will be used to examine the determinants of educational attainment along these dimensions.

4 Data and Specification of the Estimating Sample

The Australian Youth Survey is a longitudinal dataset that traces a group of 5280 men and women aged 16-18 years old in 1989 over seven years to 1996. For each year from 1990 to 1994, an additional group of around 1200 young people aged 16-17 years were added to the panel. Sample attrition in the AYS is non-trivial and has been

analyzed in Miller (1995) and Heath (1999). Heath uses the AYS data to examine neighborhood effects and educational attainment but without a focus on immigrants. A particular advantage of the AYS dataset is the relatively detailed information on characteristics of the respondent at age 14, including region of usual residence, family structure, presence of brothers and sisters, and characteristics of the parent(s). In particular, unlike the Australian Census that only records country of origin of mother and father, the AYS contains information on both parents' country of origin, parents' educational attainment, and parents' main occupations when the respondent was 14. Although no measure of family income is available, family permanent income should be a function of these parental characteristics. In addition, since we are looking at educational attainment, we do not make use of the panel nature of the dataset.

Given that our main focus is on the educational attainment of young people, ideally we would examine the educational outcomes at a point in time when investment in secondary and any tertiary education is likely to have been completed. However, given the structure of the survey, sample sizes of immigrants aged in their mid 20s are too small to be useful.[16] The problem is further compounded by sample attrition that increases with years in the survey, since older people have been in the AYS longer. Our selection of the appropriate age of individuals to study is therefore guided by the trade-off between declining sample size and increasing opportunity to gain education as sample age increases. With this in mind we choose to study the probability of completing high school and the probability of being *enrolled* in university using the AYS sample at age 21.[17] Thus for the second stage of the analysis we model the probability that an individual has either completed a degree or is currently enrolled in a tertiary institution and working towards a degree.

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[16] In order to be age 25 and in the AYS data, the individual must have been 18 years old in the first wave of the AYS in 1989. People joining the panel in 1990 would only be 24 in the last year of the AYS. As well, since all individuals enter the sample at age 16-18, the older the individuals are when sampled, the more likely that cohort of individuals is to suffer sample attrition.

Participation rates as defined above will obviously overstate tertiary completion rates owing to the proportion of students who do not complete their studies. (Betts and Lofstrom, 2000, model participation rates rather than completion rates in both secondary and post-secondary education.)[18]

We define immigrants to be both first generation immigrants (people born overseas) and second generation immigrants (people born in Australia to parents born overseas). To ensure that all immigrants have at least some Australian school experience prior to making their education decisions, we omit from the sample foreign-born individuals who arrived in Australia after the age of 14. Thus we are considering only Australian secondary school and tertiary qualifications. To allow for the possibility that immigrants arriving as teenagers may face greater difficulties in social assimilation compared to second generation immigrants born in Australia, we include two dummy variables. The first takes the value 1 if the immigrant was born overseas and migrated as a child aged 9 or less, and the second takes the value 1 if the immigrant migrated as a child aged 10 to 14. (The default group is the set of second generation immigrants.)

We define an immigrant's ethnic group according to his or her father's country/region of origin so that for example an Australian born person whose father was born in Italy will be classified as Italian for the purpose of computing neighborhood ethnic densities. We omit people born overseas to Australian parents, as well as people born in Australia with a father born overseas and a mother born in Australia. Also since the links between parental characteristics and educational attainment are one of our main issues of interest, we include in the sample only those individuals who reported living with both parents at age 14. Weights are included in

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[17] The proportion of the sample of 21 year olds recorded as currently in secondary school is virtually zero.

[18] Future work could examine tertiary completion and non-completion rates of native born individuals although sample sizes in the AYS are insufficient to allow such an analysis to be extended to immigrants.

the AYS and are used in estimation to allow our sample to be representative of the Australian population.

In order to investigate the importance of neighborhood effects, we first compute demographic information on educational and ethnic concentrations for 41 Australian census areas and 17 regions of origin as defined in the 1996 Australian Census public use file.[19] [20] Specifically for each census area we compute two measures: (i) the proportion of adults in the census area that belong to each of the 17 ethnic groupings; and (ii) the proportion of adults of each ethnic group in each census area that have a university degree. In the AYS data, both detailed country of origin information and postal code of residence are included. For the latter, we assign to each individual the first recorded postal code of residence in the panel, namely that which applied when the individual was 16-17 years old. Then we classify each postal code and each country of origin according to the 41 Census areas and 17 birth regions identified in the Census.

4.1 Descriptive Statistics

Table 1 presents sample means of the dependent and explanatory variables of 21 year old individuals classified, for illustration purposes, by four broad groups according to father's region of birth: Australia, Asia, Europe and English-speaking background regions (South Africa, Oceania, NZ, UK and Ireland, Americas). Higher rates of educational attainment are apparent for all immigrants, in particular those

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[19] Given that decisions about completing high school and going to university are likely made prior to the period of observation, data from the 1991 Census may have been more appropriate to use. However, the public use files of 1991 Census do not have locational indicators, precluding use of these data in the current paper. While it is possible that there have been demographic changes across these census areas in the five years between censuses, it is likely that our measures of ethnic and educational concentrations will be highly correlated between 1991 and 1996.

[20] The Australian Census defines 21 distinct regions of origin, but due to sample size limitations we combine Scotland, Ireland and England into a single region, we include Germany in Western Europe, and we include the Philippines in Other South-East Asia. The regions are defined in the footnote to Table 1.

immigrants from Asia.[21] As well, there are significant differences in the distribution of parental characteristics across individuals by region of origin. For example, European immigrants are more likely to have fathers who work in blue collar occupations - trades, plant and machine operators, and laborers - and are more likely to have parents who did not finish high school. Immigrants from Asia are more likely to have fathers with degrees and fathers with no formal educational qualifications. One notable difference is the relatively high proportion of immigrants from Asia who do not report an occupation for their fathers. In the econometric analysis we include a separate dummy variable for this category.[22]

In the analysis that follows, we restrict our attention to immigrants from non-English speaking (NESB) countries, and omit immigrants from English speaking background regions from the sample. It seems quite likely that the importance of ethnic networks to educational attainment is less likely to be a factor for people from these areas. Social and economic assimilation is less problematic given the broad similarities between destination and origin countries, in particular language spoken. Further, people from the United Kingdom make up about 70% of the ESB sample and a large proportion of the native born Australian population have ancestors originating from the UK. Thus, the potential role of ethnic networks distinct from the native population to affect education decisions is less obvious.[23] For these reasons, we omit ESB immigrants from the sample.

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[21] Although sample sizes in the AYS are not large, average rates of educational attainment are broadly comparable to those available from the Australian 1996 Census.

[22] These are more likely to be omitted responses rather than early retirees from the labour force as there is a separate category included in the survey defined as "no occupation" that is a very small proportion of the sample. Along with the inclusion of a separate dummy variable for this category, we also experiment with alternatives such as deleting them from the sample and classifying them as laborers. The main results are robust to these alternatives.

[23] This is less true for immigrants from South Africa and the Pacific Islands part of Oceania; however small sample sizes preclude us from considering these immigrants separately.

5 Results

5.1 High School Completion

Given the high proportion of immigrants (particularly immigrants of Asian origin) completing high school, combined with relatively small sample sizes for some ethnic groups, we combine data for men and women and estimate pooled regression results after including a dummy variable for gender. As a preliminary benchmark, we first estimate a Probit model on the probability of high school completion that includes as its only immigrant controls dummy variables for whether the person is an immigrant from Asia or an immigrant from Europe. The regressions also include a set of region-specific dummy variables. Immigrants from Asia are found to be 19% more likely to complete high school than comparable native-born persons, while immigrants from Europe are found to be 10% more likely to complete high school. In both cases, these marginal effects are significantly different from zero at the 5% level.[24] Thus in keeping with much of the existing literature, we find that first and second generation immigrants to Australia are relatively more likely to complete high school than their native born counterparts; see for example Miller and Volker (1989).

The econometric results for the main specifications with network controls are divided into two categories: (i) the economic and demographic variables typically used in educational attainment predictions, such as parents' occupation, education and number of siblings; and (ii) the ethnic neighborhood effects variables, related to region of origin. Standard errors are robust to heterogeneity that may arise from the grouped structure of the neighborhood variables (see Moulton, 1986). Results for the first set of variables generally accord with expectations and are reported in Appendix

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[24] Full results of these benchmark regressions are available from the authors on request.

2.[25] When the father was employed in a blue-collar occupation (tradesperson, plant and machine operator, laborer), the individual is significantly less likely to finish high school than if his or her father was in the default occupation of salesperson. Parents' educational attainment is also important: individuals are more likely to finish high school if either parent has a university degree. Finally, larger numbers of brothers and sisters in the family reduce the probability of finishing high school.[26]

The results relating to the role of ethnic networks are reported in Table 2. For brevity, ethnic dummy variables and region dummy variables are not reported. In the first column of Table 2 we report results for the base specification that assumes common effects of ethnic networks on immigrants from all regions. Higher concentrations of immigrants of particular ethnic groups are associated with significantly greater probability that a given immigrant completes high school. However, while the measure of ethnic network 'quality' is positive, it is not significant at conventional levels.

In columns 2 and 3, we allow separate ethnic network effects for immigrants from Asia and immigrants from Europe. Overall, these ethnic network variables are jointly significantly different from zero (p-value 0.0005), and the network variables for Asian immigrants are also jointly significantly different from zero (p-value 0.035). The results are broadly consistent with the ethnic social capital arguments in the literature: the larger and better the quality of an Asian or European community in a region, the stronger are the positive external effects that raise the probability of high school completion. Asian immigrants are found to be more likely to complete high school when the interaction of degree concentration of the ethnic group and the concentration of the ethnic group in the local area is larger. Thus, in the terminology

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[25] Other regressors included in the estimation but not reported in Table 2 or the Appendix are state and size of residence (capital city, other city, town, rural) when the respondent was 14, and a set of year dummy variables for the relevant survey year of each person. Although mother's occupation when the individual was aged 14 is available, a large number of missing values precluded its use in estimation.

of Bertrand et al (2000), higher ethnic network quality increases the high school completion rate of Asian immigrants. In contrast, high school completion rates of European immigrants depend positively on the ethnic concentrations of particular European groups, but not on the proportion of those groups that have a university degree.

It is also notable that even after controlling for observable socio-economic characteristics, neighborhood effects, and ethnic networks, the set of ethnic group dummy variables are jointly significant (p-value 0.001). In addition, though not reported, individual coefficient estimates are either positive and individually significant or poorly determined, but not negative and significant. This indicates that unobserved effects specific to particular ethnic groups are important determinants of the probability that a person finishes high school. One source of unobserved heterogeneity, consistent with our theoretical model, is a stronger preference for education for some ethnic groups.

5.2 University Enrollments

In this section, we use the same empirical framework to estimate the determinants of university participation for first and second generation immigrant men and women. Sufficient sample sizes of university participants and non-participants allow us to estimate the model separately for men and women. Again as a preliminary benchmark, we estimate a specification with only broad region of origin immigrant controls. As with the results for high school completion, immigrant men and women from Asia are 17% and 24% more likely to be enrolled in university than comparable native born men and women. For immigrants from Europe, women are 14% more likely to be enrolled in university, but university participation for European men is not significantly different from their native born counterparts.

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[26] The marginal effects reported in Table 3 are computed for a hypothetical person with characteristics

For the specifications with network controls, we again divide the main results into two sections. Coefficient estimates not related to ethnic networks are included in Appendix 2 and generally accord with expectations. Young women are more likely to be at university when their fathers were in white-collar and professional occupations, and when their father or mother has tertiary qualifications. Young men are less likely to be at university when their fathers were in blue-collar occupations, and more likely to be at university when their father or mother has tertiary qualifications.

We report three sets of results related to ethnic networks in Table 3. As can be seen from columns 1 and 4 of Table 3, there are no significant network effects when a common relationship is assumed between ethnic networks and university enrollment across immigrants from all areas. However, when the network effects are interacted with dummy variables for broad region of origin, a different pattern emerges. For women, the results are similar to those reported in Table 2 - it is the interaction of ethnic density within the local area combined with the degree density within the ethnic group that affects the likelihood that a female immigrant from Asia is at university. In addition, there are no significant network effects for female immigrants from Europe. Finally, the set of ethnic dummy variables are again jointly significant, and individual ethnic group dummy variables are either positive and significant or poorly determined.

For men, the econometric results are weaker. Based on the preferred specification, immigrants from Asia are more likely to be enrolled at University when there is a higher concentration of people from their ethnic group in their local area, but the measure of network quality is not significant. Interestingly, the probability that a European immigrant is in university is lower when there is a higher concentration of people from his ethnic group in the local area. However, both results are significant only at the 10% level. As with the results for high school completion,

equal to the average values of the other variables.

there are significant differences across ethnic groups in the probability of enrollment in university, even after controlling for socio-economic characteristics and neighborhood effects. As before, these variables are either positive and significant or poorly determined, and so may indicate greater preferences for university education on the part of some ethnic groups, ceteris paribus.

A useful extension for the analysis of male educational attainment arises from the fact that those individuals who are not enrolled in university consist of two distinct groups – people not possessing or engaged in any post-secondary education, and people possessing or enrolled in some sort of post-secondary non-degree program (such as a graduate diploma or trade certificate). We can extend the analysis to consider three educational choices via Multinomial Logit estimation.[27] Results relating to the ethnic network variables are reported in Table 4. Columns 1-3 present results corresponding to the determinants of educational choices of participation in university relative to the base category (high school education or less). Columns 4-6 present results corresponding to the determinants of participation in other post-secondary education, relative to the base category. In columns 1 and 4 that relate to the base specification, we find evidence that the 'quality' of the local ethnic networks is a significant determinant of an immigrant male's post secondary educational status. Increases in local ethnic density times concentration of degree holders in the ethnic group are associated with a greater probability of participation in both university and other post-secondary education. This effect is obscured in the probit regressions since people with post secondary education and high school or less are pooled.

When we allow for separate effects by broad region of origin (columns 2 and 5) we find these results are particularly pronounced for men of European origin. For immigrant men from Asia, the signs of the coefficient estimates are positive but the estimates are poorly determined and not jointly significantly different from zero.

Given the small sample size for Asian immigrants who have high school education or less, these results should be viewed with caution.

6 Discussion and Conclusions

Given the fundamental role that education plays in a person's future labor market experiences, understanding the determinants of an individual's educational choices and decisions has a wide range of policy implications. This is particularly relevant for immigrants since measures of the labor market success of immigrants are often part of a more general evaluation of the success of a country's immigration policies. The educational attainment of immigrants is difficult to reconcile with their circumstances and can often contradict intuition. A better understanding can also guide education policy, not only for minority groups but potentially for the whole population.

In this paper we identify three main sets of factors that can affect the educational attainment of immigrants; (i)Socio-economic environment, (ii) Neighborhood effects, and (iii) Country or ethnicity-specific but unobserved effects, including preferences for education. A static general equilibrium framework incorporating these three factors is proposed, and a reduced form model is estimated. We find evidence that each set of factors plays a significant role in a person's decisions about education. First, we find that the father's occupation and both parents' education levels are important determinants of the educational attainment of their children, as is the number of siblings present in the household.

Second, we find that the concentration of immigrants with university degrees interacted with the concentration of people of a person's ethnic group also affect the education decision of some immigrants in a way that is broadly consistent with other related research. It appears that the 'quality' of the ethnic network – in terms of degree concentration - positively affects the likelihood that an immigrant from Asia

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[27] A similar extension for women revealed no new insights compared to what is reported in earlier

completes high school and enrolls in university. One upshot of this result is that there are some positive spillovers that arise from higher concentrations of immigrants in a particular area, but the magnitude of these spillovers is very much dependent on the concentration of degree holders in that ethnic group and region.

Third, we find that after controlling for these observable determinants of educational choice, there remain significant differences in the determinants of educational attainment by immigrant group that are driven by important but unobserved factors. Immigrants from some non-English speaking regions remain significantly more likely to complete high school and enroll in university compared with second generation Australians. One interpretation is that the families of first and second generation immigrants from some non-English speaking countries display significantly different preferences for secondary and tertiary education compared to native born Australians.

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Table 1: Sample Means by Father's region of origin

Variable	Asia	Europe	English Speaking Background	Australia
Own Education				
Finished High School	0.904	0.772	0.752	0.706
Enrolled in University	0.522	0.305	0.315	0.294
Father's Occupation				
Manager	0.158	0.152	0.183	0.247
Professional	0.163	0.053	0.204	0.158
Para-Professional	0.024	0.028	0.086	0.079
Sales/Retail	0.029	0.020	0.065	0.058
Tradesman	0.158	0.317	0.190	0.166
Clerk	0.053	0.016	0.032	0.054
Plant/Machine Op	0.091	0.125	0.099	0.107
Laborer	0.134	0.190	0.090	0.086
No Occupation	0.191	0.099	0.051	0.046
Parents' Education				
Father – degree	0.263	0.091	0.241	0.178
Father – other Post.Sec	0.129	0.208	0.335	0.317
Father – high school	0.330	0.309	0.363	0.423
Father – less than H.S.	0.124	0.313	0.028	0.051
Father – no school	0.153	0.079	0.033	0.031
Mother – degree	0.124	0.065	0.162	0.123
Mother – other Post.Sec	0.435	0.434	0.600	0.603
Mother – high school	0.120	0.107	0.180	0.218
Mother – less than H.S.	0.167	0.321	0.030	0.034
Mother – no school	0.153	0.073	0.028	0.023
# Siblings	2.852	1.861	1.960	2.293
Home Town at age 14				
Capital City	0.660	0.685	0.567	0.424
Other City	0.100	0.162	0.132	0.169
Town	0.057	0.085	0.174	0.283
Rural	0.029	0.036	0.060	0.119
Neighborhood Characteristics				
Proportion of population in local area belonging to same ethnic group[1]	0.036	0.044	0.111	N/a
Proportion of same ethnic group in local area with A university degree	0.180	0.113	0.125	N/a
Sample Size	209	495	568	3016
Sample Proportion	0.049	0.115	0.132	0.703

1. Regions of birth identified in the Australian Census are: Vietnam, China, North Africa and Middle East, Southern Asia, other South East Asia, other North East Asia (Asia); Western Europe, Italy, Greece, Other Southern Europe, Eastern Europe (Europe); Americas, UK and Ireland, South Africa, New Zealand, Oceania (English Speaking Background); and Australia.

Table 2: Probability of High School Completion – Neighbourhood Effects for Men and Women Pooled (Probit Marginal Effects)[1]

Specification	Base	Full [2]	Preferred
Ethnic neighborhood density (EN)	1.935**		
	(0.73)		
Ethnic neighborhood density * ethnic degree density (ENED)	4.017		
	(9.02)		
EN – Asian immigrants		0.0782	
		(1.42)	
EN – European immigrants		2.587**	2.435**
		(0.86)	(0.74)
ENED – Asian immigrants		30.502	31.256**
		(23.40)	(14.61)
ENED – European immigrants		-2.000	
		(9.50)	
F-test of neighborhood effects (p-value)	0.0007	0.0005	0.0007
F-test of restricted specification (p-value)		0.9772	
F-test of ethnic group dummy variables (p-value)	0.0007	0.0011	0.0010

1. Robust standard errors in parentheses. The notation ** denotes significance at the 5% level and the notation * denotes significance at the 10% level.

2. The variables EN and ENED for Asian immigrants are jointly significantly different from zero with a p-value of 0.035.

Table 3: Probability of University Enrolment – Neighbourhood Effects (Probit Marginal Effects)[1]

Specification	WOMEN			MEN		
	Base	Full	Preferred	Base	Full	Preferred
Ethnic neighborhood density (EN)	1.327 (1.77)			-0.590 (1.29)		
Ethnic neighborhood density * ethnic degree density (ENED)	10.630 (11.54)			-2.433 (10.15)		
EN – Asian immigrants		-2.336 (1.61)	-2.329 (1.55)		4.191** (1.66)	2.501* (1.37)
EN – European immigrants		-1.431 (2.22)			-2.811 (1.95)	-2.335* (1.28)
ENED – Asian immigrants		59.342** (19.68)	59.542** (19.63)		-17.715 (13.13)	
ENED – European immigrants		.1063 (14.26)			5.010 (15.74)	
F-test of neighborhood effects (p-value)	0.6534	0.0408	0.0086	0.6926	0.0436	0.0617
F-test of restricted specification (p-value)		0.6258			0.4008	
F-test of ethnic group dummy variables (p-value)	0.0053	0.0577	0.0754	0.0008	0.0000	0.0000

1. Robust standard errors in parentheses. The notation ** denotes significance at the 5% level and the notation * denotes significance at the 10% level.

Table 4: Multinomial Logit Estimation of Educational Attainment: Neighbourhood Effects for Immigrant Men. (Multinomial coefficient estimates)[1]

Education alternative	University degree			Other post-secondary		
Specification	Base	Full	Preferred	Base	Full	Preferred
Ethnic neighborhood density (EN)	-13.788			-9.310		
	(8.69)			(8.81)		
Ethnic neighborhood density * ethnic degree density (ENED)	129.694*			194.193**		
	(67.24)			(79.16)		
EN – Asian immigrants		-1.453			-18.214	
		(12.52)			(14.67)	
EN – European immigrants		-20.971**	-20.908**		-4.961	-4.562
		(9.68)	(9.68)		(10.91)	(11.05)
ENED – Asian immigrants		108.234			192.507	
		(203.31)			(244.16)	
ENED – European immigrants		146.523*	141.651*		184.714**	175.713*
		(73.25)	(73.24)		(85.22)	(88.13)
F-test of neighborhood effects (p-value)[2]	0.1481	0.1937	0.0578	0.0230	0.0501	0.0549
F-test of restricted specification (p-value)[2]		0.8661			0.4283	
F-test of ethnic dummy variables (p-value)[2]	0.7425	0.6820	0.6859	0.0407	0.0772	0.1443

1. Robust standard errors in parentheses. The notation ** denotes significance at the 5% level and the notation * denotes significance at the 10% level.

2. Relative to the determinants of the default choice (no university or other post secondary education)

Appendix 1 – Main Sample Restrictions

Raw Sample of People aged 21 in the AYS data = 5428

Family Structure	Proportion of Total Sample
Father only	0.020
Mother only	0.125
No Parents	0.010
Both Parents	0.845
All Individuals	1.000

Age on arrival in Australia	Age =14 years	Age >14 years	All immigrants
Born in ESB Countries	0.914	0.086	1.000
Born in Asia or Europe	0.800	0.200	1.000

Appendix 2: Estimated marginal effects from Selected Other Variables (Preferred Specifications)[1]

| | High School Completion | Enrolled at University | |
	Men/Women Pooled	Women	Men
Father's Occupation			
Manager/Administrator	-0.026	0.194**	0.077
	(0.04)	(0.07)	(0.06)
No occupation	-0.087	0.181*	-0.079
	(0.06)	(0.10)	(0.06)
Professional	0.092**	0.270**	0.034
	(0.04)	(0.07)	(0.06)
Para-professional	-0.015	0.006	-0.016
	(0.07)	(0.09)	(0.07)
Tradesman	-0.140**	0.037	-0.083
	(0.05)	(0.06)	(0.06)
Clerk	0.017	0.174*	0.005
	(0.05)	(0.09)	(0.08)
Plant/Machine Operator	-0.191**	0.062	-0.108*
	(0.06)	(0.07)	(0.06)
Labourer	-0.215**	-0.021	-0.114**
	(0.07)	(0.08)	(0.05)
Father's Education			
Degree	0.090**	0.214**	0.226**
	(0.03)	(0.05)	(0.04)
Other Post Secondary	0.004	0.080**	0.045
	(0.02)	(0.04)	(0.03)
Primary School	0.016	0.044	-0.037
	(0.04)	(0.06)	(0.04)
No Formal Schooling	-0.069	-0.146**	0.006
	(0.04)	(0.05)	(0.07)
Mother's Education			
Degree	0.110**	0.126**	0.140**
	(0.02)	(0.04)	(0.05)
Other Post Secondary	0.024	0.052	0.062*
	(0.02)	(0.04)	(0.04)
Primary School	-0.047	-0.075	-0.001
	(0.05)	(0.05)	(0.04)
No Formal Schooling	-0.182**	-0.079	-0.075
	(0.06)	(0.08)	(0.07)
Number of siblings	-0.022**	-0.005	-0.025**
	(0.01)	(0.01)	(0.01)
Migrated age 1 - 9	0.027	0.034	0.024
	(0.08)	(0.09)	(0.07)
Migrated age 10-13	-0.159*	0.132	0.153
	(0.08)	(0.12)	(0.14)
Gender (male = 1)	-0.087**		
	(0.02)		
Pseudo-R^2	0.1336	0.1672	0.1513
Sample Size	3714	1804	1910

1. Robust standard errors in parentheses. The notation ** denotes significance at the 5% level and the notation * denotes significance at the 10% level.
2. Base Case: father in Sales with high school education, mother with high school education, only child, female, and born in Australia