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*Affirmative Action and Sector Selection:  
Malaysia's New Economic Policy*

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**Affirmative Action and Sector Selection:  
Malaysia's New Economic Policy**

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**Abstract**

Malaysia's New Economic Policy, implemented in 1971, intensified preferential treatment in education, employment, business, and asset ownership for the then economically disadvantaged Malay majority. The NEP increased the educational attainment of the Malays at the secondary level through the expansion of schools, and at the tertiary level through the introduction of quotas at public institutions. While affirmative action in secondary education did not affect the earnings of Malay secondary school graduates relative to their Chinese counterparts, quotas in capacity-constrained tertiary education led to an increase in the Malay-Chinese wage gap among tertiary graduates. Furthermore, the NEP facilitated Malay representation in upper-tier occupations through the public sector. The likelihood of Malay tertiary graduates being employed in the public sector, relative to their Chinese peers, is 23 percentage points for the pre-policy cohorts, and 31-43 percentage points for the post-policy cohorts. Affirmative action in public sector employment implies that the Malays positively select into the more lucrative private sector; indeed, Malay degree holders from overseas institutions are 16 percentage points more likely than Malay degree holders from local public institutions to enter the private sector. Analyses of private sector wages show that the Malay-Chinese wage gap among tertiary graduates is not significantly different between pre-policy and post-policy cohorts, suggesting that the overall increase in the Malay-Chinese wage gap amongst tertiary graduates is due to the greater representation of Malays in the public sector.

## 1 Introduction

Affirmative action policies are intended to address social inequities by increasing the opportunities provided to underrepresented groups. These groups, usually designated along lines of ethnicity, religion, or gender, have been historically disadvantaged or discriminated against. Such policies, precisely because they benefit a particular group arguably at the expense of other groups, are highly contentious. Ideally, affirmative action policies would be temporary measures to correct past inequities, and to enable the target group to catch up and compete on equal footing. However, Coate and Loury (1993) prove that even when the groups of workers are *ex ante* identical, highly ambitious affirmative action goals can in fact reduce the target group's incentive to perform, and subsequently reinforce negative stereotypes about the target group.

Malaysia's New Economic Policy (NEP), widely regarded as one of the world's most comprehensive affirmative action programs, was launched in 1971 in the wake of ethnic riots, and exists in various forms to this day. The NEP accords preferential treatment in education, employment, business, and asset ownership to the politically dominant *Bumiputera*, comprising the Malays and indigenous peoples. The consequences of the policies have been the subject of much debate. On the one hand, there have been few outbreaks of ethnic violence.<sup>1</sup> The creation of a Malay urban middle class in the span of a little over a generation is noteworthy. On the other hand, nepotism and cronyism is rampant (Gomez and Jomo, 1999). Intra-ethnic income inequality has worsened, particularly among the Malays (Lee, 2005; Pong, 1993). The political and education systems remain mired along ethnic lines, while ethnic enclaves in employment and business have burgeoned (Lee, 2005). Critics assert that the policies have pushed the non-*Bumiputera* to study and work abroad, resulting in brain drain, and negatively impacting economic competitiveness.<sup>2</sup>

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<sup>1</sup> Social discontent has been stifled by draconian laws such as the Sedition Act which prohibits dialogue deemed subversive, and the Internal Security Act (ISA) which permits detention without trial.

<sup>2</sup> Gooch reports in *The New York Times* (Oct 1, 2010) "Companies have long complained about a shortage of skilled labor in Malaysia, and economists say it is severely affecting the country's ability to attract more high-technology industries ... Many interviewees, when asked about their concerns about returning to Malaysia, cited racial tensions and the country's affirmative action policy."

The evolution of education, employment, and wages in Malaysia has been widely analyzed. Previous studies have established that the NEP increased the education level of the Malays. Compared to non-Malays, Malays born after the mid-1950's were both more likely to attend secondary school (Pong, 1993), and to obtain post-secondary education (Agadjanian and Liew, 2005). However, Malay representation in upper-tier occupations has stagnated since the mid-1990's, and continues to rely heavily on the public sector (Lee, 2010). The negative Malay-Chinese wage gap narrowed between 1957 and 1970, but has surprisingly widened since the introduction of the NEP in 1971 (Gomez and Jomo, 1999). Fang and Norman (2006) posit a theory where the exclusion of minorities from the public sector creates incentives to invest in human capital valued by the private sector, thus minimizing the informational free-riding problem. Therefore, it is possible that the discriminated group is economically better off even in the presence of high public sector wages.

In this paper, I investigate the extent to which the consequences of affirmative action in education depend on capacity constraints at the various levels of education. I also study how affirmative action in public sector employment affects selection into the public sector versus the private sector, and subsequently, wage outcomes in those sectors. My empirical analysis is based on the 1970 and 2000 Population and Housing Census as well as the 1992 and 1999 Household and Income Surveys. I employ a difference-in-differences approach, comparing the outcomes between the *Bumiputera* and non-*Bumiputera*, and between the pre-policy and post-policy cohorts, while adjusting for trends in cohort effects. I find that the NEP increased the educational attainment of the Malays relative to the Chinese by 4.8-5.7 percentage points at the secondary level through the expansion of schools, and by 1.1 percentage points at the tertiary level through quotas at public institutions. While affirmative action in secondary education did not affect the earnings of Malay secondary school graduates relative to their Chinese counterparts, quotas in capacity-constrained tertiary education led to an increase in the Malay-Chinese wage gap among tertiary graduates.

Furthermore, the NEP facilitated Malay representation in upper-tier occupations through the public sector. The likelihood of Malay tertiary graduates being employed in the public sector, relative to

their Chinese peers, is 23.4 percentage points for the pre-policy cohorts, 31.2 percentage points for the post-1953 cohorts, and 43.2 percentage points for the post-1958 cohorts. Affirmative action in public sector employment implies that the Malays likely positively select into the more lucrative private sector. Indeed, Malay degree holders are 6.5-13.5 percentage points more likely than Malay certificate or diploma holders to be employed in upper-tier occupations in the private sector, and amongst Malay degree holders, those from overseas institutions are 16.0 percentage points more likely than those from local public institutions to enter the private sector. Analyses of private sector wages show that the Malay-Chinese wage gap among tertiary graduates is not significantly different between pre-policy and post-policy cohorts, suggesting that the overall increase in the racial wage gap amongst tertiary graduates is due to the greater representation of Malays in the public sector.

The rest of the paper is organized as follows. Section 2 describes the institutional setting, and Section 3, the demographics and data. I present a theoretical framework of affirmative action in education and in labor markets in Section 4. Section 5 discusses the empirical results. Section 6 concludes.

## **2 Institutional Setting**

### **2.1 History of Malaysia**

Between 1786 and 1957, Malaya was colonized by the British. Indentured laborers were brought in from India to work on rubber and oil palm plantations. Immigrant workers from China established small towns around tin mines and ports, and were employed as miners, wage laborers, artisans, traders, and merchants. Meanwhile, the Malays remained as subsistence farmers and fishermen in rural villages. Residential location and occupation were largely stratified by ethnicity, as was education. The colonial government provided four-year elementary education in Malay, and established an English language fully-residential secondary school for children of the Malay elite. Positions in the Malayan Civil Service and the Malayan Administrative Service were reserved for Malays, in line with British policy recognizing the Malays as the rightful owners of Malaya. The Chinese and Indians were regarded as temporary

residents, and no special provisions were made for them. The Chinese founded their own vernacular schools through private funding, importing curricula, teachers, and textbooks from China. The Indians were largely dependent on British plantation owners, who provided primary education in Tamil.

Independent of the government, Christian missionaries founded English language primary and secondary schools in major towns. Few Malay families availed themselves of the opportunities offered by the English schools, partly due to geographic location, and partly due to their distrust of Christian education. Because secondary and tertiary education were available mostly in the English medium, and because the English language dominated the lucrative sectors of trade, commerce, and industry, the Chinese and Indians who attended English schools experienced upward occupational mobility. Hence, the Malays, the majority of whom remained in the rural areas, were disadvantaged, despite having been granted special protection by the British.

In 1957, Malaya gained independence from the British. In return for citizenship for the Chinese and Indians, the Malays were granted special rights, which are enshrined in Article 153 of the Constitution of Malaysia, and include reservation of positions in the public service, scholarships, and permits or licenses. Malaya, together with Singapore and the North Borneo states of Sabah and Sarawak, formed the federation of Malaysia in 1963; the indigenous peoples of Sabah and Sarawak were included as beneficiaries of the special rights.<sup>3</sup>

The geographic segregation in place during British colonial rule largely persisted even after independence in 1957. As the urban areas grew richer and more developed, the income gap between the urban Chinese and the rural Malays widened. In 1969, the Malays, who formed almost half the country's population, controlled 1.5 percent of corporate equity, while the Chinese who made up a third of the population held a 22.8 percent share (Jomo, 2004).<sup>4</sup> The challenges facing a young multi-ethnic nation quickly became apparent; the Malays were unhappy about the economic dominance of the Chinese, while the Chinese were leery of the political might of the Malays.

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<sup>3</sup> Singapore seceded from Malaysia in 1965 after the 1964 Sino-Malay riots.

<sup>4</sup> Foreign interests dominated the corporate sector, owning 62.1 percent of share capital of limited companies.

In the 1969 general elections, the Chinese-dominated opposition made considerable gains at the expense of the Malay-dominated ruling coalition, sparking racial riots.<sup>5</sup> A state of emergency was declared, curfew was imposed, and Parliament was suspended. The New Economic Policy (NEP) was launched in 1971 “to eradicate poverty irrespective of race” and “to restructure society to abolish the identification of race with economic function” (*The Second Malaysia Plan*, 1971). A new term—*Bumiputera* or “sons of the soil”—was coined to refer to the beneficiaries of the NEP: the Malays and the indigenous peoples of Sabah and Sarawak.<sup>6</sup> The NEP aimed to increase the *Bumiputera* share of corporate equity from 1.5 percent in 1969 to 30 percent by 1990.<sup>7</sup> Preferential treatment in areas of education, employment, business, and asset ownership were intensified.<sup>8</sup>

The NEP was replaced by the National Development Policy in 1991, the National Vision Policy in 2001, and the New Economic Model in 2011. While the latter policies place greater emphasis on growth and industrialization, the racial nature of the policies first implemented under the NEP is largely unchanged. In this paper, I refer to the positive discrimination policies which were expanded in 1971 and which persist to this day as the NEP.

## 2.2 Affirmative Action in Education

The Malaysian education system consists of three levels—primary, secondary, and tertiary. Figure A1 maps out the education system. Primary education is six years, lower secondary education is three years, while upper secondary education—culminating in the *Sijil Pelajaran Malaysia* (SPM), the

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<sup>5</sup> An analysis of declassified documents from the Public Records Office in London and the first-hand accounts of a Malay politician and a British observer, among other reports, suggest that the riots were instigated as a coup d’etat to unseat the then Prime Minister, Tunku Abdul Rahman (Kua, 2007; Hassan, 2007; Slimming, 1969). Although the official death toll was 196, independent reporters and observers estimated fatalities to be between 1,000 and 2,000 people, 75 percent of whom were Chinese (Kua, 2007).

<sup>6</sup> The earliest settlers in Peninsular Malaysia, the *Orang Asli*, are not classified as *Bumiputera* under the Constitution.

<sup>7</sup> In 2002, the *Bumiputera* share was reported as 18.7 percent. Between 1969 and 2002, the Chinese share increased from 22.8 percent to 40.9 percent, while the Indian share barely moved from 0.9 percent to 1.5 percent. Due to the lack of transparency on socioeconomic data deemed sensitive, the official figures have been hotly debated. The *Bumiputera* share is likely to be understated as the official figures exclude federal and state government share ownership (Jomo, 2004; Jomo, 1990).

<sup>8</sup> The NEP’s focus on equality of outcomes, rather than equality of opportunities, is especially striking in the policies regarding asset ownership. Thirty percent of initial public offerings on the local stock market are reserved for *Bumiputera*. Sale or transfer of corporate or other assets in selected sectors have a minimum *Bumiputera* quota. The *Bumiputera* Lot Quota Regulation requires developers to set aside at least 30 percent of property development for *Bumiputera* at discounted rates of between 5 to 15 percent of the selling price.

equivalent of the GCE O-Level—is two years. Public schools constitute 95 percent of primary and secondary education. Tertiary education comprises certificate, diploma, and degree programs. Students may progress to certificate or diploma programs upon passing the SPM. Degree programs, however, require one to two years of pre-university education beyond the SPM.

The education system has largely been shaped by the National Education Policy (1961) and the New Economic Policy (1971). The National Education Policy (1961) implemented *Bahasa Malaysia* or the Malaysian language, the mother tongue of the Malays, as the medium of instruction in all secondary schools and public higher educational institutions.<sup>9</sup> Effectively, the *Bahasa Malaysia* policy facilitated the entry of Malay students into secondary and tertiary education, the main channels of occupational mobility. The National Education Policy also established free primary education with automatic promotion up to the lower secondary level, which necessitated greater provision of secondary schools, primarily for rural Malays. Consequently, secondary school enrollment doubled between 1970 and 1980 (*The Fourth Malaysia Plan*, 1981).

Under the New Economic Policy (1971), secondary schools—comprising Fully Residential Schools, Science Secondary Schools, and the elite MARA Junior Science Colleges—were constructed exclusively for the *Bumiputera*.<sup>10</sup> Between 1984 and 2000, enrollment in Fully Residential Schools and Science Secondary Schools doubled, while enrollment in MARA Junior Science Colleges tripled (Lee, 2005). Although the construction of these schools was targeted for low-income rural *Bumiputera*, they have instead benefitted mostly the urban middle and professional classes (Selvaratnam, 1988).

Table 1 shows enrollment by level of education and ethnicity. Between 1970 and 1985, the *Bumiputera* share of enrollment increased from 51.0 percent to 65.2 percent at the lower secondary level, and from 48.8 percent to 68.1 percent at the upper secondary level. The *Bumiputera* share of enrollment

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<sup>9</sup> This process was completed at the secondary level in Peninsular Malaysia and Sabah in 1980, and in Sarawak in 1987, and at the tertiary level in the late 1980's (*The Fourth Malaysia Plan*, 1981).

<sup>10</sup> In 2004, a 10 percent non-*Bumiputera* quota was introduced to the MARA Junior Science Colleges. MARA Junior Science Colleges enroll barely one percent of total secondary school students, but consumes between five to six percent of the budget for secondary education (*The Fifth Malaysia Plan*, 1986; *The Ninth Malaysia Plan*, 2006).



exceeded the *Bumiputera* share of the population at the upper secondary level by 1975, and at the lower secondary level by 1980.

At the pre-university and tertiary levels, numerous institutions have been set up exclusively for the *Bumiputera* by the Indigenous People's Trust Council or *Majlis Amanah Rakyat* (MARA).<sup>11</sup> By 1986, MARA had established higher institutions in every state, offering a variety of certificate and diploma programs. Enrollment quadrupled from 7,900 in 1975 to 32,500 in 1995 (*The Third Malaysia Plan, 1976; The Seventh Malaysia Plan, 1996*). Table 1 shows that enrollment in certificate and diploma programs are almost exclusively the domain of the *Bumiputera*; the *Bumiputera* share of enrollment in certificate and diploma programs increased from 82.9 percent in 1970 to 88.0 percent in 1985.

Ethnic quotas at public universities were set at 55 percent *Bumiputera*, 30 percent Chinese, and 10 percent Indian (Lee, 2005).<sup>12</sup> As shown in Table 1, enrollment in tertiary education in fact exceeded the quotas. The *Bumiputera* share of enrollment in degree programs increased from 39.7 percent in 1970 to 57.2 percent in 1975, 62.0 percent in 1980, and 63.0 percent in 1985.

A *Bumiputera*-exclusive pre-university program, Matriculation, was expanded in the late 1990s to fulfill the quotas at public universities.<sup>13</sup> The Matriculation program is a shorter and less rigorous alternative to Form 6. Unlike the STPM, however, the Matriculation program is not recognized by local private institutions or overseas institutions. Enrollment in Matriculation more than tripled from 15,500 students in 1995 to 55,500 in 2005 (*The Seventh Malaysia Plan, 1996; The Ninth Malaysia Plan, 2006*).

Government scholarships for local and overseas education are largely reserved for *Bumiputera*. In a survey of 1982/83 graduates, Mehmet and Yip (1986) find that almost 80 percent of local public university scholarships are awarded to Malay students, compared to 14 percent to the Chinese, 4 percent

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<sup>11</sup> MARA constituted 25 percent of tertiary enrollment in 1975, and consumed over 50 percent of the 1971-75 expenditure on tertiary institutions. In contrast, Tunku Abdul Rahman College, established by a political party, the Malaysian Chinese Association (MCA), and with a 99 percent non-*Bumiputera* enrollment, constituted 13 percent of tertiary enrollment in 1975, and consumed less than 2 percent of the 1971-75 expenditure on tertiary institutions (*The Third Malaysia Plan, 1976*).

<sup>12</sup> In 2002, the government announced a switch to meritocracy. *Bumiputera* enrollment continues hovering above 60 percent.

<sup>13</sup> A 10% non-*Bumiputera* quota in the Matriculation program was introduced in 2003.

to the Indians, and 3 percent to the indigenous peoples.<sup>14</sup> Furthermore, 95 percent of overseas scholarship recipients between 1980 and 1984 were *Bumiputera* (Brown, 2007).

Affirmative action in secondary education occurred through the expansion of schools, including *Bumiputera*-exclusive schools. Affirmative action in tertiary education, however, was implemented through the establishment of *Bumiputera*-exclusive certificate and diploma programs, and through ethnic quotas for public university admissions and scholarships. While capacity in secondary education expanded rapidly, slots in tertiary education, while growing, were much more constrained.<sup>15</sup> As depicted in Table 2, lower secondary enrollment as a percentage of primary enrollment increased from 26.6 percent in 1970 to 41.7 percent in 1985, while upper secondary enrollment as a percentage of lower secondary enrollment increased from 23.6 percent in 1970 to 36.1 percent in 1985. Enrollment in certificate and diploma programs as a percentage of upper secondary enrollment increased from 6.6 percent in 1970 to 12.5 percent in 1985 for *Bumiputera*, but from 1.3 percent to 3.5 percent for Non-*Bumiputera*. Enrollment in degree programs as a percentage of upper secondary enrollment was 9.1 percent in 1970, and fell in the ensuing years before rising slightly to 11.5 percent in 1985. The varying capacity constraints in secondary and tertiary education affected the nature of the affirmative action policies implemented at each level, and the subsequent outcomes in the labor market.

### **2.3 Affirmative Action in the Labor Market**

The NEP attempted to regulate the private sector through the Industrial Coordination Act (1975) which gave the Ministry of Trade of Industry discretionary power over licensing, ownership structure, ethnic employment targets, and product distribution quotas (Jesudason, 1989). A 30 percent *Bumiputera* employment quota in private companies in selected sectors was introduced (Khoo, 2005). The issuance

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<sup>14</sup> The scholarships are regressively distributed, with the bulk of scholarships being awarded to higher income households in each of the ethnic groups. The intra-ethnic inequality is especially stark for the Malays. The richest Malays are 21 times more likely to obtain a scholarship than the poorest Malays, while the intra-ethnic ratio is 13:1 and 10:1 for the richest and poorest Chinese and Indians respectively (Mehmet and Yip, 1986).

<sup>15</sup> The limited slots in tertiary education may be due to the greater academic rigor demanded at that level. However, the difference between tertiary educational attainment overall (including private and overseas institutions) and tertiary educational attainment from local public institutions, as shown in Figures 1.5-1.6, indicates that growth in public tertiary education, especially for the non-*Bumiputera*, was insufficient to meet demand.

of manufacturing and trade licenses are conditional on compliance with the quota. Furthermore, the *Bumiputera* are given special consideration for government contracts and licenses. This has given rise to the “Ali Baba” joint venture, where “Ali,” the Malay partner, obtains the contract or license on behalf of “Baba,” the Chinese partner (Jomo, 2004). Approved Permits for imported automobiles are issued to companies with at least 70 percent *Bumiputera* ownership. In practice, Malay politicians and politically-connected businessmen have benefitted disproportionately from these business prospects (Jomo, 1990).<sup>16</sup>

For the majority of Malays, however, it is in the public sector that the NEP has been most effective. The NEP’s twin goals of eradicating poverty and restructuring society necessitated and justified the expansion of the public sector, as illustrated in Table 3. Public expenditure budgets ballooned from RM 4.6 billion, or 8.7 percent of GDP, in 1966-1970 to RM 48.9 billion, or 14.1 percent of GDP, in 1981-1985 (*Malaysia Plans*, various years). The number of public enterprises increased twentyfold between 1965 and 1985, and encompassed a multitude of sectors and industries (Mohamed, 1995). Correspondingly, the number of public sector employees almost quadrupled between 1970 and 1983 (Mehmet, 1986). The expansion of the public sector also served to provide employment for the *Bumiputera*. In 1969, the civil service comprised 61 percent Malays, 20 percent Chinese, and 17 percent Indians (Puthuchery, 1978). In 2005, the Malay share had risen to 77 percent, while the Chinese and Indian shares had fallen to 9 percent and 5 percent respectively. Since 1963, the Malays have been heavily represented in upper-tier positions, making up 85 percent of the elite *Perkhidmatan Tadbir dan Diplomatik* or Administrative and Diplomatic Service (Centre for Public Policy Studies, 2006).

Public sector jobs, although offering lower wages than comparable private sector jobs, are associated with job security and guaranteed pensions. The underrepresentation of non-Malays in the public sector may be traced to the common perception of unequal chances in recruitment and promotion. Means observes that “the natural proclivity of the government, particularly after the NEP, has been to fill

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<sup>16</sup> In July 2005, the government released the list of individuals granted Approved Permits to import foreign cars. Four individuals were granted more than 28,000 of the 67,158 APs allocated thus far that year. The four individuals comprised a multi-millionaire businessman, two former officials at the International Trade and Industry Ministry, and a retired lieutenant-general. Each AP was valued between RM 20,000 and RM 30,000, approximately the starting annual salary of a teacher (*The Star*, July 19, 2005).

the positions with Malays if at all possible,” and that “Malays have been promoted because of race to assure that the highest policy-making positions will be filled by Malays regardless of objective performance standards” (Means, 1986; Means, 1972). Indeed, the public sector has become an increasingly Malay domain while the private sector is still perceived as a Chinese domain (Jomo, 1990).

### **3 Demographics and Data**

#### **3.1 Demographics**

Peninsular Malaysia, while comprising 40 percent of land mass, has approximately 80 percent of the population. The main ethnic groups in Peninsular Malaysia are the Malays, Chinese, and Indians, while the various indigenous peoples make up over half the population in East Malaysia. I focus on Peninsular Malaysia because the Household Income Surveys do not distinguish between the Malays and the indigenous peoples, although the two groups are inherently different.<sup>17</sup>

In the Federal Constitution of Malaysia, the term Malay refers to a person who professes Islam, habitually speaks the Malay language, and conforms to Malay customs.<sup>18</sup> The Chinese hail from southern China—Fujian, Guangdong, and Hainan—and came in two waves, in the 15<sup>th</sup> century, and in the 19<sup>th</sup> and early 20<sup>th</sup> centuries. The Indians are Tamil, Telugu, Malayali, Punjabi, Bengali, and Gujarati, who migrated during the British colonial era. The ethnic groups are further differentiated from one another by religion and language. Malays are Muslim; the Chinese are predominantly Buddhists, Taoists, or Christians; and the Indians are mainly Hindus, Christians, or Muslims. While the official language is Malay, English is also widely spoken, along with Chinese dialects (Mandarin, Cantonese, Hokkien, Teochew, Hakka, Hainanese), and Indian dialects (Tamil, Telugu, Malayalam, Punjabi).

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<sup>17</sup> There might be concerns that individuals residing in one region might have been born and raised in the other region. However, migration between Peninsular and East Malaysia is not a widespread phenomenon. The 2000 Population and Housing Census data shows that of 26-54 year olds, only 0.88 percent of individuals residing in Peninsular Malaysia were born in East Malaysia, and 2.99 percent of individuals residing in East Malaysia were born in Peninsular Malaysia.

<sup>18</sup> The definition of Malay according to the Federal Constitution of Malaysia encompasses people of other ethnic origins, and differs from the anthropological definition of an ethnic Malay.

### 3.2 Data

The data in this paper come from four sources: the 1970 and 2000 Population and Housing Census (PHC), and the 1992 and 1999 Household Income Surveys (HIS). I focus on individuals between the ages of 26 and 54 in each dataset, as they would most likely have completed their schooling and still be in the labor force.<sup>19</sup>

The PHC datasets, although missing data on wages, have richer sets of variables, e.g., district of residence, state of birth, and employment sector (the latter only for the 2000 data). On the other hand, the HIS datasets have wage information. The HIS datasets I am working with are 30 percent weighted samples. However, I was fortunate to obtain HIS data on ethnicity, which have rarely been released due to issues of national security. Descriptive statistics of the PHC and HIS data are shown in Table 4.<sup>20</sup>

In Peninsular Malaysia, Malays comprise over half the population, Chinese, a third, and Indians, one-tenth. In 1970, approximately a quarter of the Malays, three-quarters of the Chinese, and half of the Indians resided in urban areas. In 2000, urban shares of each ethnic group had risen to 56.4 percent, 88.0 percent, and 80.5 percent respectively.

Educational attainment varies across ethnic groups as shown in Table 4. Figures 1.1-1.6 show the share of each ethnicity and birth cohort at various levels of educational attainment based on the PHC data. The vertical black lines denote the pre-policy and post-policy cohorts for the given level of education. The first cohorts affected by the NEP were the 1959 cohorts (12 years old in 1971) at the secondary level, and the 1954 cohorts (17 years old in 1971) at the tertiary level.

Figures 1.1-1.2 show that at the lower and upper secondary levels, the Malays are on a steeper trajectory than the Chinese and Indians. The Malays initially trail the Chinese and Indians, but surpass them around the 1957 cohort, and eventually level off at 90.0 percent at the lower secondary level, and at 70.0 percent at the upper secondary level. The steepness of the pre-policy Malay trend relative to the pre-

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<sup>19</sup> The retirement age for civil servants was 55 years old in 2000.

<sup>20</sup> The 2000 PHC and 1999 HIS datasets are comparable in terms of ethnic share, educational attainment, and employment rates. One noticeable discrepancy is lower secondary educational attainment, which is higher for all ethnic groups in the 2000 PHC sample compared to the 1999 HIS sample.

policy Chinese and Indian trends is consistent with the pro-Malay outcomes of the National Education Policy (1961). Clearly, the National Education Policy (1961) and NEP (1971) were effective in raising the educational attainment of the Malays.

Figure 1.3 shows that at the tertiary level, the Malays and Chinese track each other closely, while the Indians appear to have stagnated since the 1965 cohorts. However, while the share of Malays with local public tertiary education has increased over time, the corresponding share of Chinese and Indians experienced a much slower growth, as shown in Figure 1.4. For the youngest cohorts, 11.0 percent of Malays graduated from a public tertiary institution, compared to 6.0 percent of Chinese and 4.5 percent of Indians. Figures 1.5-1.6 focusing on degree holders and degrees from public institutions are analogous to Figures 1.3-1.4. In Figure 1.5, the Malay and Chinese trends for degree holders are similar, with the divergence revealing itself only in degree holders from public institutions depicted in Figure 1.6.

I now turn to the employment statistics. As shown in Table 4, the employment rate of males is consistent across the ethnic groups, hovering around 90.0 percent in the 1970 PHC data, and around 95.0 percent in the 2000 PHC data. Females are about half as likely to be employed as males. Figure 2 shows the employment rate by ethnicity and birth cohort. While the employment rate is relatively constant across male cohorts below the age of 50, the employment rate of females is rising with each successive cohort.

Finally, I look at employment in the public sector. Table 4 shows that among males, Malays are 10.5 times more likely than the Chinese and 2.5 times more likely than the Indians to be employed in the public sector. Among females, Malays are 3.5 times more likely than the Chinese and 3.0 times more likely than the Indians to be employed in the public sector. Figure 3.1 illustrates employment patterns by sex, ethnicity, and birth cohort. For both males and females, the likelihood of being employed in the public sector is higher for Malays across all birth cohorts. Unfortunately, employment sector is not available in the 1970 PHC data. However, industry sector is correlated with employment sector, as shown in Table 5. In the 2000 PHC data, 67.8 percent of individuals in Public Administration and Defense and 69.4 percent of individuals in Education are in the public sector. Figures 3.2-3.3 trace

employment patterns in Public Administration and Defense and in Education, respectively. The likelihood of Malays being employed in either of these two industries has increased dramatically between 1970 and 2000.

#### 4 Theoretical Framework

My first objective is to show how the consequences of affirmative action in education may vary with capacity constraints. While the number of students enrolled in secondary education expanded rapidly between 1970 and 1985, the increase in tertiary enrollment was much slower, as shown in Table 2. The introduction of quotas in capacity-constrained tertiary education suggests that the quality of *Bumiputera* and non-*Bumiputera* tertiary graduates vary. My second objective is to show how affirmative action in public sector employment affects selection into the public sector versus the private sector. Positive discrimination in public sector recruitment, hiring, and promotion for the *Bumiputera* suggest that the *Bumiputera* in the private sector are positively selected.

Consider a population with a continuum of individuals, where each individual is born into one of two ethnic groups, beneficiaries,  $B$ , and non-beneficiaries,  $N$ . Each individual  $i$  is endowed with a level of ability  $\omega \in \{Low, High\}$ . The distributions of ability type in the two groups are identical. Within each group, there is a proportion  $l^g$  of *Low* types and a proportion  $1 - l^g$  of *High* types, where  $g = B, N$ . I assume that general equilibrium effects do not vary across ethnic groups.

##### 4.1 Affirmative Action in Education

Admission into public universities depends on examination results, which is a measure of potential. An individual's examination results is a function of his ability, effort, and environmental factors. Suppose  $r^B \sim \log N(-\varepsilon, \sigma^2)$  and  $r^N \sim \log N(0, \sigma^2)$ , i.e., the distribution of examination results for  $B$  is to the left of  $N$ , as shown in Figure 4. With the same initial admission threshold,  $a^0$ , (denoted by the red lines), the fraction of  $N$  admitted to university is greater than the fraction of  $B$  admitted,  $\rho^N > \rho^B$ .

Suppose affirmative action in tertiary education is introduced; quotas reflecting the population breakdown are set, such that  $\rho^N = \rho^B$ . The admission threshold for  $B$  shifts left to  $a^B$ , and the admission threshold for  $N$  shifts right to  $a^N$  (denoted by the dashed red lines).<sup>21</sup> While substitutes to public tertiary institutions exist, namely private institutions and overseas institutions, there are significant financial barriers to accessing those substitutes.<sup>22</sup> Even if  $N$ 's are able to substitute public tertiary education with private or overseas tertiary education, the  $N$  tertiary graduates are of higher potential than the  $B$  tertiary graduates as long as the admission threshold (to private or overseas institutions) for  $N$ 's is above  $a^B$ .

Affirmative action in secondary education, however, is implemented through the building of both *Bumiputera*-exclusive and non-exclusive institutions. The expansion of non-exclusive secondary schools, particularly in rural areas, where a substantial proportion of  $B$ 's reside, indicate that  $N$ 's in rural areas may in fact enjoy spillover effects from the increased capacity. The relatively unconstrained capacity of secondary education, and the establishment of a uniform certification threshold for both groups indicate that the potential of secondary school graduates do not differ significantly between the  $B$ 's and the  $N$ 's.

## 4.2 Affirmative Action in the Labor Market

The labor market comprises the public sector and the private sector. The wage structure varies by the level of schooling (e.g., upper secondary and tertiary). Public sector wages are fixed at  $W_{Public}$ , while private sector wages depend on productivity, and are such that low-productivity individuals will earn less than public sector wages, but high-productivity individuals will earn more than public sector wages:

$$W_{Private, High Productivity} > W_{Public} > W_{Private, Low Productivity}$$

Let High Ability individuals be indexed by  $HA$ , and Low Ability by  $LA$ . The cost of effort required to achieve high productivity is higher for Low Ability individuals compared to High Ability individuals, i.e.,  $c(e)^{LA} > c(e)^{HA}$ . An individual who exerts zero cost of effort will be low productivity.

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<sup>21</sup> It is highly likely that effort around the old threshold decreases, whereas effort around the new threshold increases.

<sup>22</sup> Public tertiary education is subsidized by the government with only ten percent of the cost being covered by student fees. Local private institutions charge varying tuition which are substantially higher than those charged by public institutions.



For High Ability individuals, high-productivity private sector wages net of cost of effort exceeds public sector wages:

$$W_{Private, High Productivity} - c(e)^{HA} > W_{Public}.$$

For Low Ability individuals, public sector wages exceeds high-productivity private sector wages net of cost of effort, which in turn exceeds low-productivity private sector wages:

$$W_{Public} > W_{Private, High Productivity} - c(e)^{LA} > W_{Private, Low Productivity}.$$

Individuals have perfect information about their ability type, the cost of effort required to achieve high productivity, and wages in both sectors.

Suppose affirmative action in public sector employment is introduced; quotas in hiring are set at  $q^B > q^N$ . Beliefs about the probability of being hired in a public sector job,  $\pi^B$  and  $\pi^N$ , are normally distributed and depend on the hiring quotas,  $q^B$  and  $q^N$ . Individual beliefs,  $\pi_i^B$  and  $\pi_i^N$ , are drawn from the respective group's distribution. Individuals choose their effort level and desired employment sector, conditional on their ability type and their beliefs about the probability of public sector employment. A job in the private sector is guaranteed; a job in the public sector is not. An individual may choose to try his luck in the public sector; if he fails, he gets a job in the private sector with probability 1. All High Ability types exert cost of effort of  $c(e)^{HA}$  and enter the private sector. A Low Ability type exerts zero effort and tries his luck in the public sector if  $\pi_i > \pi^*$ , and exerts cost of effort of  $c(e)^{LA}$  and enters the private sector if  $\pi_i < \pi^*$ .<sup>23</sup>

Let  $x^{g=B,N}$  be the share of Low types in each group for whom  $\pi_i > \pi^*$ . Since public sector quotas are  $q^B > q^N$ , clearly  $x^B > x^N$ . Let  $h^{g=B,N}$  be the probability of being hired for a public sector job. The public sector comprises  $h^g x^g l^g$  of group  $g = B, N$ —Low Ability types with  $\pi_i > \pi^*$  who exerted zero effort and earn wages of  $W$ . The private sector comprises the following:

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<sup>23</sup> A Low Ability type chooses his effort level by comparing his expected utility from exerting zero effort with his utility from exerting cost of effort of  $c(e)^{LA}$  and entering the private sector.  $\pi^* = \frac{W_{Private, High Productivity} - c(e)^{LA} - W_{Private, Low Productivity}}{W_{Public} - W_{Private, Low Productivity}}$  is derived from solving  $\pi^* W_{Public} + (1 - \pi^*) W_{Private, Low Productivity} = W_{Private, High Productivity} - c(e)^{LA}$ .

1.  $1 - l^g$  of group  $g = B, N$  are High Ability types who exerted cost of effort of  $c(e)^{HA}$  and earn high-productivity wages.
2.  $(1 - x^g)l^g$  of group  $g = B, N$  are Low Ability types with  $\pi_i < \pi^*$  who exerted effort of  $c(e)^{LA}$  and earn high-productivity wages.
3.  $(1 - h^g)x^gl^g$  of group  $g = B, N$  are Low Ability types with  $\pi_i > \pi^*$ —but failed to get a job in the public sector—who exerted zero effort and earn low-productivity wages.

### 4.3 Hypotheses

First, the expansion of secondary schools, particularly in rural areas, implies that the *Bumiputera* experience an increase in secondary educational attainment in the post-policy period. The non-*Bumiputera* may experience a similar increase due to spillover effects. On the other hand, the introduction of quotas in public universities suggests that public tertiary educational attainment rises for the *Bumiputera* relative to the non-*Bumiputera* in the post-policy period. The trends in overall tertiary educational attainment depend on the degree to which non-*Bumiputera* are able to substitute public tertiary education with private or overseas tertiary education.

Second, affirmative action in secondary education where capacity is relatively unconstrained implies that the relative returns to secondary education for the *Bumiputera* and the non-*Bumiputera* do not vary between pre-policy and post-policy cohorts. Conversely, the introduction of university quotas, coupled with the huge capacity constraints in tertiary education, lead to different admission thresholds for different ethnic groups,<sup>24</sup> suggesting that the returns to tertiary education for the *Bumiputera*, relative to the non-*Bumiputera*, falls between pre-policy and post-policy cohorts.

Third, preferential treatment in public sector hiring indicates that the *Bumiputera* are more likely than the non-*Bumiputera* to be employed in the public sector, and that the likelihood is higher in 2000

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<sup>24</sup> Between 1975 and 1985, Malays comprised 57 to 63 percent of students enrolled in degree courses in local public universities, but represented merely 46 to 54 percent of degree students in the top two institutions—*University Malaya* and *University Sains Malaysia* (*The Third Malaysia Plan*, 1976; *The Fifth Malaysia Plan*, 1986). Furthermore, Malays are underrepresented in Science, Engineering, and Medicine, Dentistry, and Pharmacy, making up 26, 39, and 32 percent of the enrollment, respectively, in 1975 (*The Third Malaysia Plan*, 1976).

compared to 1970 (before the introduction of the NEP). The lowering of university admission thresholds for the *Bumiputera* suggests that post-policy *Bumiputera* tertiary graduates are more likely to be employed in the public sector than their pre-policy counterparts, as illustrated in Figure 5. Accordingly, the likelihood of public sector employment for the *Bumiputera* relative to the non-*Bumiputera* is higher for the post-policy cohorts compared to the pre-policy cohorts.

Fourth, if the *Bumiputera* positively select into the private sector, then among the *Bumiputera* in the private sector, the post-policy tertiary graduate is not significantly different from the pre-policy tertiary graduate. Consequently, the *Bumiputera*-non-*Bumiputera* private sector wage gap should not vary between pre-policy and post-policy tertiary graduates.

## **5 Empirical Results**

I investigate how ethnic differences in education and labor market outcomes vary across cohorts, while adjusting for trends in cohort effects. Attributing the difference-in-differences to the NEP depends on the identification assumption that other than the NEP, there are no omitted time-varying effects positively impacting the Malays relative to the Chinese and Indians. The stock of each ethnic group did not change between the pre-policy and post-policy periods since immigration from China and India had largely ceased by World War II. Among the 1946-1953 birth cohorts who received their tertiary education before the NEP, over 97.5 percent of each ethnic group was born in Malaysia. Among the 1954-1974 birth cohorts who received their tertiary education under the NEP, over 99.4 percent of each ethnic group was born in Malaysia.

### **5.1 Ethnicity and Birth Cohort Effects on Education Outcomes**

The effects of the NEP on education outcomes are depicted by the interethnic differences in level shifts for birth cohorts affected by the NEP, while controlling for differential levels and trends. I estimate ethnicity and birth cohort effects on education outcomes with the following linear regression model:

$$\begin{aligned}
S_i = & \beta_0 + \beta_{1E} \cdot Ethnicity_i + \beta_2 \cdot Post_i + \beta_{3E} \cdot Ethnicity_i * Post_i \\
& + \beta_4 \cdot Birth Cohort_i * Pre_i + \beta_{5E} \cdot Ethnicity_i * Birth Cohort_i * Pre_i \\
& + \beta_6 \cdot Birth Cohort_i * Post_i + \beta_{7E} \cdot Ethnicity_i * Birth Cohort_i * Post_i + \beta_8 \cdot X_i + \varepsilon_i \quad (1)
\end{aligned}$$

where  $S_i$  is a dummy variable indicating whether individual  $i$  completed his schooling at a given level;  $Ethnicity_i$  is a vector of dummies indicating the individual's ethnicity: Malay, Chinese, Indian;  $Birth Cohort_i$  is a series of integers indicating the individual's birth cohort, with 0 being the youngest pre-policy cohort;  $Pre_i$  is a dummy variable with a value of 1 for pre-policy birth cohorts;  $Post_i$  is a dummy variable with a value of 1 for post-policy birth cohorts; and  $X_i$  is a vector of controls. The interaction variables are interpreted in the following manner:  $Ethnicity_i * Post_i$  is the differential level effect for the post-policy birth cohorts of a given ethnic group;  $Birth Cohort_i * Pre_i$  is the time trend for the pre-policy birth cohorts;  $Ethnicity_i * Birth Cohort_i * Pre_i$  is the differential time trend for the pre-policy birth cohorts of a given ethnic group;  $Birth Cohort_i * Post_i$  is the time trend for the post-policy birth cohorts;  $Ethnicity_i * Birth Cohort_i * Post_i$  is the differential time trend for the post-policy birth cohorts of a given ethnic group. The omitted ethnic group is the Chinese. The main variable of interest is  $Malay * Post$  which depicts the post-policy change in the Malay-Chinese gap. Figure A2 illustrates how the levels and slopes of each ethnic group's pre-policy and post-policy trends are obtained. Standard errors are adjusted for heteroskedasticity and clustered by birth cohort.

Tables 6.1 and 6.2 present the results for secondary education and tertiary education, respectively.<sup>25</sup> Columns (1) and (3) in Table 6.1, and columns (1), (3), (5), and (7) in Table 6.2 show the results without any controls, while columns (2) and (4) in Table 6.1, and columns (2), (4), (6), and (8) in Table 6.2 show the results controlling for sex, the interaction of sex and ethnicity, urban-rural location, state of residence, district of residence, state of birth, and birth cohort fixed effects. The level effects of the NEP are depicted in the coefficients of the variables  $Post$  and  $Ethnicity * Post$ , while the slope

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<sup>25</sup> These specifications impose linear time trends on the data; allowing for quadratic time trends, however, does not increase the  $R^2$ .

effects are represented by the coefficients of the variables *Birth Cohort \* Post* and *Ethnicity \* Birth Cohort \* Post*.

The linear specifications with controls in columns (2) and (4) in Table 6.1 indicate that the NEP had statistically significant level effects on the secondary educational attainment of the Malays. The pre-policy likelihoods of obtaining lower and upper secondary education were higher for the Malays relative to the Chinese by 16.6 and 16.2 percentage points, respectively, reflecting the effects of the National Education Policy (1961). The NEP further increased the Malay probability of obtaining lower secondary education by 4.8 percentage points, and of obtaining upper secondary education by 5.7 percentage points. The slightly negative slope effect for post-policy Malays at the lower secondary level reflects that lower secondary educational attainment levels off at approximately 90.0 percent beginning with the 1969 cohorts.

These regressions yield an interesting result: post-policy Indian cohorts have a 3.9 percentage points increased likelihood of completing upper secondary school. However, these effects are somewhat muted due to the slight negative coefficient on the Indian post-policy trend. Also, pre-policy Indians are 25.5 percentage points less likely than their Malay peers of obtaining upper secondary education. One possible channel through which the younger Indians benefitted is the building of non-exclusive secondary schools, especially in rural areas. Unfortunately, I am unable to explore this further as the PHC data does not have information on whether an individual's region of birth is urban or rural.

The estimates on tertiary education in Table 6.2 indicate that the Malay gains in tertiary education are driven by public institutions. Column (2) shows that pre-policy Malays were 3.3 percentage points more likely to obtain tertiary education (certificates/diplomas/degrees) relative to their Chinese peers; this likelihood increased by another 1.1 percentage points post-policy. These gains can be traced to public tertiary education; as shown in column (4), the likelihood of obtaining public tertiary education, relative to the Chinese, is 2.2 percentage points for pre-policy Malays, and 3.6 percentage points for post-policy Malays—an increase of 1.4 percentage points.

Analogous results for degrees and degrees from public institutions are shown in columns (6) and (8). Both pre-policy and post-policy Malays are 2.0 percentage points more likely than their Chinese and Indian peers to obtain degrees. However, degree attainment from public institutions exhibit very different trends. The Malay likelihood of obtaining a degree from a public institution, relative to the Chinese and Indians, doubles from 1.0 percentage points pre-policy to 2.2 percentage points post-policy.

## 5.2 Education, Ethnicity, and Birth Cohort Effects on Labor Market Outcomes

The effects of the NEP on labor market outcomes are captured by the interethnic differences in level shifts for birth cohorts affected by the NEP—post-1953 tertiary graduates and post-1958 secondary school graduates—while controlling for differential levels and trends. I estimate education, ethnicity, and birth cohort effects on labor market outcomes, such as wages, employment sector, and occupation:

$$\begin{aligned}
L_i = & \gamma_0 + \gamma_{1E} \cdot \text{Ethnicity}_i + \gamma_{2S} \cdot \text{Schooling}_i + \gamma_{3ES} \cdot \text{Ethnicity}_i * \text{Schooling}_i \\
& + \gamma_4 \cdot \text{Post 1953}_i + \gamma_{5E} \cdot \text{Ethnicity}_i * \text{Post 1953}_i \\
& + \gamma_{6S} \cdot \text{Schooling}_i * \text{Post 1953}_i + \gamma_{7ES} \cdot \text{Ethnicity}_i * \text{Schooling}_i * \text{Post 1953}_i \\
& + \gamma_8 \cdot \text{Post 1958}_i + \gamma_{9E} \cdot \text{Ethnicity}_i * \text{Post 1958}_i \\
& + \gamma_{10S} \cdot \text{Schooling}_i * \text{Post 1958}_i + \gamma_{11ES} \cdot \text{Ethnicity}_i * \text{Schooling}_i * \text{Post 1958}_i \\
& + \gamma_{12} \cdot \text{Birth Cohort}_i + \gamma_{13E} \cdot \text{Ethnicity}_i * \text{Birth Cohort}_i + \gamma_{14} \cdot X_i + \mu_i
\end{aligned} \tag{2}$$

where  $L_i$  is labor market outcomes;  $\text{Ethnicity}_i$  is a vector of dummies indicating the individual's ethnicity;  $S_i$  is the individual's schooling level;  $\text{Post 1953}_i$  is a dummy variable with a value of 1 for cohorts born after 1953 whose tertiary education would have been affected by the NEP;  $\text{Post 1958}_i$  is a dummy variable with a value of 1 for cohorts born after 1958 whose secondary education would have been affected by the NEP;  $\text{Birth Cohort}_i$  is a series of integers indicating the individual's birth cohort, with 0 being the youngest pre-policy cohort; and  $X_i$  is a vector of controls. The interaction variables are interpreted in the following manner:  $\text{Ethnicity}_i * \text{Schooling}_i$  is the differential effect of education for a given ethnic group;  $\text{Ethnicity}_i * \text{Post 1953}_i$  and  $\text{Ethnicity}_i * \text{Post 1958}_i$  are the differential effects for

the post-policy birth cohorts of a given ethnic group;  $Schooling_i * Post\ 1953_i$  and  $Schooling_i * Post\ 1958_i$  are the differential effects of education for the post-policy birth cohorts;  $Ethnicity_i * Schooling_i * Post\ 1953_i$  and  $Ethnicity_i * Schooling_i * Post\ 1958_i$  are the differential effects of education for the post-policy birth cohorts of a given ethnic group;  $Ethnicity_i * Birth\ Cohort_i$  is the differential time trend for a given ethnic group. The omitted ethnic group is the Chinese, while the omitted schooling level is upper secondary. The main variables of interest are  $Malay * Tertiary * Post\ 1953$  which depicts the post-policy change in the Malay-Chinese gap among tertiary graduates, and  $Malay * Post\ 1958$  which depicts the post-policy change in the Malay-Chinese gap among secondary school graduates. Standard errors are adjusted for heteroskedasticity and clustered by birth cohort.

### **5.21 Education, Ethnicity, and Birth Cohort Effects on Wage Outcomes**

To study education, ethnicity, and birth cohort effects on wage outcomes, I turn to the 1992 and 1999 Household Income Surveys. I focus my analysis on males in Peninsular Malaysia for three reasons. First, as shown in Figure 2, 95 percent of males are employed, compared to 43 percent of females. Second, the male employment profile is similar across ethnic groups. Third, by focusing on males only, I avoid complexities arising from the gender wage gap which might vary across ethnic groups and over time.

I estimate equation (2) with log wages as the dependent variable. The NEP potentially affected wage outcomes through a variety of channels: education, hiring, and the awarding of government contracts and licenses. Since positive discrimination in employment and business opportunities affected all Malays regardless of birth cohort, to the degree that those effects are not correlated with educational attainment, those effects will be captured in the coefficient on *Malay*. Positive discrimination in tertiary education affected the post-1953 cohorts, denoted by the coefficient on  $Malay * Tertiary * Post\ 1953$ , while positive discrimination in secondary education affected the post-1958 cohorts, denoted by the coefficient on  $Malay * Post\ 1958$ .

Table 7.1 shows the results for the regressions on wages in 1999. While 96.0 percent of males are employed, wages are observed for only 71.8 percent of employed males. Of the sample of employed males, 75.2 percent are employees and 24.8 percent are self-employed. The likelihood of reporting wages is very different between employees and self-employed; 99.6 percent of employees report wages, versus 3.5 percent of self-employed. Hence, in addition to columns (1)-(3) which are limited to the sample of males for whom wages are observed, I consider two alternative procedures to correct for sample selection. Columns (4)-(6) use estimated selection probabilities as weights; the likelihood of observing wages conditional on sex, ethnicity, age, state, urban-rural location, and education is calculated, and the inverse of that likelihood is multiplied by the original weights. Columns (7)-(9) employ the Heckman correction methodology which assumes that the error terms are jointly normal.

Columns (1), (4), and (7) show that there are interethnic differences in wages; Malays and Indians earn less than Chinese. I control for education in columns (2), (5), and (8); the negative coefficient on Malay falls, but the negative coefficient on Indian rises. Columns (3), (6), and (9) control ethnicity, education, and policy cohorts. Due to the sample selection problem, and since the estimates for the weighted sample and Heckman correction methodologies are consistent, I focus on the latter two results in columns (6) and (9). Malay secondary school graduates earn between -0.526 and -0.634 less than their Chinese counterparts, and these estimates are statistically significant at the 1 percent level. The wage gap is consistent for all policy cohorts, as reflected by the non-statistically significant coefficients on *Malay \* Post 1953* and *Malay \* Post 1958*. These results indicate that the value of secondary school certification for Malays, relative to Chinese and Indians, did not deteriorate after the implementation of the NEP.

For Malay tertiary graduates, the weighted sample methodology in column (6) indicate that pre-policy cohorts earn 0.244 less than their Chinese counterparts; the post-1953 cohorts, however, earn 0.653 less than their Chinese counterparts, and the results are statistically significant at the 5 percent level. The Heckman correction methodology in column (9) yields estimated Malay-Chinese wage differentials of -0.313 for the pre-policy cohorts, and -0.553 for the post-1953 cohorts, although these results are



statistically significant only at the 10 percent level. The widening of the Malay-Chinese wage gap indicate that compared to pre-policy Malays, Malays who obtained tertiary education in the NEP era see a lower return to their education, relative to the Chinese.<sup>26</sup>

## **5.22 Education, Ethnicity, and Birth Cohort Effects on Employment Sector Outcomes**

I investigate the consequences of affirmative action in public sector hiring. I estimate equation (2) with employment in the public sector as the dependent variable. Table 8.1 reports the results for the 2000 PHC data. Column (1) estimates the ethnic effects, controlling for sex, geography, and birth cohort. Compared to the Chinese, Malays and Indians are 27.7 and 3.6 percentage points more likely to be employed in the public sector. Column (2) controls for schooling. Among secondary school graduates, Malays and Indians are 31.7 and 6.2 percentage points more likely to be employed in the public sector relative to their Chinese counterparts. For tertiary graduates, the likelihoods rise to 40.0 and 11.1 percentage points for the Malays and Indians, respectively, relative to the Chinese. Column (3) allows the likelihood of public sector employment to vary between pre-policy and post-policy secondary school graduates, and between pre-policy and post-policy tertiary graduates. Among secondary school graduates, the likelihood of being employed in the public sector, relative to the Chinese, is 29.3 percentage points for pre-policy Malays, and 37.1 percentage points for post-1953 Malays. Among tertiary graduates, that likelihood is 23.4 percentage points for pre-policy Malays, 31.2 percentage points for post-1953 Malays, and 43.2 percentage points for post-1958 Malays. Similarly, Malay secondary school and tertiary graduates are more likely than their Indian counterparts to be employed in the public sector, and that likelihood increases for the post-1953 cohorts relative to the pre-policy cohorts. These estimates are statistically significant at the 5 percent level.

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<sup>26</sup> As a further check, I estimate equation (2) on the 1992 HIS data; the results are shown in Table 7.2. Similar to the 1999 data, the Malay-Chinese wage differential among secondary school graduates is consistent across all policy cohorts. Among tertiary graduates, the Malay-Chinese wage gap rises from -0.059 for the pre-policy cohorts to -0.408 for the post-1953 cohorts according to the weighted sample methodology in column (6), and from -0.156 to -0.462 according to the Heckman correction methodology in column (9); these estimates are statistically significant only at the 10 percent level.

It would be informative to compare ethnic patterns in public sector employment pre-NEP and post-NEP. Unfortunately, employment sector is found only in the 2000 PHC data, and not in the 1970 PHC data. As shown in Table 5, over two-thirds of individuals employed in Public Administration and Defense and in Education in 2000 were in the public sector. Hence, I use Public Administration and Defense and Education as proxies for the public sector. Table 8.1, columns (4)-(6) and columns (7)-(9) report the results for employment in Public Administration and Defense and in Education, respectively, based on the 2000 PHC data. Table 8.2, columns (1)-(2) and columns (3)-(4) present the analogous results for the 1970 PHC data.

Table 8.1, columns (4) and (7) estimate the ethnic effects in 2000. Compared to the Chinese, Malays are 13.2 percentage points more likely to be employed in Public Administration and 6.6 percentage points more likely to be employed in Education, while Indians are 2.3 percentage points more likely to be employed in Public Administration and Defense, and 2.4 percentage points less likely to be employed in Education. Compare these likelihoods to the 1970 estimates, shown in Table 8.2, columns (1) and (3). In 1970, relative to the Chinese, Malays are 8.1 percentage points more likely to be employed in Public Administration and Defense and 3.1 percentage points less likely to be employed in Education. The corresponding likelihoods are 8.2 and -2.1 percentage points for the Indians. Within three decades, the Malays have come to dominate both the Public Administration and Defense and the Education sectors.

Ethnic patterns in employment sectors vary by education levels. Table 8.1, columns (5) and (8) show that in 2000, between the two industry sectors, Malay secondary school graduates are drawn to Public Administration and Defense, while Malay tertiary graduates are drawn to Education. Malay secondary school graduates are 19.0 and 14.6 percentage points more likely than their Chinese and Indian counterparts of being employed in Public Administration and Defense, while Malay tertiary graduates are 17.5 and 12.3 percentage points more likely than their Chinese and Indian counterparts of being employed in Education. Table 8.2, columns (2) and (4) show that in 1970, Malay secondary school graduates are 11.2 and 0.3 percentage points more likely than their Chinese and Indian counterparts of being employed

in Public Administration and Defense, while Malay tertiary graduates are 7.8 and 21.2 percentage points more likely to be employed in Education.

Ethnicity, education, and policy cohort effects are shown in Table 8.1, columns (6) and (9). Among secondary school graduates, Malay pre-policy cohorts are 14.9 percentage points more likely than their Chinese peers of being employed in Public Administration and Defense. This likelihood rises to 21.6 percentage points for the post-1953 cohorts. Among tertiary graduates, the likelihood of being employed in Education, relative to the Chinese, is 10.1 percentage points for pre-policy Malays, 12.3 percentage points for post-1953 Malays, and 15.4 percentage points for post-1958 Malays. These estimates are statistically significant at the 5 percent level. Clearly, the presence of Malays in the public sector is facilitated by Malay secondary school graduates in Public Administration and Defense, and Malay tertiary graduates in Education.

Next, I compare employment sector outcomes in upper-tier occupations.<sup>27</sup> Table 9 shows the results. The sample is limited to individuals who report an employment sector. Columns (1), (4), (7), and (10) depict the ethnic patterns. Compared to the Chinese, Malays are 0.8 percentage points more likely to be Legislators and Directors in the public sector, and 1.7 percentage points less likely to be Legislators and Directors in the private sector. Similarly, Malays are 0.8 percentage points less likely to be Non-Teaching Professionals in the public sector, and 1.9 percentage points less likely to be Non-Teaching Professionals in the private sector. The positive coefficients for Malays in the public sector and the negative coefficients for Malays in the private sector remain after controlling for education, as shown in columns (2), (5), (8), and (11). These estimates are statistically significant at the 1 percent level.

Columns (3), (6), (9), and (12) allow ethnicity and education effects to vary by policy cohorts. Among tertiary graduates, the likelihood of being employed as Legislators and Directors, relative to the Chinese, falls from 7.4 percentage points for the pre-policy Malays to 3.8 percentage points for the post-1958 Malays. The corresponding likelihood of being employed as Legislators and Directors in the private

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<sup>27</sup> Table A1 shows the distribution of upper-tier occupations by employment sectors. Since 93.2 percent of Managers are in the private sector (which includes individual/family enterprises), and 83.6 percent of Teaching Professionals are in the public sector, I examine only Legislators and Directors and Non-Teaching Professionals.

sector falls from -2.0 percentage points for the pre-policy Malays to -8.3 percentage points for the post-1953 Malays. Malay tertiary graduates are 2.8 percentage points more likely than their Chinese counterparts of being employed as Non-Teaching Professionals in the public sector, and this likelihood is constant across all policy cohorts. On the other hand, pre-1958 and post-1958 Malay tertiary graduates are 13.9 and 11.1 percentage points less likely than the Chinese to be employed as Non-Teaching Professionals in the private sector. These estimates are statistically significant at the 5 percent level, and suggest that the representation of Malays in upper-tier occupations is facilitated through the public sector.

### **5.23 Ethnicity, Tertiary Education, and Tertiary Institution Effects on Employment Sector Outcomes**

As shown in the model on the choice between the public sector and the private sector, preferential treatment in public sector hiring suggests that the beneficiaries positively select into the private sector. As I do not have data on examination results, I will test for positive selection in two ways by exploiting the fact that tertiary education is more heterogeneous than secondary education. First, as shown in Figure A1, degree programs take three to four years to complete, in addition to one to two years of pre-university studies, and are considered more rigorous than certificate and diploma programs which do not require pre-university studies and take only two to three years to complete.<sup>28</sup> If Malays positively select into the private sector, we should see Malays with degrees entering the private sector at higher rates than Malays with certificates and diplomas.

I limit the sample to individuals with tertiary education, and estimate the effects of ethnicity and tertiary education on employment outcomes:

$$E_i = \delta_0 + \delta_{1E} \cdot \text{Ethnicity}_i + \delta_{2S} \cdot \text{Schooling}_i + \delta_{3ES} \cdot \text{Ethnicity}_i * \text{Schooling}_i + \delta_4 \cdot X_i + \xi_i \quad (3)$$

where  $E_i$  is employment outcomes;  $\text{Ethnicity}_i$  is a vector of dummies indicating the individual's ethnicity;  $S_i$  is the individual's schooling; and  $X_i$  is a vector of controls. Standard errors are adjusted for

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<sup>28</sup> In 2000, 54.6 percent of Malay tertiary graduates, 57.5 percent of Chinese tertiary graduates, and 60.3 percent of Indian tertiary graduates were degree holders. The rest were certificate or diploma holders.

heteroskedasticity and clustered by birth cohort. The omitted ethnic group is the Chinese, while the omitted schooling level is certificates / diplomas.

The results are shown in Table 10. Column (1) suggests that degree holders are not significantly more likely than certificate or diploma holders to enter the private sector. However, column (2) indicates that although ethnic differences exist in the likelihood of being employed as Legislators and Directors in the private sector, within each ethnic group, degree holders are 6.5 percentage points more likely than certificate and diploma holders to be employed in that position in the private sector. Column (3) shows that Malays with tertiary education are 5.4 percentage points less likely than their Chinese and Indian counterparts to be employed as Non-Teaching Professionals in the private sector. However, degree holders from all ethnic groups are 13.5 percentage points more likely than their counterparts with certificates or diplomas to be Non-Teaching Professionals in the private sector. These estimates are statistically significant at the one percent level, and imply that degree holders are more likely than certificate and diploma holders to be employed in upper-tier occupations in the private sector.

Second, the 2000 data contains information on the type of tertiary institution attended—public, private, or overseas—for 85.0 percent of degree holders.<sup>29</sup> Overseas institutions are generally more highly esteemed than local public or private institutions. The government offers prestigious overseas scholarships to the most promising students, and these scholarships are largely reserved for the *Bumiputera*.<sup>30</sup> Therefore, Malays who attended overseas institutions are likely to be academically superior to Malays who attended local public or private institutions. Furthermore, employers perceive overseas graduates to be superior to local graduates (Quah et al., 2009). Positive selection into the private sector implies that within each ethnic group, overseas graduates have greater presence in the private sector compared to public university graduates.

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<sup>29</sup> Only 1.9 percent of certificate and diploma holders report their institution types as overseas institution while 21.6 percent of degree holders report their institution types as overseas institutions. Table A2 shows degree institution types by ethnicity.

<sup>30</sup> In 1995, out of an estimated 50,600 students enrolled in degree courses overseas, 18,300 students were sponsored by the government (*The Seventh Malaysia Plan*, 1996).

I limit the sample to degree holders, and estimate the effects of ethnicity and tertiary institution types on employment outcomes:

$$E_i = \lambda_0 + \lambda_{1E} \cdot Ethnicity_i + \lambda_{2T} \cdot Institution\ Type_i + \lambda_{3ET} \cdot Ethnicity_i * Institution\ Type_i + \lambda_4 \cdot X_i + v_i \quad (4)$$

where  $E_i$  is employment outcomes;  $Ethnicity_i$  is a vector of dummies indicating the individual's ethnicity;  $T_i$  is the individual's institution type; and  $X_i$  is a vector of controls. Standard errors are adjusted for heteroskedasticity and clustered by birth cohort. The omitted ethnic group is the Chinese, while the omitted institution type is public.

Table 11 shows the results. Column (1) indicates that Malays, Chinese, and Indians degree holders from public institutions enter the private sector at different rates; Malays are 34.7 and 20.9 percentage points less likely than Chinese and Indians, respectively, to be in the private sector. However, within each ethnic group, overseas graduates are 16.0 percentage points more likely to be employed in the private sector compared to their counterparts who graduated from public universities. Columns (2) and (3) show the probability of being employed as Legislators and Directors and as Non-Teaching Professionals in the private sector. For each ethnic group, overseas graduates are 8.3 percentage points more likely than public university graduates to be employed as Legislators and Directors in the private sector. The probability of overseas graduates being employed as Non-Teaching Professionals in the private sector, compared to public university graduates, is 4.7 percentage points for Malays and Chinese, and 18.8 percentage points for Indians.

Columns (4) and (5) show the probability of being employed in Public Administration and Defense and in Education. Malay overseas graduates are 7.0 percentage points less likely to be employed in Public Administration and Defense than Malay public university graduates. The corresponding likelihood for Chinese and Indian overseas graduates relative to their public university counterparts is -3.2 percentage points. Likewise, overseas graduates are less likely to be employed in Education compared to public university graduates; the estimated likelihood is -10.8 percentage points for the Malays and Chinese, and -19.2 for the Indians. These results indicate that overseas graduates of all three ethnic

groups are more likely to be employed in the private sector, and less likely to be employed in Public Administration and Defense and in Education.

#### **5.24 Education, Ethnicity, and Birth Cohort Effects on Wage Outcomes in Private Sector Industries**

The HIS data, although lacking information on employment sector, contains industry categories. As shown in Table 5, certain industries are more closely identified with the public sector, e.g., Education (69.4 percent), Public Administration and Defense (67.8 percent), Health and Social Work (52.7 percent), Electricity, Gas, and Water (20.3 percent).<sup>31</sup> In the rest of the industries, between 1.7 and 9.6 percent of employees report themselves as public sector employees.<sup>32</sup> I consider these industries to be private sector industries, and estimate equation (2) with log wages as the dependent variable on the sample of private sector industries.

The estimation results for the private sector industries in 1999 is shown in Table 12.1, and are analogous to the results for all industries shown in Table 7.1. Columns (1)-(3) are limited to the sample of males for whom wages are observed, columns (4)-(6) use estimated selection probabilities as weights, and columns (7)-(9) employ the Heckman correction methodology. The coefficients on *Tertiary* are higher in Table 12.1, the sample of private sector industries, compared to Table 12.2, the sample of all industries, indicating that returns to tertiary education relative to secondary education is higher in private sector industries. As in Table 7.1, the coefficients on *Malay* are negative and statistically significant. However, unlike in Table 7.1 where the coefficient on *Malay \* Tertiary \* Post 1953* is negative and statistically significant at the 5 percent level for the weighted sample methodology, and at the 10 percent level for the Heckman correction methodology, that same coefficient for the sample of private sector industries in Table 12.1 is not statistically significant. Furthermore, in Table 12.1, none of the

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<sup>31</sup> Including Electricity, Gas, and Water as a private sector industry does not fundamentally affect the results.

<sup>32</sup> These industries comprise Agriculture, Fishing, and Forestry; Mining; Manufacturing; Construction; Wholesale and Retail Trade; Hotels and Restaurants; Transportation and Communication; Financial Services and Insurance; Real Estate and Business Services; Other Services; Private Household Services; and Unknown.

coefficients on *Malay \* Post 1953*, *Malay \* Post 1958*, or *Malay \* Tertiary \* Post 1958* are statistically significant. While the Malay-Chinese wage gap widens for the post-1953 cohorts relative to the pre-policy cohorts in the sample of all industries in Table 7.1, the Malay-Chinese wage gap is not differentiable across policy cohorts in the sample of private sector industries in Table 12.1.<sup>33</sup> These results collectively imply that the overall increase in the racial wage gap amongst tertiary graduates is due to the greater representation of Malays in the public sector.

## 6 Conclusion

My analysis shows that capacity constraints in education dictate the type of affirmative action policies that are implemented, which in turn affect labor market outcomes. Affirmative action in secondary education did not unduly affect the relative earnings of the Malays and Chinese. However, quotas in capacity-constrained tertiary education resulted in different standards for different ethnic groups, and consequently, a widening of the Malay-Chinese wage gap for the post-policy cohorts.

Positive discrimination in public sector employment, in addition to affirmative action in education, has implications on selection into employment sectors, and consequently on wage outcomes. Malay tertiary graduates are more likely than their Chinese counterparts to be employed in the public sector; the likelihood varies across policy cohorts, from 23.4 percentage points for the pre-policy cohorts to 31.2 percentage points for the post-1953 cohorts to 43.2 percentage points for the post-1958 cohorts. Affirmative action in public sector employment likely intensified the positive selection of Malay tertiary graduates into the private sector. Malay degree holders are 6.5-13.5 percentage points more likely than Malay certificate or diploma holders to be employed in upper-tier occupations in the private sector, and Malay degree holders from overseas institutions are 16.0 percentage points more likely than Malay degree holders from local public institutions to enter the private sector. Subsequently, within private sector

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<sup>33</sup> The results for private sector industries in 1992, shown in Table 12.2, are analogous to the results for all industries in Table 7.2. The estimates suggest that within the private sector, the Malay-Chinese wage gap is either unchanged or may even be narrowing for both post-policy secondary school graduates as well as post-policy tertiary graduates, in contrast to the widening wage gap in the sample of all industries in Table 7.2.



industries, the Malay-Chinese wage gap among tertiary graduates is constant across policy cohorts. Positive selection into the private sector suggests that the public sector is propping up affirmative action in tertiary education by hiring graduates who might find it difficult to compete in the private sector.

The NEP is a challenging topic to study for several reasons. First, pro-*Bumiputera* policies existed even before the NEP. For example, the *Bahasa Malaysia* policy and the building of secondary schools implemented under the National Education Policy (1961) largely benefitted the Malays. Second, the NEP is not a one-time shock, but rather a shift in political ideology. Therefore, the effects of the NEP are not constrained to the span of a few years; on the contrary, positive discrimination policies continue to this day. Third, there are likely general equilibrium effects which are difficult to measure. The target group of the NEP was unusually large; the policy accorded preferential treatment to over half the population, implicitly discriminating against the rest. Increasing the stock of educated individuals could have had general equilibrium effects on the returns to education, which in turn, would affect individuals' educational choice. Moreover, the wide-ranging nature of the NEP, encompassing education, employment, business, and asset ownership, suggest that there are spillover effects in other aspects of life. The policy possibly impacted educational choice, occupational choice, and even how much effort to exert in school and at work. The NEP has been criticized for focusing on equality of outcomes, rather than on equality of opportunities. Preferential treatment for the *Bumiputera* might have the unintended consequence of removing incentives for the *Bumiputera* to work hard, and of spurring the non-*Bumiputera* to work even harder, as proposed by Coate and Loury (1993). Furthermore, the policy likely affected fertility and migration decisions.<sup>34</sup>

One caveat worth bearing in mind is that my analysis is constrained to individuals currently residing in Malaysia. I am unable to account for migration. Anecdotal evidence suggests that non-

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<sup>34</sup> In 1970, Malays comprised 47.1 percent of the population, indigenous peoples 8.5 percent, Chinese 33.9 percent, and Indians 9.0 percent. In 2000, the share of Malays and indigenous peoples had increased to 53.4 percent and 11.7 percent respectively, while the share of Chinese and Indians had shrunk to 26.0 percent and 7.7 percent respectively.

*Bumiputera* studying abroad are less likely to return than *Bumiputera*.<sup>35</sup> The departure of high ability non-*Bumiputera* from the country has strong implications for the aggregate effect of the NEP.

Furthermore, the fixation on wealth redistribution targets has engendered an unhealthy mix of business and politics. In addition to the distribution of government contracts and licenses, privatization opportunities are allocated by the government. The rampant and distortionary nature of nepotism and cronyism in business practices have been recognized as having hindered the country's development (Jomo, 2004).

This paper focused on the effect of the NEP on education outcomes, and the consequent education, ethnic, and birth cohort effects on labor market outcomes. There remain broader questions regarding the NEP's aggregate impact on the economy. The multi-faceted effects of the NEP would have to be considered carefully when assessing the gains in equity versus the losses in efficiency. Studying these topics will be the subject of future work.

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<sup>35</sup> Malott reports in *The Wall Street Journal* (Feb 8, 2011) "Almost 500,000 Malaysians left the country between 2007 and 2009, more than doubling the number of Malaysian professionals who live overseas. It appears that most were skilled ethnic Chinese and Indian Malaysians, tired of being treated as second-class citizens in their own country and denied the opportunity to compete on a level playing field, whether in education, business, or government. Many of these emigrants, as well as the many Malaysian students who study overseas and never return (again, most of whom are ethnic Chinese and Indian), have the business, engineering, and scientific skills that Malaysia needs for its future."

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**Table 1: Enrollment by Level of Education and Ethnicity**

	1970			1975			1980			1985		
	Bumiputera	Chinese	Indian	Bumiputera	Chinese	Indian	Bumiputera	Chinese	Indian	Bumiputera	Chinese	Indian
<i>Population distribution</i>	55.6%	33.9%	9.0%	57.1%	33.0%	8.8%	58.6%	32.1%	8.6%	60.1%	30.9%	8.4%
Primary	53.4%	36.0%	10.0%	55.2%	34.7%	9.6%	58.4%	32.2%	7.7%	61.0%	29.7%	7.6%
Lower Secondary	51.0%	38.8%	9.6%	54.4%	35.4%	9.7%	60.3%	30.0%	8.5%	65.2%	27.3%	5.7%
Upper Secondary	48.8%	43.4%	7.0%	60.7%	32.4%	6.2%	66.3%	27.0%	6.0%	68.1%	25.2%	6.0%
Pre-University	43.4%	49.6%	6.0%	54.0%	40.5%	4.9%	61.4%	32.9%	4.7%	56.9%	36.4%	5.8%
Certificate & Diploma	82.9%	15.5%	1.0%	85.4%	13.4%	1.0%	87.5%	10.9%	1.4%	88.0%	10.7%	1.2%
Degree	39.7%	49.2%	7.3%	57.2%	36.6%	5.2%	62.0%	31.2%	5.7%	63.0%	29.7%	6.5%

## Notes:

[1] The 1975 population distribution are estimated based on the 1970 and 1980 population distributions.

[2] Enrollment in Certificate & Diploma and Degree programs are limited to local public tertiary institutions and Tunku Abdul Rahman College (TARC), a private institution established by a political party, the Malaysian Chinese Association (MCA) and receiving minimal government support. The TARC share of Chinese enrollment in Certificate & Diploma programs was 64 percent in 1975, 53 percent in 1980, and 63 percent in 1985. The TARC share of Chinese enrollment in Degree programs was 25 percent in 1980 and 19 percent in 1985.

Sources: Population and Housing Census of Malaysia, 1970; *The Third Malaysia Plan*, 1976; *The Fifth Malaysia Plan*, 1986.

**Table 2: Growth in Enrollment at Various Levels of Education**

	1970			1975			1980			1985		
	Total Enrollment	Bumiputera Enrollment	Non-Bumiputera Enrollment	Total Enrollment	Bumiputera Enrollment	Non-Bumiputera Enrollment	Total Enrollment	Bumiputera Enrollment	Non-Bumiputera Enrollment	Total Enrollment	Bumiputera Enrollment	Non-Bumiputera Enrollment
Primary	1,421,469	759,064	662,405	1,586,909	875,975	710,934	2,008,587	1,173,015	835,572	2,191,676	1,336,922	854,754
Lower Secondary	378,535	193,054	185,481	561,471	305,700	255,771	809,406	488,072	321,334	914,434	596,211	318,223
<i>Percent of Primary Enrollment</i>	26.6%	25.4%	28.0%	35.4%	34.9%	36.0%	40.3%	41.6%	38.5%	41.7%	44.6%	37.2%
Upper Secondary	89,400	43,627	45,773	167,109	101,486	65,623	247,039	163,787	83,252	329,950	224,696	105,254
<i>Percent of Lower Secondary Enrollment</i>	23.6%	22.6%	24.7%	29.8%	33.2%	25.7%	30.5%	33.6%	25.9%	36.1%	37.7%	33.1%
Certificate & Diploma	3,457	2,865	592	13,547	11,579	1,968	14,865	13,055	1,810	31,924	28,194	3,730
<i>Percent of Upper Secondary Enrollment</i>	3.9%	6.6%	1.3%	8.1%	11.4%	3.0%	6.0%	8.0%	2.2%	9.7%	12.5%	3.5%
Degree	8,148	3,237	4,911	14,254	8,153	6,101	21,944	13,605	8,339	37,838	23,838	14,000
<i>Percent of Upper Secondary Enrollment</i>	9.1%	7.4%	10.7%	8.5%	8.0%	9.3%	8.9%	8.3%	10.0%	11.5%	10.6%	13.3%

Note:

[1] Enrollment in Certificate & Diploma and Degree programs are limited to local public tertiary institutions and Tunku Abdul Rahman College (TARC), a private institution established by a political party, the Malaysian Chinese Association (MCA) and receiving minimal government support. The TARC share of non-Bumiputera enrollment in Certificate & Diploma programs was 61 percent in 1975, 62 percent in 1980, and 57 percent in 1985. The TARC share of non-Bumiputera enrollment in Degree programs was 21 percent in 1980 and 15 percent in 1985.

Sources: Population and Housing Census of Malaysia, 1970; *The Third Malaysia Plan*, 1976; *The Fifth Malaysia Plan*, 1986.

**Table 3: Expansion of the Public Sector***Panel A: Growth in Public Expenditure Budgets in the 5-year Malaysia Plans*

	<b>1966-1970</b>	<b>1971-1975</b>	<b>1976-1980</b>	<b>1981-1985</b>
RM billion	4.6	10.3	31.1	48.9
Percent of GDP	8.7%	11.3%	15.7%	14.1%

*Panel B: Growth in the Number of Public Enterprises by Industry Category*

	<b>1965</b>	<b>1970</b>	<b>1975</b>	<b>1980</b>	<b>1985</b>
Agriculture	5	10	38	83	127
Building and Construction	9	9	33	65	121
Extractive Industries	1	3	6	25	30
Finance	9	17	50	78	116
Manufacturing	11	40	132	212	289
Services	6	13	76	148	258
Transport	13	17	27	45	63
Others	0	0	0	0	6
<b>Total</b>	<b>54</b>	<b>109</b>	<b>362</b>	<b>656</b>	<b>1,010</b>

*Panel C: Growth in Public Sector Employment (Excluding Military and Police Personnel)*

	<b>1970</b>	<b>1983</b>
Number of public sector employees	139,467	521,818

Sources: *The First Malaysia Plan*, 1966; *The Second Malaysia Plan*, 1971; *The Third Malaysia Plan*, 1976; *The Fourth Malaysia Plan*, 1981; Mohamed, 1995; Mehmet, 1986.



**Table 4: Descriptive Statistics of the Data***Panel A: Population and Housing Census*

	1970			2000		
	Malay	Chinese	Indian	Malay	Chinese	Indian
Number of Observations	24,889	16,489	5,154	69,301	36,554	12,112
Share of Sample by Ethnicity	53.5%	35.4%	11.1%	58.7%	31.0%	10.3%
Share of Ethnic Group in Urban Areas	22.5%	72.5%	48.9%	56.4%	88.0%	80.5%
<u>Education (by Share of Ethnic Group)</u>						
Lower Secondary Education or Higher	6.4%	17.1%	17.4%	70.3%	62.9%	60.5%
Upper Secondary Education or Higher	3.3%	10.0%	10.5%	51.2%	40.3%	34.0%
Tertiary Education	0.3%	1.0%	1.0%	11.5%	11.6%	7.7%
Tertiary Education from a Public Institution				7.4%	3.6%	3.1%
<u>Employment (by Share of Ethnic Group)</u>						
Share of Males Employed	90.9%	91.1%	89.4%	94.6%	94.5%	94.4%
Share of Males Employed in the Public Sector				23.0%	2.2%	9.2%
Share of Females Employed	41.4%	32.6%	39.6%	41.7%	44.9%	49.2%
Share of Females Employed in the Public Sector				12.9%	3.6%	4.6%

*Panel B: Household Income Survey*

	1992			1999		
	Bumiputera	Chinese	Indian	Bumiputera	Chinese	Indian
Number of Observations	10,671	6,268	1,836	7,762	4,225	1,313
Share of Sample by Ethnicity	56.5%	33.6%	9.9%	57.3%	32.5%	10.2%
Share of Ethnic Group in Urban Areas	47.6%	80.4%	68.6%	45.8%	76.4%	66.2%
<u>Education (by Share of Ethnic Group)</u>						
Lower Secondary Education or Higher	49.9%	42.2%	42.6%	63.5%	55.2%	56.5%
Upper Secondary Education or Higher	36.8%	29.6%	25.5%	48.2%	39.8%	35.8%
Tertiary Education	8.4%	7.4%	5.3%	11.0%	11.1%	8.1%
<u>Employment (by Share of Ethnic Group)</u>						
Share of Males Employed	96.5%	95.6%	95.9%	96.3%	95.8%	95.4%
Share of Males with Wage Data	74.3%	68.0%	84.0%	72.0%	68.0%	83.0%
Mean Log(Wage) for Males	9.07	9.47	9.11	9.56	9.97	9.65
Share of Females Employed	39.6%	41.8%	49.9%	42.4%	45.5%	48.0%
Share of Females with Wage Data	31.5%	33.7%	47.3%	35.1%	38.6%	45.0%
Mean Log(Wage) for Females	8.90	9.12	8.62	9.38	9.67	9.19

Notes:

[1] Each sample is restricted to 26-54 year olds in Peninsular Malaysia.

[2] The Household Income Survey data are 30 percent weighted samples provided by the Economic Planning Unit of Malaysia. Shares are calculated using the weights provided.

Sources: Population and Housing Census of Malaysia, 1970; Population and Housing Census of Malaysia, 2000; Household Income Survey of Malaysia, 1992; Household Income Survey of Malaysia, 1999.

**Table 5: Industry Category and Employment Sector  
(2000 Population and Housing Census)**

	Public Sector	Private Sector	Individual or Family	Unknown	Total
Agriculture, Fishing, and Forestry	345 2.6%	3,081 23.1%	9,193 69.0%	707 5.3%	13,326 100.0%
Mining	10 3.3%	238 78.5%	34 11.2%	21 6.9%	303 100.0%
Manufacturing	387 2.2%	13,495 75.3%	2,843 15.9%	1,204 6.7%	17,929 100.0%
Electricity, Gas, and Water	204 20.3%	664 66.2%	82 8.2%	53 5.3%	1,003 100.0%
Construction	130 1.9%	3,622 54.0%	2,605 38.8%	353 5.3%	6,710 100.0%
Wholesale and Retail Trade	196 1.7%	4,967 42.8%	5,707 49.1%	743 6.4%	11,613 100.0%
Hotels and Restaurants	96 1.9%	2,083 40.7%	2,650 51.7%	295 5.8%	5,124 100.0%
Transportation and Communication	336 4.9%	4,442 65.4%	1,611 23.7%	402 5.9%	6,791 100.0%
Financial Services and Insurance	278 7.8%	2,705 76.0%	332 9.3%	242 6.8%	3,557 100.0%
Public Administration and Defense	8,396 67.8%	2,513 20.3%	818 6.6%	651 5.3%	12,378 100.0%
Real Estate and Business Services	199 5.7%	2,427 69.4%	652 18.6%	218 6.2%	3,496 100.0%
Education	5,690 69.4%	1,592 19.4%	445 5.4%	470 5.7%	8,197 100.0%
Health and Social Work	1,403 52.7%	819 30.7%	279 10.5%	163 6.1%	2,664 100.0%
Other Services	161 9.6%	952 56.9%	443 26.5%	116 6.9%	1,672 100.0%
Private Household Services	19 3.2%	264 44.1%	215 35.9%	101 16.9%	599 100.0%
Unknown	129 4.0%	1,678 52.3%	1,174 36.6%	228 7.1%	3,209 100.0%
<i>Total</i>	17,979 18.2%	45,542 46.2%	29,083 29.5%	5,967 6.1%	98,571 100.0%

Note:

[1] The sample is restricted to 26-54 year old employed individuals in Peninsular Malaysia.

Source: Population and Housing Census, 2000.

**Table 6.1: Ethnicity and Birth Cohort Effects on Secondary Education  
(2000 Population and Housing Census Data)**

	Lower Secondary Education or Higher		Upper Secondary Education or Higher	
	(1)	(2)	(3)	(4)
Constant	0.565 *** (0.014)	0.481 *** (0.014)	0.339 *** (0.008)	0.284 *** (0.015)
Malay	0.073 *** (0.009)	0.166 *** (0.009)	0.086 *** (0.011)	0.162 *** (0.010)
Indian	-0.059 *** (0.018)	-0.065 *** (0.015)	-0.090 *** (0.011)	-0.093 *** (0.009)
Post	0.006 (0.016)	-0.006 (0.011)	0.008 (0.011)	0.001 (0.011)
Malay * Post	0.053 *** (0.018)	0.048 ** (0.018)	0.058 *** (0.019)	0.057 *** (0.017)
Indian * Post	0.043 * (0.024)	0.032 (0.020)	0.049 *** (0.017)	0.039 *** (0.014)
Birth cohort * Pre	0.018 *** (0.002)	0.015 *** (0.001)	0.010 *** (0.001)	0.008 *** (0.001)
Malay * Birth cohort * Pre	0.014 *** (0.001)	0.014 *** (0.001)	0.014 *** (0.001)	0.013 *** (0.001)
Indian * Birth cohort * Pre	-0.008 *** (0.003)	-0.006 *** (0.002)	-0.007 *** (0.002)	-0.005 *** (0.002)
Birth cohort * Post	0.017 *** (0.001)	0.017 *** (0.001)	0.014 *** (0.001)	0.013 *** (0.001)
Malay * Birth cohort * Post	-0.001 (0.002)	-0.003 * (0.001)	0.002 (0.002)	0.000 (0.002)
Indian * Birth cohort * Post	-0.001 (0.001)	-0.001 (0.001)	-0.003 ** (0.001)	-0.003 ** (0.001)
Controls	No	Yes	No	Yes
R <sup>2</sup>	0.146	0.231	0.107	0.193
Number of observations	119,703	119,703	119,703	119,703

Notes:

[1] The sample is restricted to 26-54 year olds in Peninsular Malaysia.

[2] The omitted ethnic group is the Chinese. Controls comprise sex, ethnicity\*sex, urban-rural location, state of residence, district of residence, state of birth, and birth cohort fixed effects.

[3] Post is a dummy variable with a value of 1 for the 1959-1974 birth cohorts.

[4] Standard errors are in parentheses, and are robust and clustered by birth cohort.

[5] \*\*\* denotes statistical significance at the 1 percent level; \*\* at the 5 percent level; and \* at the 10 percent level.

Source: Population and Housing Census of Malaysia, 2000.

**Table 6.2: Ethnicity and Birth Cohort Effects on Tertiary Education  
(2000 Population and Housing Census Data)**

	Certificates/Diplomas/Degrees		Certificates/Diplomas/Degrees from Public Institutions		Degrees		Degrees from Public Institutions	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.063 *** (0.003)	0.024 *** (0.006)	0.025 *** (0.003)	0.016 *** (0.003)	0.043 *** (0.004)	0.006 (0.004)	0.018 *** (0.003)	0.005 * (0.002)
Malay	0.006 *** (0.002)	0.033 *** (0.003)	0.016 *** (0.002)	0.022 *** (0.003)	-0.002 (0.003)	0.020 *** (0.003)	0.003 * (0.002)	0.010 *** (0.002)
Indian	-0.022 *** (0.008)	-0.014 * (0.007)	-0.010 *** (0.003)	-0.005 (0.003)	-0.012 (0.009)	-0.002 (0.008)	-0.003 (0.004)	0.001 (0.004)
Post	-0.006 (0.006)	-0.006 (0.004)	-0.006 (0.004)	-0.011 *** (0.002)	-0.002 (0.006)	-0.001 (0.003)	-0.005 (0.004)	-0.006 *** (0.001)
Malay * Post	0.008 (0.005)	0.011 ** (0.005)	0.012 *** (0.003)	0.014 *** (0.003)	0.002 (0.005)	0.004 (0.004)	0.010 *** (0.002)	0.011 *** (0.002)
Indian * Post	0.020 (0.012)	0.019 * (0.010)	0.014 *** (0.004)	0.013 *** (0.004)	0.010 (0.011)	0.009 (0.009)	0.006 (0.005)	0.005 (0.005)
Birth cohort * Pre	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.002 *** (0.000)	0.002 ** (0.001)	0.002 *** (0.000)	0.001 (0.001)	0.002 *** (0.000)
Malay * Birth cohort * Pre	0.003 *** (0.001)	0.003 * (0.001)	0.002 *** (0.000)	0.002 *** (0.000)	0.001 (0.001)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)
Indian * Birth cohort * Pre	-0.003 (0.002)	-0.002 (0.002)	-0.001 (0.001)	-0.001 (0.001)	-0.003 (0.002)	-0.002 (0.002)	0.000 (0.001)	0.000 (0.001)
Birth cohort * Post	0.006 *** (0.000)	0.006 *** (0.000)	0.002 *** (0.000)	0.002 *** (0.000)	0.003 *** (0.000)	0.002 *** (0.000)	0.001 *** (0.000)	0.001 *** (0.000)
Malay * Birth cohort * Post	-0.001 *** (0.000)	-0.002 *** (0.000)	0.001 *** (0.000)	0.001 *** (0.000)	-0.001 * (0.000)	-0.001 *** (0.000)	0.000 ** (0.000)	0.000 (0.000)
Indian * Birth cohort * Post	-0.004 *** (0.001)	-0.004 *** (0.001)	-0.001 *** (0.000)	-0.001 *** (0.000)	-0.002 *** (0.000)	-0.002 *** (0.000)	0.000 *** (0.000)	0.000 *** (0.000)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
R <sup>2</sup>	0.018	0.076	0.016	0.042	0.007	0.052	0.006	0.026
Number of observations	119,703	119,703	119,703	119,703	119,703	119,703	119,703	119,703

Notes:

[1] The sample is restricted to 26-54 year olds in Peninsular Malaysia.

[2] The omitted ethnic group is the Chinese. Controls comprise sex, ethnicity\*sex, urban-rural location, state of residence, district of residence, state of birth, and birth cohort fixed effects.

[3] Post is a dummy variable with a value of 1 for the 1954-1974 birth cohorts.

[4] Standard errors are in parentheses, and are robust and clustered by birth cohort.

[5] \*\*\* denotes statistical significance at the 1 percent level; \*\* at the 5 percent level; and \* at the 10 percent level.

Source: Population and Housing Census of Malaysia, 2000.

**Table 7.1: Education, Ethnicity, and Birth Cohort Effects on Wage Outcomes  
(1999 Household Income Survey Data)**

	Sample of Observed Wages			Weighted Sample of Observed Wages			Heckman Correction		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	9.987 *** (0.054)	10.190 *** (0.065)	10.050 *** (0.085)	9.920 *** (0.060)	10.160 *** (0.069)	10.080 *** (0.087)	10.650 *** (0.229)	10.890 *** (0.156)	10.530 *** (0.258)
Malay	-0.237 *** (0.028)	-0.305 *** (0.039)	-0.456 *** (0.082)	-0.219 *** (0.033)	-0.308 *** (0.041)	-0.526 *** (0.088)	-0.437 *** (0.070)	-0.621 *** (0.078)	-0.634 *** (0.123)
Indian	-0.300 *** (0.039)	-0.169 *** (0.057)	-0.059 (0.091)	-0.256 *** (0.042)	-0.160 *** (0.053)	-0.115 (0.093)	-0.589 *** (0.112)	-0.474 *** (0.084)	-0.325 * (0.175)
Tertiary		0.731 *** (0.048)	0.715 *** (0.080)		0.742 *** (0.054)	0.666 *** (0.076)		0.440 *** (0.077)	0.522 *** (0.125)
Malay * Tertiary		-0.026 (0.047)	0.186 (0.128)		-0.026 (0.050)	0.282 ** (0.122)		0.081 (0.049)	0.321 ** (0.135)
Indian * Tertiary		-0.153 (0.104)	-0.333 (0.219)		-0.161 (0.102)	-0.291 (0.235)		0.178 (0.120)	-0.100 (0.267)
Post 1953			0.267 ** (0.100)			0.213 * (0.121)			0.199 * (0.112)
Malay * Post 1953			0.060 (0.092)			0.168 (0.112)			0.059 (0.095)
Indian * Post 1953			-0.166 (0.139)			-0.041 (0.156)			-0.131 (0.150)
Tertiary * Post 1953			0.085 (0.120)			0.189 (0.137)			0.008 (0.127)
Malay * Tertiary * Post 1953			-0.249 * (0.139)			-0.409 *** (0.145)			-0.240 * (0.139)
Indian * Tertiary * Post 1953			-0.043 (0.293)			-0.185 (0.320)			0.165 (0.295)
Post 1958			-0.129 (0.082)			-0.155 (0.108)			-0.188 ** (0.086)
Malay * Post 1958			0.150 * (0.085)			0.129 (0.107)			0.124 (0.085)
Indian * Post 1958			0.033 (0.127)			-0.002 (0.138)			0.141 (0.142)
Tertiary * Post 1958			-0.096 (0.109)			-0.134 (0.135)			0.050 (0.133)
Malay * Tertiary * Post 1958			0.018 (0.073)			0.073 (0.093)			-0.108 (0.095)
Indian * Tertiary * Post 1958			0.319 (0.234)			0.418 (0.252)			-0.001 (0.290)
R <sup>2</sup>	0.229	0.485	0.494	0.252	0.486	0.496	0.231	0.488	0.495
Number of observations	4,818	4,818	4,818	4,818	4,818	4,818	4,818	4,818	4,818

Notes:

[1] The sample is restricted to 26-54 year old employed males in Peninsular Malaysia.

[2] The omitted ethnic group is the Chinese. Education levels are primary, lower secondary, upper secondary, post-secondary, and tertiary. The omitted education level is upper secondary. Controls comprise birth cohort, ethnicity\*birth cohort, urban-rural location, state of residence, and birth cohort fixed effects.

[3] Standard errors are in parentheses, and are robust and clustered by birth cohort.

[4] \*\*\* denotes statistical significance at the 1 percent level; \*\* at the 5 percent level; and \* at the 10 percent level.

Source: Household Income Survey of Malaysia, 1999.

**Table 7.2: Education, Ethnicity, and Birth Cohort Effects on Wage Outcomes  
(1992 Household Income Survey Data)**

	Sample of Observed Wages			Weighted Sample of Observed Wages			Heckman Correction		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	9.524 *** (0.068)	9.767 *** (0.048)	9.469 *** (0.071)	9.525 *** (0.070)	9.798 *** (0.057)	9.458 *** (0.079)	9.992 *** (0.147)	10.150 *** (0.102)	9.604 *** (0.122)
Malay	-0.172 *** (0.017)	-0.295 *** (0.035)	-0.413 *** (0.087)	-0.161 *** (0.019)	-0.293 *** (0.037)	-0.351 *** (0.090)	-0.379 *** (0.071)	-0.486 *** (0.062)	-0.490 *** (0.100)
Indian	-0.309 *** (0.029)	-0.228 *** (0.048)	-0.355 *** (0.117)	-0.282 *** (0.030)	-0.231 *** (0.051)	-0.318 ** (0.121)	-0.543 *** (0.085)	-0.369 *** (0.063)	-0.437 *** (0.133)
Tertiary		0.543 *** (0.053)	0.409 *** (0.075)		0.549 *** (0.053)	0.420 *** (0.081)		0.319 *** (0.080)	0.349 *** (0.086)
Malay * Tertiary		0.154 ** (0.069)	0.306 *** (0.085)		0.145 ** (0.070)	0.292 *** (0.089)		0.232 *** (0.072)	0.334 *** (0.086)
Indian * Tertiary		0.185 * (0.106)	0.290 (0.194)		0.189 * (0.110)	0.285 (0.196)		0.443 *** (0.135)	0.413 * (0.225)
Post 1953			0.309 *** (0.088)			0.377 *** (0.100)			0.298 *** (0.090)
Malay * Post 1953			0.202 * (0.108)			0.160 (0.116)			0.205 * (0.109)
Indian * Post 1953			0.136 (0.129)			0.106 (0.138)			0.192 (0.141)
Tertiary * Post 1953			0.266 * (0.143)			0.243 (0.150)			0.211 (0.146)
Malay * Tertiary * Post 1953			-0.355 * (0.175)			-0.349 * (0.179)			-0.306 * (0.179)
Indian * Tertiary * Post 1953			-0.388 (0.304)			-0.385 (0.313)			-0.447 (0.315)
Post 1958			-0.067 (0.076)			-0.099 (0.083)			-0.053 (0.077)
Malay * Post 1958			0.001 (0.087)			-0.037 (0.094)			0.014 (0.086)
Indian * Post 1958			0.038 (0.107)			0.019 (0.117)			0.032 (0.108)
Tertiary * Post 1958			-0.145 (0.143)			-0.120 (0.146)			-0.095 (0.145)
Malay * Tertiary * Post 1958			0.204 (0.184)			0.193 (0.187)			0.133 (0.193)
Indian * Tertiary * Post 1958			0.397 (0.261)			0.388 (0.272)			0.408 (0.262)
R <sup>2</sup>	0.224	0.457	0.472	0.248	0.453	0.468	0.226	0.459	0.473
Number of observations	7,189	7,189	7,189	7,189	7,189	7,189	7,189	7,189	7,189

Notes:

[1] The sample is restricted to 26-54 year old employed males in Peninsular Malaysia.

[2] The omitted ethnic group is the Chinese. Education levels are primary, lower secondary, upper secondary, post-secondary, and tertiary. The omitted education level is upper secondary. Controls comprise birth cohort, ethnicity\*birth cohort, urban-rural location, state of residence, and birth cohort fixed effects.

[3] Standard errors are in parentheses, and are robust and clustered by birth cohort.

[4] \*\*\* denotes statistical significance at the 1 percent level; \*\* at the 5 percent level; and \* at the 10 percent level.

Source: Household Income Survey of Malaysia, 1992.

**Table 8.1: Education, Ethnicity, and Birth Cohort Effects on Employment Sector Outcomes  
(2000 Population and Housing Census Data)**

	Public Sector			Public Administration & Defense			Education		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	0.060 *** (0.011)	0.080 *** (0.010)	0.084 *** (0.014)	0.049 *** (0.010)	0.068 *** (0.010)	0.079 *** (0.013)	0.100 *** (0.006)	0.113 *** (0.006)	0.128 *** (0.008)
Malay	0.277 *** (0.010)	0.317 *** (0.011)	0.293 *** (0.023)	0.132 *** (0.007)	0.190 *** (0.009)	0.149 *** (0.012)	0.066 *** (0.005)	0.026 *** (0.004)	0.016 ** (0.007)
Indian	0.036 *** (0.009)	0.062 *** (0.011)	0.041 * (0.020)	0.023 *** (0.005)	0.044 *** (0.007)	0.034 (0.022)	-0.024 *** (0.006)	-0.009 (0.007)	-0.011 (0.016)
Tertiary		0.130 *** (0.013)	0.254 *** (0.018)		0.032 *** (0.005)	0.051 *** (0.014)		0.151 *** (0.010)	0.206 *** (0.023)
Malay * Tertiary		0.083 *** (0.020)	-0.059 ** (0.028)		-0.102 *** (0.014)	-0.115 *** (0.021)		0.149 *** (0.009)	0.085 *** (0.023)
Indian * Tertiary		0.049 ** (0.023)	-0.136 ** (0.059)		-0.028 * (0.014)	-0.108 *** (0.034)		0.052 *** (0.014)	0.019 (0.030)
Post 1953			0.028 * (0.016)			0.011 (0.011)			-0.028 *** (0.007)
Malay * Post 1953			0.078 *** (0.027)			0.067 *** (0.017)			0.022 *** (0.008)
Indian * Post 1953			0.019 (0.028)			0.028 (0.025)			0.006 (0.018)
Tertiary * Post 1953			-0.088 *** (0.022)			-0.024 (0.018)			-0.031 (0.025)
Malay * Tertiary * Post 1953			0.057 (0.043)			-0.002 (0.030)			0.045 * (0.025)
Indian * Tertiary * Post 1953			0.095 (0.069)			0.090 * (0.044)			-0.034 (0.053)
Post 1958			0.007 (0.012)			-0.008 (0.008)			0.010 * (0.005)
Malay * Post 1958			-0.044 * (0.025)			-0.004 (0.018)			-0.011 * (0.006)
Indian * Post 1958			0.017 (0.027)			-0.017 (0.020)			-0.006 (0.014)
Tertiary * Post 1958			-0.059 *** (0.019)			0.003 (0.013)			-0.036 ** (0.014)
Malay * Tertiary * Post 1958			0.120 *** (0.037)			0.020 (0.026)			0.031 ** (0.014)
Indian * Tertiary * Post 1958			0.132 *** (0.043)			0.002 (0.032)			0.085 * (0.045)
R <sup>2</sup>	0.126	0.213	0.217	0.080	0.101	0.103	0.059	0.182	0.183
Number of observations	77,600	77,600	77,600	79,380	79,380	79,380	79,380	79,380	79,380

Notes:

[1] The sample is restricted to 26-54 year old employed individuals in Peninsular Malaysia. Specifications (1)-(3) restricts the sample to individuals who reported their employment sector. Specifications (4)-(6) restricts the sample to individuals who reported their industry category.

[2] The omitted ethnic group is the Chinese. Education levels are primary, lower secondary, upper secondary, post-secondary, and tertiary. The omitted education level is upper secondary. Controls comprise birth cohort, ethnicity\*birth cohort, sex, ethnicity\*sex, urban-rural location, state of residence, district of residence, state of birth, and birth cohort fixed effects.

[3] Standard errors are in parentheses, and are robust and clustered by birth cohort.

[4] \*\*\* denotes statistical significance at the 1 percent level; \*\* at the 5 percent level; and \* at the 10 percent level.

Source: Population and Housing Census of Malaysia, 2000.

**Table 8.2: Education, Ethnicity, and Birth Cohort Effects on Employment Sector Outcomes  
(1970 Population and Housing Census Data)**

	Public Administration & Defense		Education	
	(1)	(2)	(3)	(4)
Constant	-0.004 (0.007)	0.035 *** (0.012)	0.151 *** (0.013)	0.405 *** (0.024)
Malay	0.081 *** (0.005)	0.147 *** (0.018)	-0.031 *** (0.006)	0.078 ** (0.030)
Indian	0.082 *** (0.008)	0.144 *** (0.028)	-0.021 * (0.011)	-0.134 *** (0.032)
Tertiary		0.033 (0.028)		0.115 (0.077)
Malay * Tertiary		-0.039 (0.060)		-0.141 (0.097)
Indian * Tertiary		-0.167 ** (0.065)		-0.009 (0.123)
R <sup>2</sup>	0.106	0.120	0.041	0.207
Number of observations	28,756	28,756	28,756	28,756

Notes:

- [1] The sample is restricted to 26-54 year old employed individuals in Peninsular Malaysia who reported their industry category.  
[2] The omitted ethnic group is the Chinese. Education levels are primary, lower secondary, upper secondary, post-secondary, and tertiary. The omitted education level is upper secondary. Controls comprise birth cohort, ethnicity\*birth cohort, sex, ethnicity\*sex, urban-rural location, state of residence, district of residence, state of birth, and birth cohort fixed effects.  
[3] Standard errors are in parentheses, and are robust and clustered by birth cohort.  
[4] \*\*\* denotes statistical significance at the 1 percent level; \*\* at the 5 percent level; and \* at the 10 percent level.  
Source: Population and Housing Census of Malaysia, 1970.



**Table 9: Education, Ethnicity, and Birth Cohort Effects on Employment Sector Outcomes in Upper-Tier Occupations  
(2000 Population and Housing Census Data)**

	Legislators & Directors						Professionals (Non-Teaching)					
	Public			Private			Public			Private		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	-0.001 (0.001)	0.000 (0.001)	0.003 (0.002)	0.024 *** (0.004)	0.020 *** (0.005)	0.008 (0.008)	0.003 (0.002)	0.002 (0.002)	-0.001 (0.003)	0.031 *** (0.004)	0.004 (0.005)	0.027 *** (0.007)
Malay	0.008 *** (0.001)	0.006 *** (0.001)	0.005 * (0.003)	-0.017 *** (0.003)	-0.021 *** (0.004)	-0.020 ** (0.008)	0.008 *** (0.001)	0.003 *** (0.001)	0.003 (0.003)	-0.019 *** (0.003)	-0.013 *** (0.003)	-0.019 *** (0.006)
Indian	0.000 (0.001)	-0.001 (0.001)	-0.004 * (0.002)	-0.029 *** (0.004)	-0.016 *** (0.005)	-0.017 (0.015)	0.004 *** (0.001)	0.002 * (0.001)	0.004 (0.004)	-0.019 *** (0.005)	-0.004 (0.005)	-0.024 ** (0.010)
Tertiary		0.005 ** (0.002)	0.024 (0.014)		0.152 *** (0.009)	0.116 *** (0.017)		0.014 *** (0.002)	0.026 *** (0.008)		0.225 *** (0.013)	0.166 *** (0.008)
Malay * Tertiary		0.021 *** (0.004)	0.074 *** (0.021)		-0.080 *** (0.008)	-0.037 * (0.021)		0.027 *** (0.003)	0.028 *** (0.009)		-0.102 *** (0.009)	-0.120 *** (0.009)
Indian * Tertiary		0.005 (0.004)	-0.003 (0.028)		-0.066 *** (0.012)	-0.073 ** (0.029)		0.025 *** (0.009)	0.003 (0.017)		0.006 (0.017)	0.104 * (0.051)
Post 1953			-0.004 ** (0.002)			0.016 (0.010)			0.006 *** (0.002)			-0.010 (0.008)
Malay * Post 1953			-0.001 (0.003)			0.010 (0.011)			0.002 (0.003)			-0.010 (0.009)
Indian * Post 1953			0.003 (0.002)			0.008 (0.016)			0.003 (0.005)			-0.013 (0.014)
Tertiary * Post 1953			-0.019 (0.015)			0.074 *** (0.020)			-0.013 (0.008)			0.017 (0.017)
Malay * Tertiary * Post 1953			-0.026 (0.022)			-0.063 ** (0.027)			-0.012 (0.012)			0.010 (0.019)
Indian * Tertiary * Post 1953			0.008 (0.029)			0.021 (0.032)			-0.004 (0.026)			-0.127 ** (0.054)
Post 1958			0.000 (0.001)			0.021 ** (0.009)			0.001 (0.001)			-0.037 *** (0.008)
Malay * Post 1958			0.002 (0.002)			-0.020 * (0.011)			-0.001 (0.002)			0.028 *** (0.009)
Indian * Post 1958			0.002 (0.002)			-0.010 (0.009)			-0.005 (0.005)			0.050 *** (0.014)
Tertiary * Post 1958			-0.003 (0.003)			-0.038 ** (0.016)			-0.001 (0.004)			0.058 ** (0.022)
Malay * Tertiary * Post 1958			-0.036 *** (0.005)			0.018 (0.019)			0.014 (0.009)			0.009 (0.020)
Indian * Tertiary * Post 1958			0.001 (0.008)			-0.016 (0.020)			0.034 (0.022)			0.019 (0.026)
R <sup>2</sup>	0.008	0.023	0.038	0.041	0.092	0.093	0.008	0.028	0.029	0.039	0.136	0.140
Number of observations	77,600	77,600	77,600	77,600	77,600	77,600	77,600	77,600	77,600	77,600	77,600	77,600

Notes:

[1] The sample is restricted to 26-54 year old employed individuals in Peninsular Malaysia who reported their employment sector.

[2] The omitted ethnic group is the Chinese. Education levels are primary, lower secondary, upper secondary, post-secondary, and tertiary. The omitted education level is upper secondary. Controls comprise birth cohort, ethnicity\*birth cohort, ethnicity\*sex, urban-rural location, state of residence, district of residence, state of birth, and birth cohort fixed effects.

[3] Standard errors are in parentheses, and are robust and clustered by birth cohort.

[4] \*\*\* denotes statistical significance at the 1 percent level; \*\* at the 5 percent level; and \* at the 10 percent level.

Source: Population and Housing Census of Malaysia, 2000

**Table 10: Ethnicity and Tertiary Education Effects on Employment Outcomes  
(2000 Population and Housing Census Data)**

	Private Sector		
	All Occupations	Legislators & Directors	Professionals (Non-Teaching)
	(1)	(2)	(3)
Constant	0.437 *** (0.054)	0.054 (0.035)	-0.053 (0.032)
Malay	-0.281 *** (0.031)	-0.065 *** (0.020)	-0.054 *** (0.019)
Indian	-0.092 ** (0.040)	-0.102 *** (0.030)	-0.033 (0.042)
Degree	0.013 (0.013)	0.065 *** (0.013)	0.135 *** (0.019)
Malay * Degree	-0.032 (0.021)	-0.015 (0.014)	-0.026 (0.020)
Indian * Degree	-0.023 (0.028)	-0.032 (0.030)	0.088 *** (0.027)
R <sup>2</sup>	0.327	0.093	0.112
Number of observations	11,557	11,557	11,557

Notes:

[1] The sample is restricted to 26-54 year old employed tertiary graduates in Peninsular Malaysia who reported their employment sector.

[2] The omitted ethnic group is the Chinese. The omitted education level is certificate/diploma. Controls comprise birth cohort, ethnicity\*birth cohort, sex, ethnicity\*sex, urban-rural location, state of residence, district of residence, state of birth, and birth cohort fixed effects.

[3] Standard errors are in parentheses, and are robust and clustered by birth cohort.

[4] \*\*\* denotes statistical significance at the 1 percent level; \*\* at the 5 percent level; and \* at the 10 percent level.

Source: Population and Housing Census of Malaysia, 2000.

**Table 11: Ethnicity and Degree Institution Effects on Employment Outcomes  
(2000 Population and Housing Census Data)**

	Private Sector				
	All Occupations	Legislators & Directors	Professionals (Non-Teaching)	Public Administration & Defense	Education
	(1)	(2)	(3)	(4)	(5)
Constant	0.484 *** (0.071)	0.064 (0.055)	0.020 (0.066)	0.334 *** (0.080)	0.390 *** (0.056)
Malay	-0.347 *** (0.033)	-0.065 ** (0.026)	-0.147 *** (0.023)	0.143 *** (0.028)	0.047 (0.032)
Indian	-0.138 ** (0.056)	-0.128 *** (0.040)	0.012 (0.057)	-0.006 (0.032)	0.080 (0.054)
Private Institution	0.187 *** (0.021)	0.103 *** (0.031)	0.018 (0.030)	-0.029 ** (0.013)	-0.106 *** (0.022)
Malay * Private Institution	0.107 *** (0.031)	-0.012 (0.042)	0.094 * (0.052)	-0.009 (0.033)	-0.039 (0.027)
Indian * Private Institution	0.152 *** (0.034)	-0.111 ** (0.041)	0.201 *** (0.064)	-0.037 (0.034)	-0.075 * (0.044)
Overseas Institution	0.160 *** (0.022)	0.083 *** (0.025)	0.047 * (0.026)	-0.032 ** (0.014)	-0.108 *** (0.021)
Malay * Overseas Institution	-0.001 (0.028)	-0.032 (0.025)	0.035 (0.038)	-0.038 ** (0.015)	0.041 (0.027)
Indian * Overseas Institution	0.076 (0.051)	-0.054 (0.055)	0.141 ** (0.055)	-0.004 (0.027)	-0.084 ** (0.040)
R <sup>2</sup>	0.353	0.104	0.113	0.099	0.252
Number of observations	5,583	5,583	5,583	5,793	5,793

Notes:

[1] The sample is restricted to 26-54 year olds in Peninsular Malaysia, with degrees and with tertiary institutions reported as public, private, or overseas.

[2] The omitted ethnic group is the Chinese. The omitted tertiary institution type is public. Controls comprise birth cohort, ethnicity\*birth cohort, sex, ethnicity\*sex, urban-rural location, state of residence, district of residence, state of birth, and birth cohort fixed effects.

[3] Standard errors are in parentheses, and are robust and clustered by birth cohort.

[4] \*\*\* denotes statistical significance at the 1 percent level; \*\* at the 5 percent level; and \* at the 10 percent level.

Source: Population and Housing Census of Malaysia, 2000.

**Table 12.1: Education, Ethnicity, and Birth Cohort Effects on Wage Outcomes in Private Sector Industries  
(1999 Household Income Survey Data)**

	Sample of Observed Wages			Weighted Sample of Observed Wages			Heckman Correction		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	9.995 *** (0.070)	10.230 *** (0.085)	9.885 *** (0.112)	9.942 *** (0.075)	10.190 *** (0.086)	9.930 *** (0.103)	11.140 *** (0.263)	11.340 *** (0.167)	11.010 *** (0.381)
Malay	-0.298 *** (0.033)	-0.331 *** (0.045)	-0.436 *** (0.126)	-0.290 *** (0.038)	-0.337 *** (0.049)	-0.527 *** (0.127)	-0.313 *** (0.034)	-0.424 *** (0.051)	-0.564 *** (0.137)
Indian	-0.298 *** (0.040)	-0.122 * (0.066)	0.050 (0.110)	-0.265 *** (0.042)	-0.121 * (0.064)	0.024 (0.102)	-0.717 *** (0.098)	-0.495 *** (0.073)	-0.437 * (0.216)
Tertiary		0.766 *** (0.055)	0.853 *** (0.159)		0.774 *** (0.060)	0.838 *** (0.155)		0.386 *** (0.069)	0.570 *** (0.170)
Malay * Tertiary		0.073 (0.069)	0.095 (0.308)		0.076 (0.071)	0.205 (0.306)		0.114 (0.068)	0.371 (0.287)
Indian * Tertiary		-0.173 (0.126)	-0.534 (0.331)		-0.177 (0.124)	-0.538 (0.339)		0.319 ** (0.132)	-0.184 (0.354)
Post 1953			0.477 *** (0.117)			0.405 *** (0.129)			0.029 (0.194)
Malay * Post 1953			-0.007 (0.131)			0.123 (0.134)			0.155 (0.142)
Indian * Post 1953			-0.067 (0.164)			-0.011 (0.156)			0.029 (0.180)
Tertiary * Post 1953			0.002 (0.183)			0.072 (0.195)			-0.138 (0.184)
Malay * Tertiary * Post 1953			0.078 (0.353)			-0.102 (0.351)			-0.278 (0.327)
Indian * Tertiary * Post 1953			-0.166 (0.354)			-0.229 (0.364)			0.342 (0.379)
Post 1958			-0.120 (0.084)			-0.152 (0.112)			-0.196 ** (0.085)
Malay * Post 1958			0.197 * (0.100)			0.178 (0.111)			0.033 (0.101)
Indian * Post 1958			-0.144 (0.163)			-0.148 (0.157)			0.127 (0.206)
Tertiary * Post 1958			-0.134 (0.111)			-0.187 (0.138)			0.106 (0.124)
Malay * Tertiary * Post 1958			-0.093 (0.182)			-0.019 (0.185)			-0.040 (0.172)
Indian * Tertiary * Post 1958			0.677 *** (0.193)			0.757 *** (0.191)			0.032 (0.305)
R <sup>2</sup>	0.286	0.512	0.523	0.318	0.516	0.527	0.290	0.518	0.524
Number of observations	3,489	3,489	3,489	3,489	3,489	3,489	3,489	3,489	3,489

Notes:

[1] The sample is restricted to 26-54 year old employed males in Peninsular Malaysia, and excludes individuals who are employed in the following sectors: Public Administration and Defense, Education, Health and Social Work, and Electricity, Gas, and Water.

[2] The omitted ethnic group is the Chinese. Education levels are primary, lower secondary, upper secondary, post-secondary, and tertiary. The omitted education level is upper secondary. Controls comprise birth cohort, ethnicity\*birth cohort, urban-rural location, state of residence, and birth cohort fixed effects.

[3] Standard errors are in parentheses, and are robust and clustered by birth cohort.

[4] \*\*\* denotes statistical significance at the 1 percent level; \*\* at the 5 percent level; and \* at the 10 percent level.

Source: Household Income Survey of Malaysia, 1999.

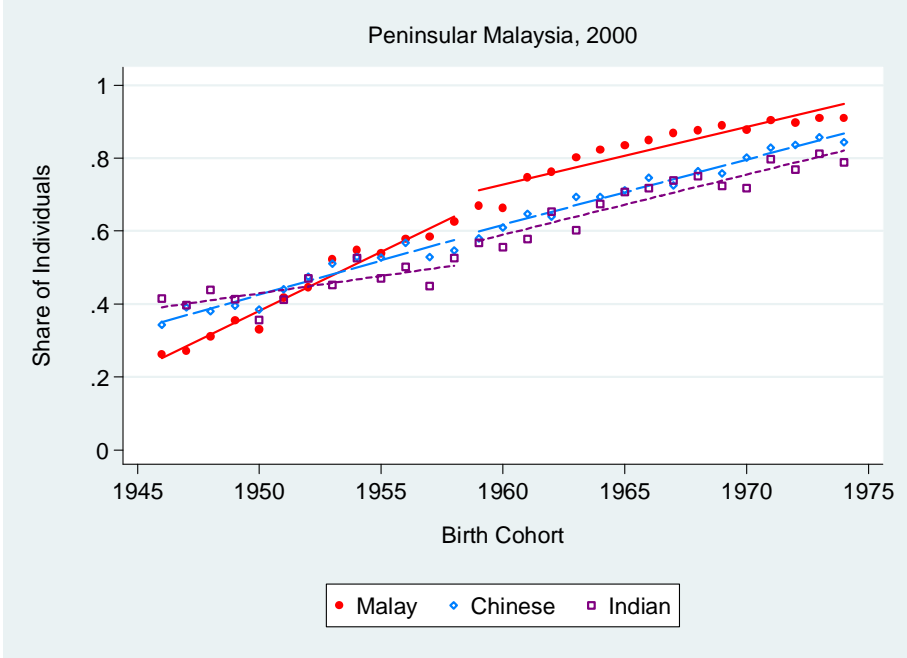
**Table 12.2: Education, Ethnicity, and Birth Cohort Effects on Wage Outcomes in Private Sector Industries  
(1992 Household Income Survey Data)**

	Sample of Observed Wages			Weighted Sample of Observed Wages			Heckman Correction		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	9.521 *** (0.063)	9.801 *** (0.056)	9.490 *** (0.080)	9.529 *** (0.065)	9.831 *** (0.065)	9.470 *** (0.087)	10.320 *** (0.241)	10.580 *** (0.153)	9.818 *** (0.129)
Malay	-0.261 *** (0.024)	-0.341 *** (0.045)	-0.490 *** (0.109)	-0.261 *** (0.025)	-0.334 *** (0.051)	-0.403 *** (0.117)	-0.402 *** (0.050)	-0.444 *** (0.047)	-0.602 *** (0.110)
Indian	-0.293 *** (0.028)	-0.272 *** (0.059)	-0.546 *** (0.125)	-0.271 *** (0.029)	-0.269 *** (0.061)	-0.484 *** (0.143)	-0.651 *** (0.110)	-0.444 *** (0.070)	-0.760 *** (0.147)
Tertiary		0.707 *** (0.060)	0.658 *** (0.091)		0.718 *** (0.059)	0.692 *** (0.096)		0.392 *** (0.087)	0.578 *** (0.094)
Malay * Tertiary		0.128 (0.099)	0.441 ** (0.170)		0.098 (0.104)	0.390 ** (0.172)		0.221 ** (0.098)	0.617 *** (0.175)
Indian * Tertiary		0.194 (0.164)	0.546 (0.336)		0.178 (0.163)	0.474 (0.341)		0.595 *** (0.173)	0.748 ** (0.335)
Post 1953			0.320 *** (0.104)			0.411 *** (0.121)			0.425 *** (0.097)
Malay * Post 1953			0.264 * (0.143)			0.214 (0.166)			0.315 ** (0.145)
Indian * Post 1953			0.388 ** (0.143)			0.286 (0.168)			0.525 *** (0.161)
Tertiary * Post 1953			0.250 * (0.140)			0.202 (0.142)			-0.068 (0.155)
Malay * Tertiary * Post 1953			-0.448 (0.294)			-0.450 (0.317)			-0.243 (0.295)
Indian * Tertiary * Post 1953			-0.802 (0.473)			-0.683 (0.493)			-0.719 (0.460)
Post 1958			-0.038 (0.083)			-0.091 (0.096)			0.013 (0.088)
Malay * Post 1958			-0.004 (0.110)			-0.064 (0.136)			-0.008 (0.110)
Indian * Post 1958			-0.004 (0.111)			0.034 (0.125)			0.028 (0.110)
Tertiary * Post 1958			-0.326 ** (0.131)			-0.298 ** (0.130)			-0.093 (0.133)
Malay * Tertiary * Post 1958			0.207 (0.273)			0.239 (0.300)			-0.237 (0.278)
Indian * Tertiary * Post 1958			0.486 (0.372)			0.421 (0.390)			0.464 (0.361)
R <sup>2</sup>	0.316	0.478	0.494	0.341	0.476	0.491	0.320	0.483	0.496
Number of observations	4,949	4,949	4,949	4,949	4,949	4,949	4,949	4,949	4,949

Notes:

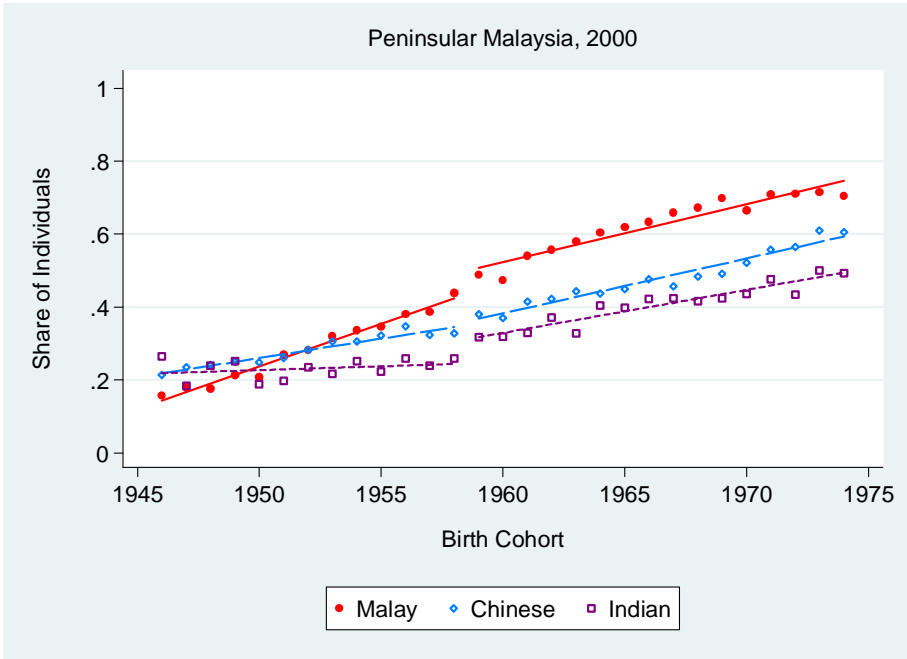
- [1] The sample is restricted to 26-54 year old employed males in Peninsular Malaysia, and excludes individuals who are employed in the following sectors: Public Administration and Defense, Education, Health and Social Work, and Electricity, Gas, and Water.  
[2] The omitted ethnic group is the Chinese. Education levels are primary, lower secondary, upper secondary, post-secondary, and tertiary. The omitted education level is upper secondary. Controls comprise birth cohort, ethnicity\*birth cohort, urban-rural location, state of residence, and birth cohort fixed effects.  
[3] Standard errors are in parentheses, and are robust and clustered by birth cohort.  
[4] \*\*\* denotes statistical significance at the 1 percent level; \*\* at the 5 percent level; and \* at the 10 percent level.  
Source: Household Income Survey of Malaysia, 1992.

**Figure 1.1: Share of Individuals with at least Lower Secondary Education by Ethnicity and Birth Cohort**



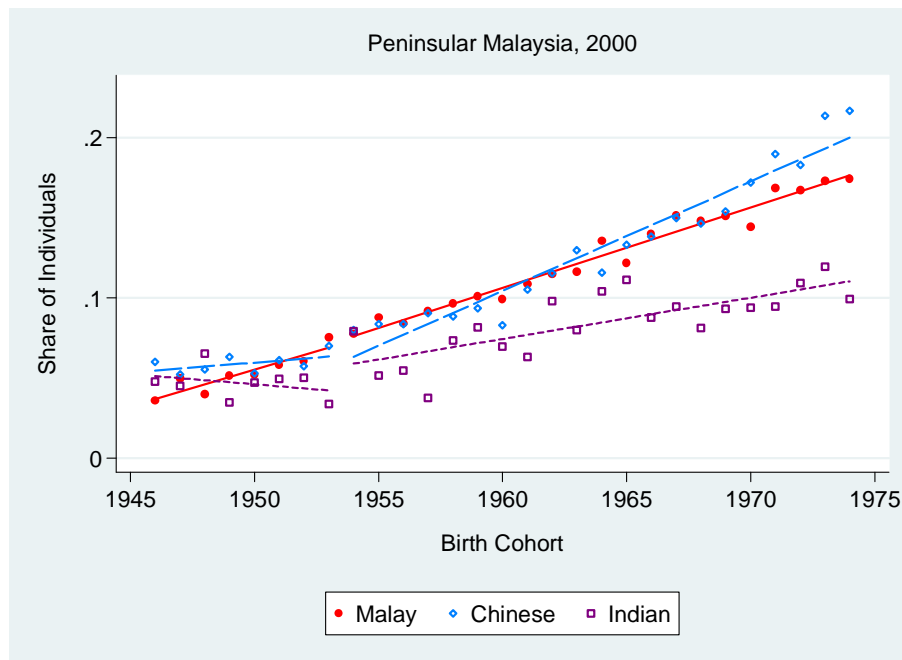
Source: Population and Housing Census of Malaysia, 2000.

**Figure 1.2: Share of Individuals with at least Upper Secondary Education by Ethnicity and Birth Cohort**



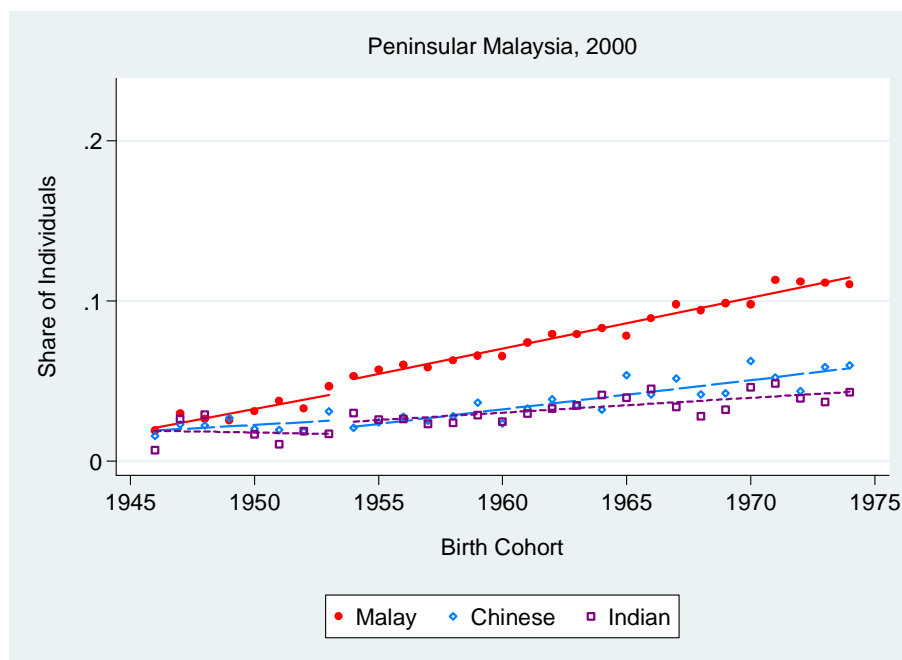
Source: Population and Housing Census of Malaysia, 2000.

**Figure 1.3: Share of Individuals with Tertiary Education (Certificate/Diploma/Degree) by Ethnicity and Birth Cohort**



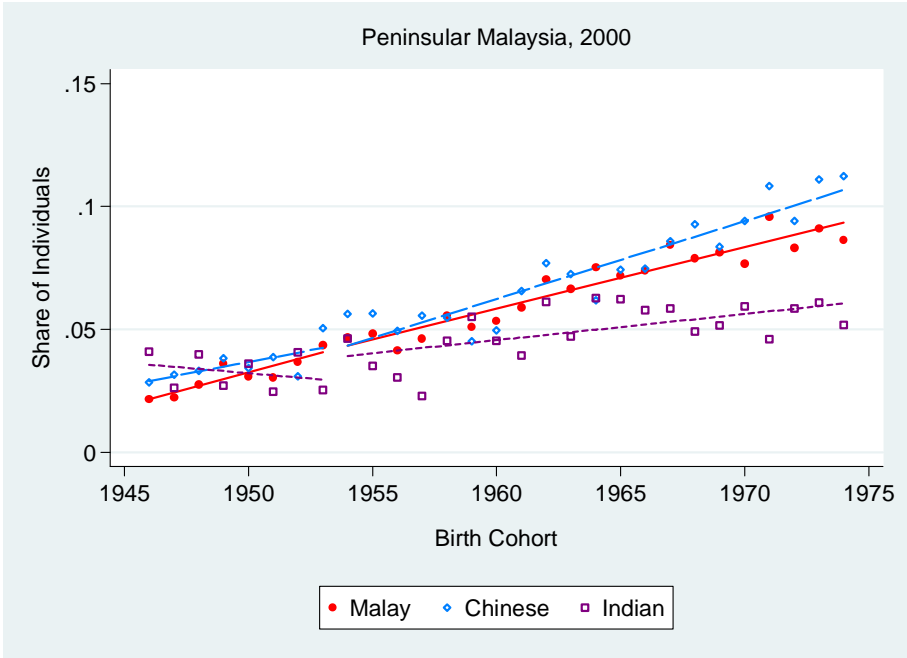
Source: Population and Housing Census of Malaysia, 2000.

**Figure 1.4: Share of Individuals with Tertiary Education (Certificate/Diploma/Degree) from Local Public Institutions by Ethnicity and Birth Cohort**



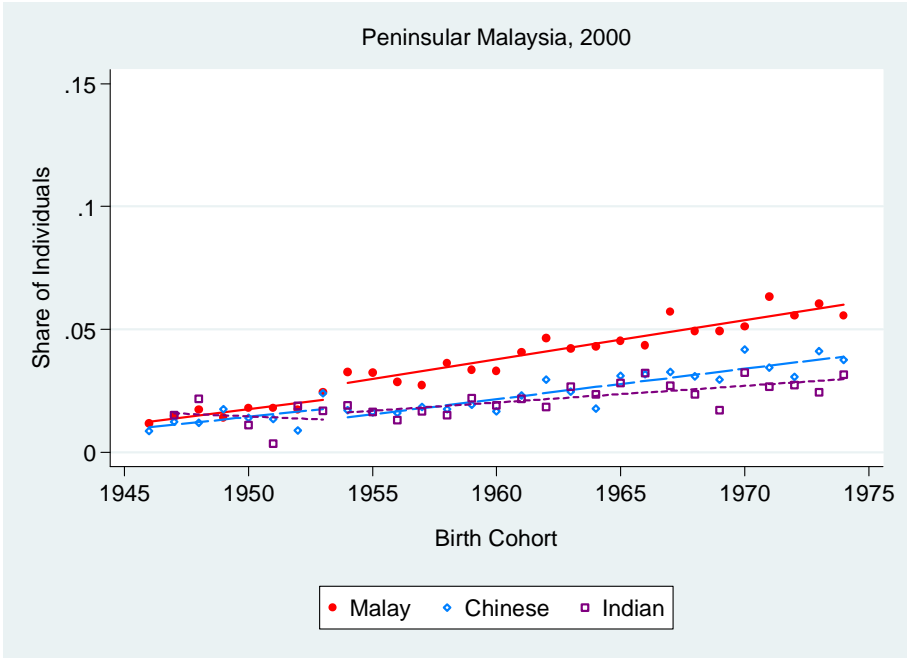
Source: Population and Housing Census of Malaysia, 2000.

**Figure 1.5: Share of Individuals with Degrees by Ethnicity and Birth Cohort**



Source: Population and Housing Census of Malaysia, 2000.

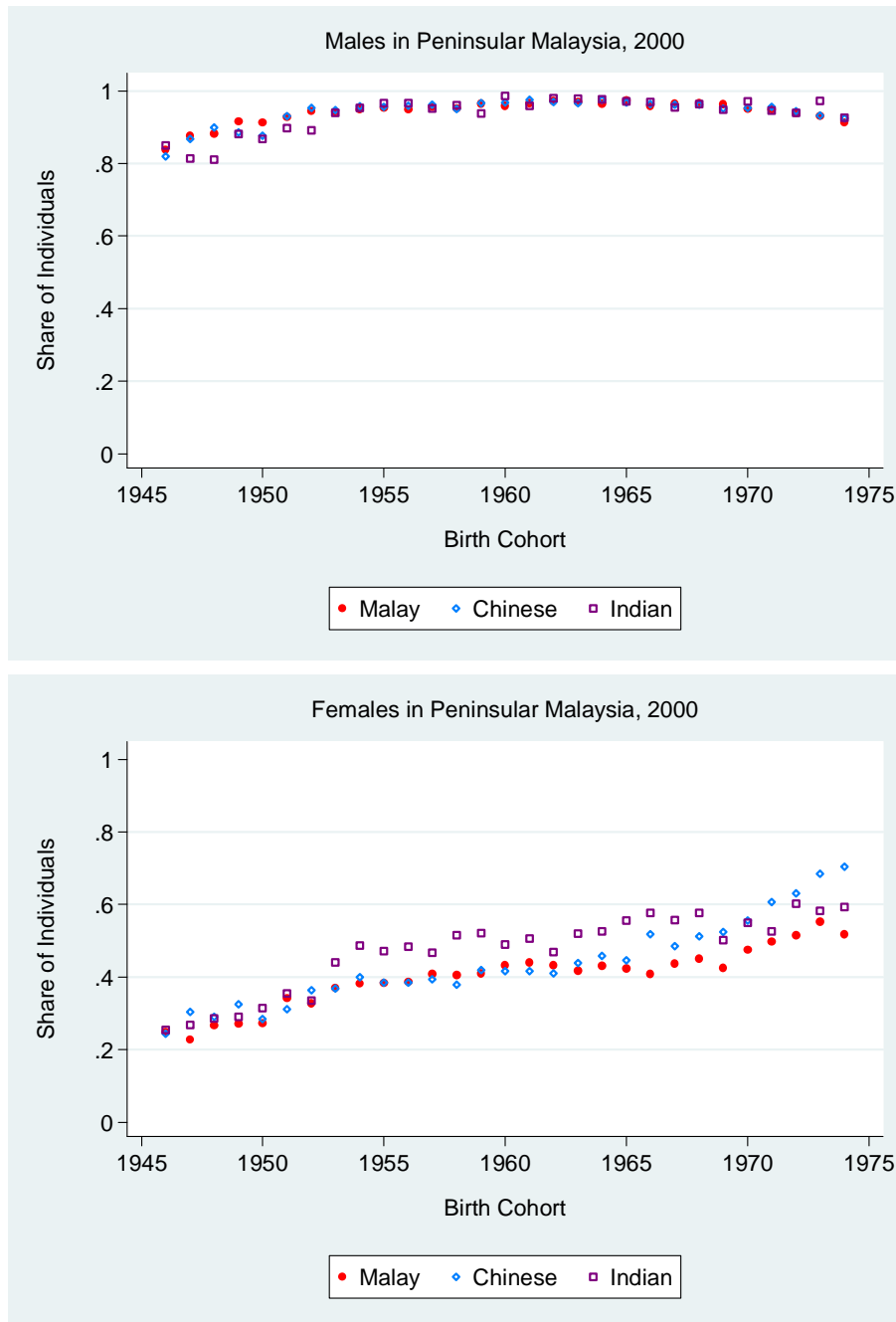
**Figure 1.6: Share of Individuals with Degrees from Local Public Institutions by Ethnicity and Birth Cohort**



Source: Population and Housing Census of Malaysia, 2000.

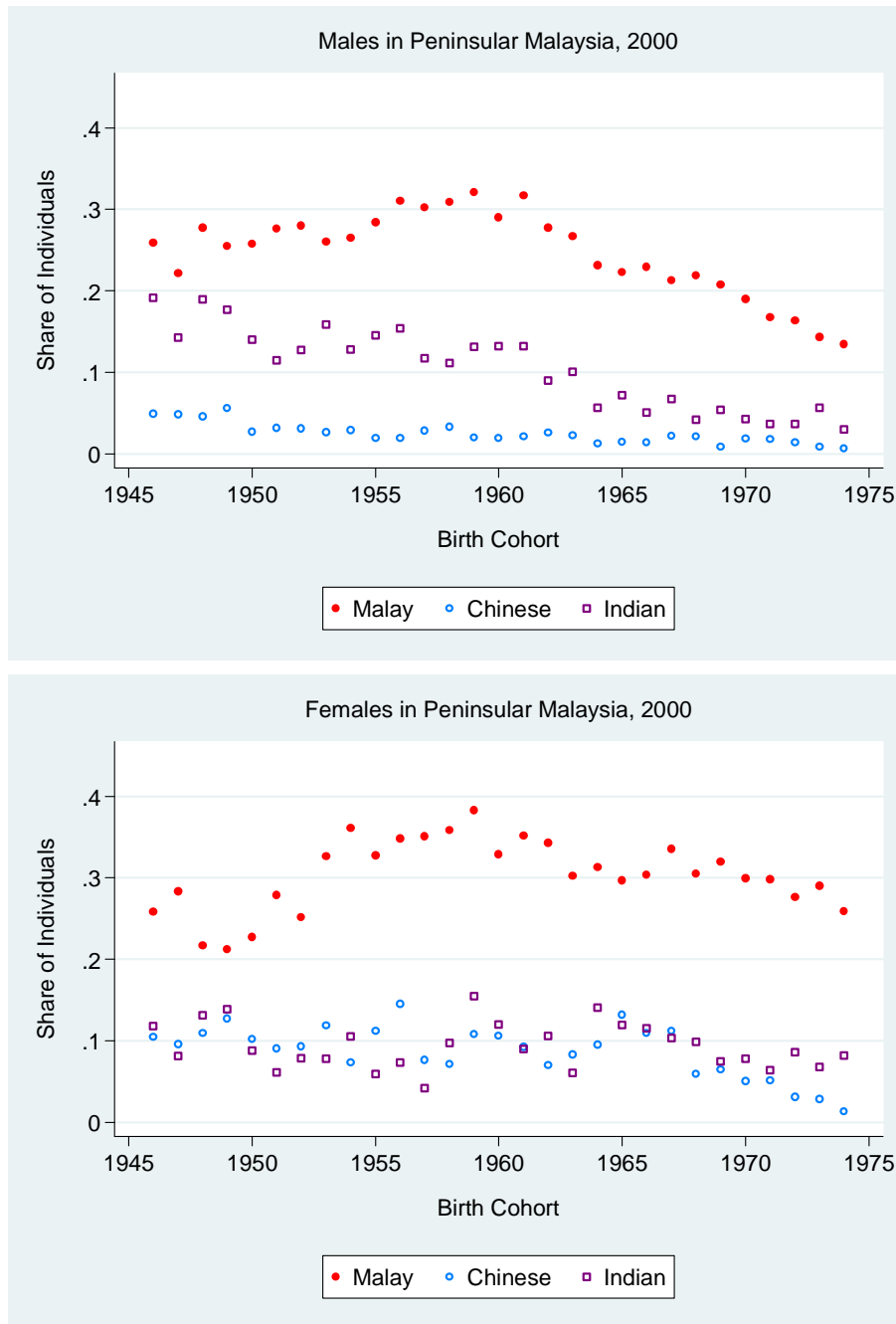


**Figure 2: Employment by Sex, Ethnicity, and Birth Cohort**



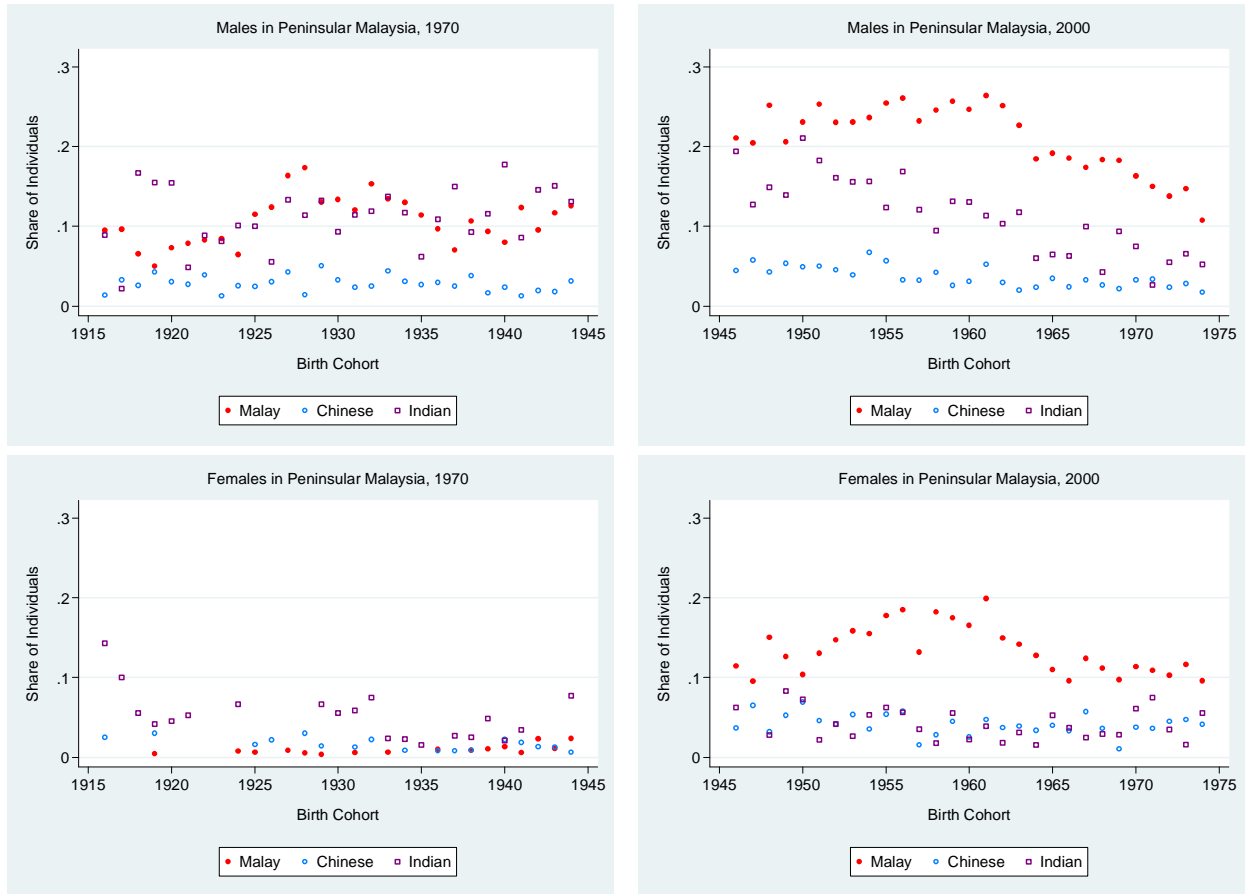
Source: Population and Housing Census of Malaysia, 2000.

**Figure 3.1: Public Sector Employment Rate by Sex, Ethnicity, and Birth Cohort**



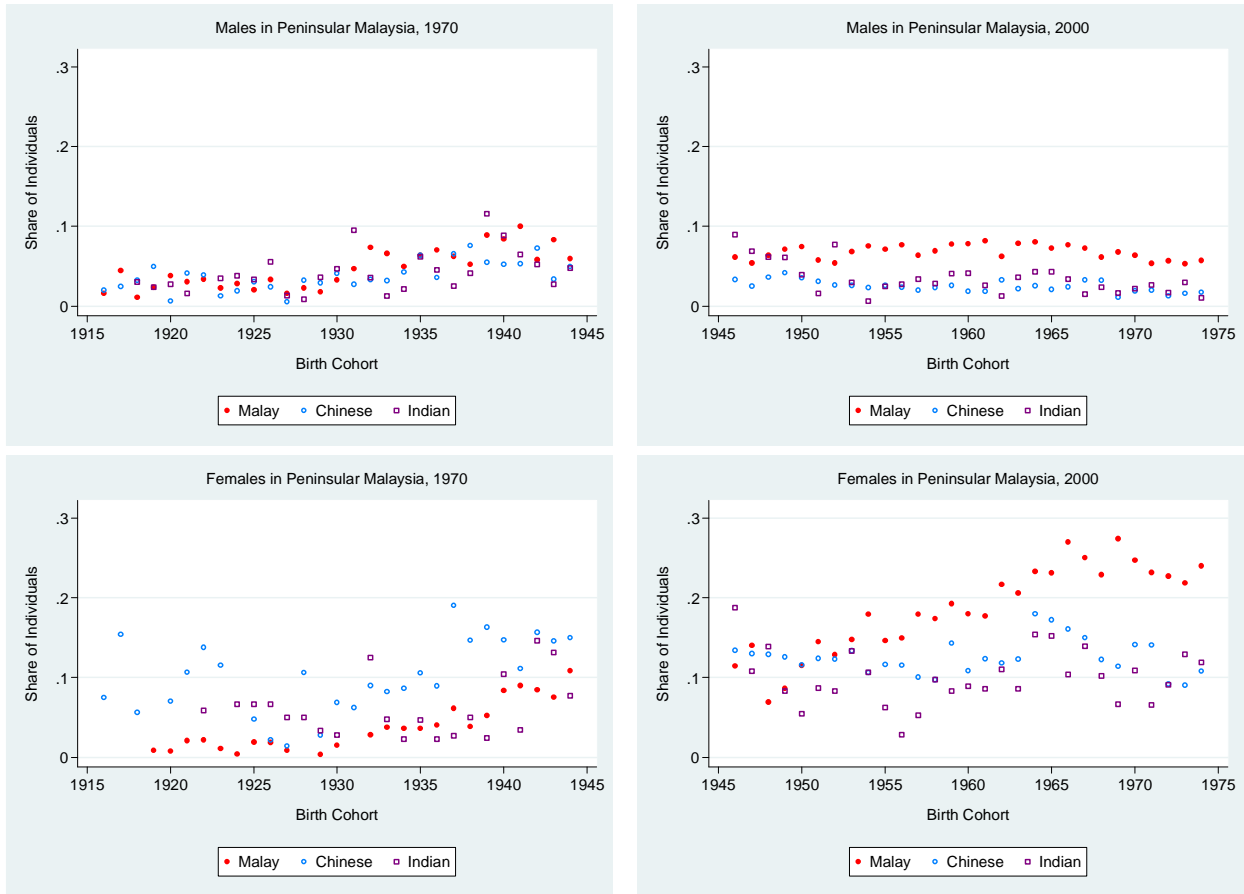
Source: Population and Housing Census of Malaysia, 2000.

**Figure 3.2: Employment in Public Administration and Defense by Sex, Ethnicity, and Birth Cohort**



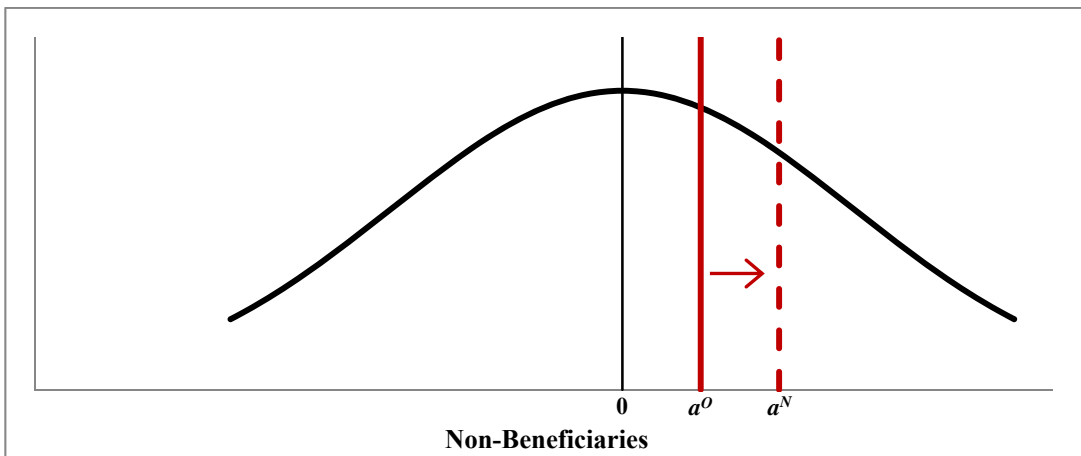
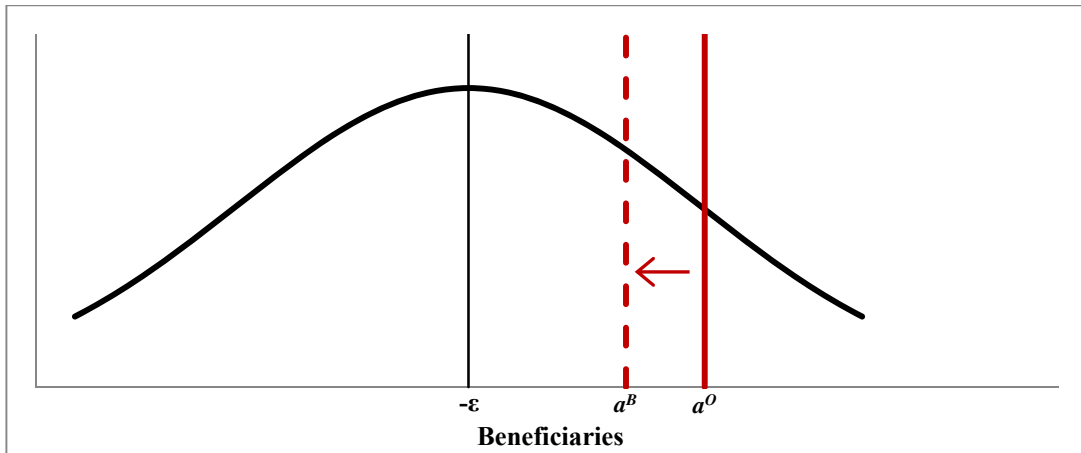
Sources: Population and Housing Census of Malaysia, 1970; Population and Housing Census of Malaysia, 2000.

**Figure 3.3: Employment in Education by Sex, Ethnicity, and Birth Cohort**

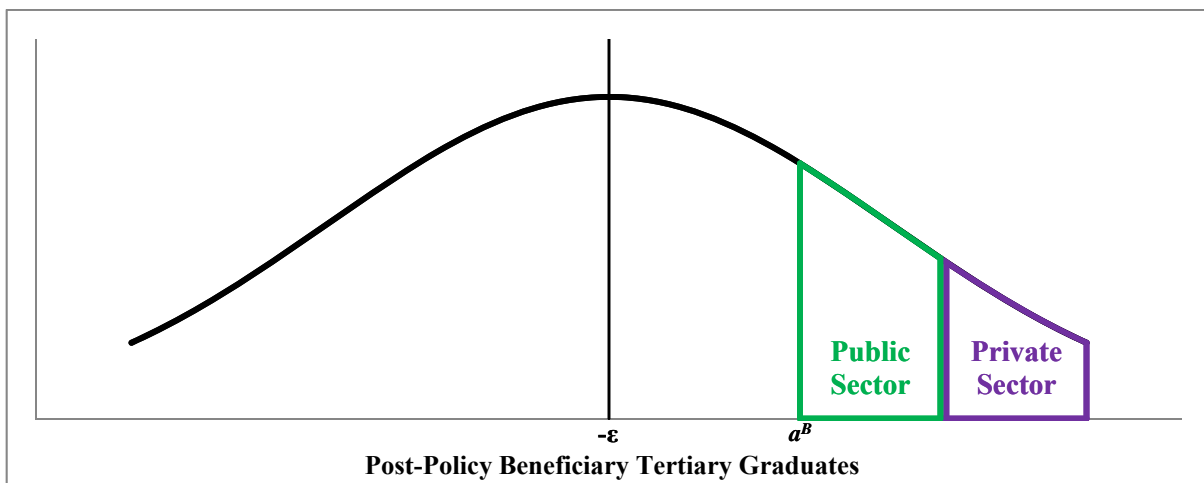
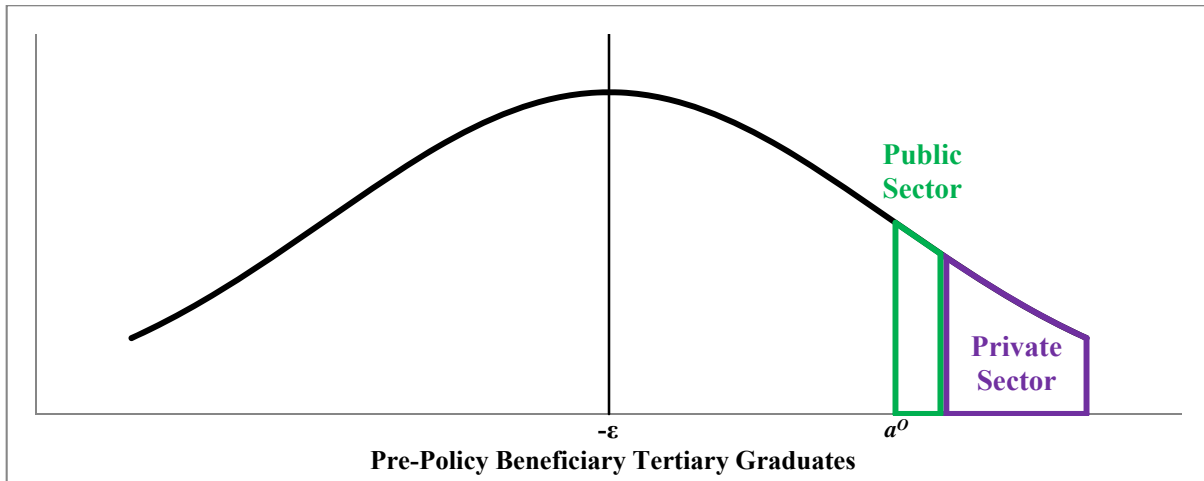


Sources: Population and Housing Census of Malaysia, 1970; Population and Housing Census of Malaysia, 2000.

**Figure 4: Distribution of Examination Results and Admission Thresholds for Beneficiaries and Non-Beneficiaries**



**Figure 5: Selection into Employment Sectors among Pre-Policy and Post-Policy Beneficiary Tertiary Graduates**



**Table A1: Upper-Tier Occupations and Employment Sector  
(2000 Population and Housing Census)**

	<b>Public Sector</b>	<b>Private Sector</b>	<b>Individual / Family</b>	<b>Unknown</b>	<b>Total</b>
Legislators and Directors	350 10.7%	2,113 64.5%	620 18.9%	194 5.9%	3,277 100.0%
Managers	48 1.2%	563 14.1%	3,157 79.1%	223 5.6%	3,991 100.0%
Professionals (Non-Teaching)	567 15.3%	2,576 69.3%	359 9.7%	214 5.8%	3,716 100.0%
Professionals (Teaching)	2,137 83.6%	265 10.4%	24 0.9%	131 5.1%	2,557 100.0%
<i>Total</i>	3,102 22.9%	5,517 40.7%	4,160 30.7%	762 5.6%	13,541 100.0%

Note:

[1] The sample is restricted to 26-54 year olds in Peninsular Malaysia.

Source: Population and Housing Census, 2000.

**Table A2: Ethnicity and Degree Institution Types  
(2000 Population and Housing Census)**

	<b>Public Institution</b>	<b>Private Institution</b>	<b>Overseas Institution</b>	<b>Unknown</b>	<b>Total</b>
Malay	2,748 63.5%	168 3.9%	734 17.0%	679 15.7%	4,329 100.0%
Chinese	874 35.9%	511 21.0%	697 28.7%	350 14.4%	2,432 100.0%
Indian	254 45.0%	87 15.4%	155 27.4%	69 12.2%	565 100.0%
<i>Total</i>	3,876 52.9%	766 10.5%	1,586 21.6%	1,098 15.0%	7,326 100.0%

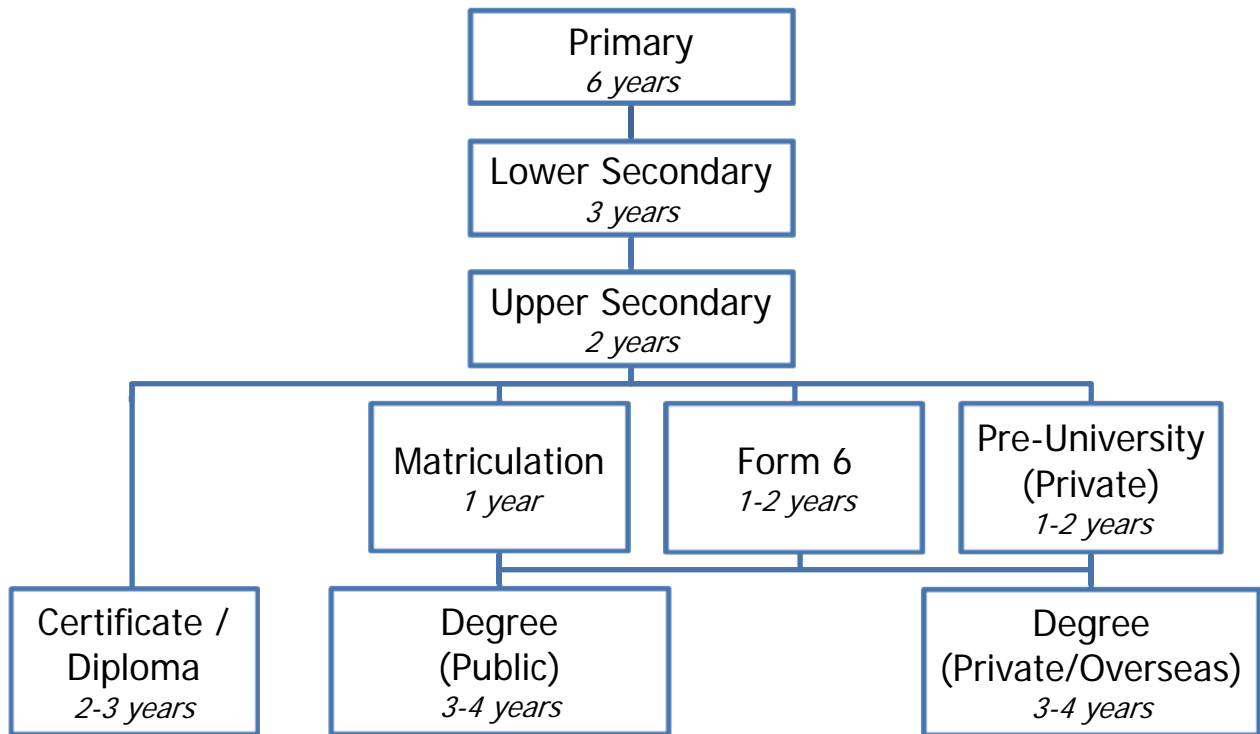
Note:

[1] The sample is restricted to 26-54 year old degree-holders in Peninsular Malaysia.

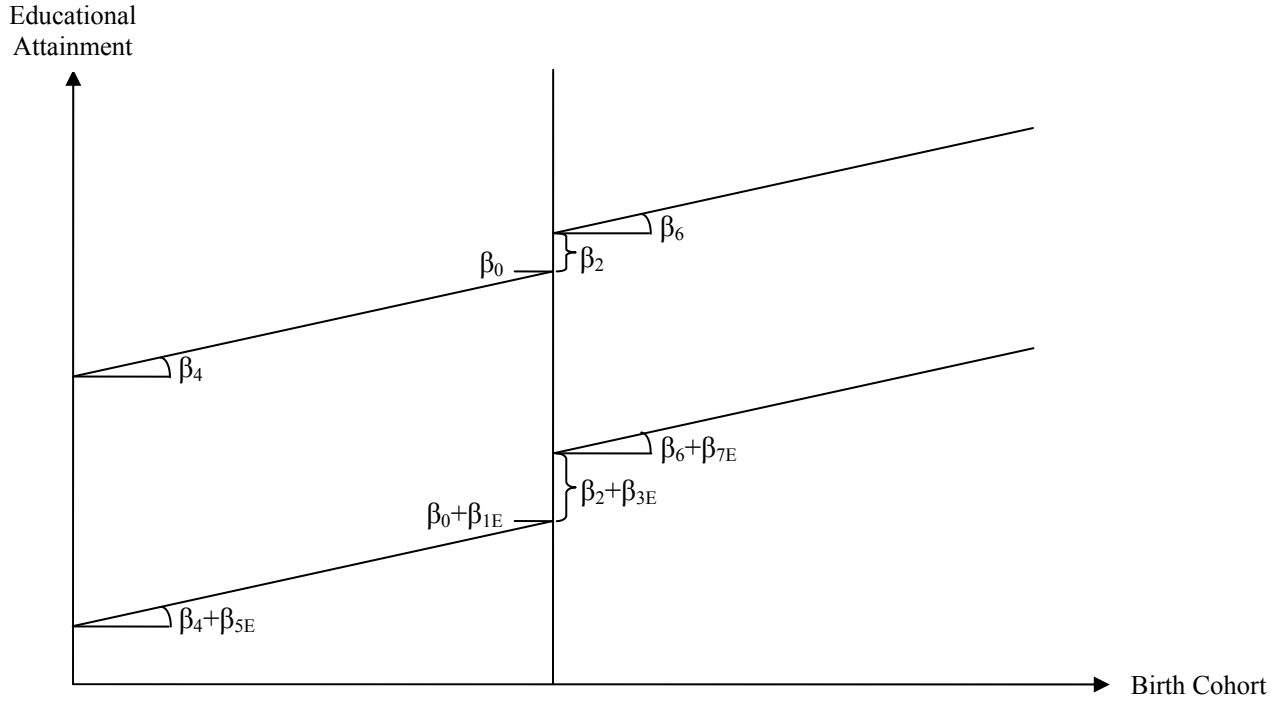
Source: Population and Housing Census, 2000.



**Figure A1: The Malaysian Education System**



**Figure A2: Interpretation of Coefficients of Equation 1**



$$\begin{aligned}
 S_i = & \beta_0 + \beta_{1E} \cdot \text{Ethnicity}_i + \beta_2 \cdot \text{Post}_i + \beta_{3E} \cdot \text{Ethnicity}_i * \text{Post}_i \\
 & + \beta_4 \cdot \text{Birth Cohort}_i * \text{Pre}_i + \beta_{5E} \cdot \text{Ethnicity}_i * \text{Birth Cohort}_i * \text{Pre}_i \\
 & + \beta_6 \cdot \text{Birth Cohort}_i * \text{Post}_i + \beta_{7E} \cdot \text{Ethnicity}_i * \text{Birth Cohort}_i * \text{Post}_i + \beta_8 \cdot X_i + \varepsilon_i \quad (1)
 \end{aligned}$$