Human Capital Investment Responses to Skilled Migration Prospects: Evidence from a Natural Experiment in Nepal

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Abstract

The brain drain has been perceived as a hindrance to poor countries' development. Recent theoretical literature suggests that emigration prospects can increase the expected returns to education and stimulate human capital investment at home. However, empirical evidence is scare because of endogeneity that arises as household characteristics influence both emigration and education choices.

This paper focuses on the recruitment of Nepali men of Gurkha origin into the British Army, a tradition that originated during British colonial rule in South Asia. In 1993 the British Army raised the education requirement for its Nepali recruits, which exogenously increased their skilled emigration relative to unskilled emigration prospects. I use the individual's ethnicity and age at the time of the rule change in a diff-in-diff strategy to estimate the educational impacts on Gurkha men affected by the rule change.

My results suggest that affected men raised their education by 1.1 years, with an increase of 20% in first-time enrollment. These large estimates not only challenge the negative view of brain drain but also highlight the potential role of skilled emigration prospects in improving human capital investment in developing countries that have low returns to schooling.

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1 Introduction

The "brain drain" describes the emigration of skilled workers, mainly from developing to developed countries. Most economists have taken a pessimistic view of brain drain because it robs countries of their scarce human capital, thereby constraining their long-run economic growth (Mincer, 1984). In 2000 more than 12 million individuals from developing countries with tertiary education, 20 percent of their educated workforce, were living in OECD countries. Given a rapid rise of skilled emigration in developing countries, it becomes crucial to evaluate the effect of skilled emigration on their human capital accumulation.[1]

A new literature in skilled emigration emphasizes the effect of future emigration opportunities on human capital investment. The reasoning behind these "brain gain" models is that migration prospects raise the expected returns to education and encourage individuals at home to increase their human capital investment. Although these new theoretical predictions challenge the negative view of brain drain commonly held by economists, empirical evidence is scarce because migration prospects are endogenous. This paper overcomes the problem by identifying a natural experiment that exogenously differentially raised emigration prospects for skilled vs. unskilled individuals at home.

The experiment involves a change in the British Gurkha Army recruitment regulations. The British Gurkha Army is the unit of the British Armed Forces that is composed of Nepali men of Monglo-Tibeto origins. According to Banskota (1994), since 1857 the Monglo-Tibeto tribes have created a tradition of enlisting in the British Gurkha Army, and thereby they are collectively referred to as Gurkha ethnic group.[2]

[1]For developing countries, the growth in skilled emigration has outpaced the growth in overall emigration. Docquier et al. (2007) document that between 1990 and 2000, the emigration rate in developing countries increased by 40%, skilled emigration by 70%, and unskilled emigration by 30%. The brain drain, measured as the emigration rate of skilled natives, remained almost constant over the same period due to the increase in average education level in developing countries.

[2]All the remaining ethnicities in Nepal, excluding the Gurkha ethnic group, are referred to as

Furthermore, the economic and anthropological data from Nepal indicate that this British colonial tradition still plays an important financial and cultural role in the Gurkha communities of Nepal.[3] In 1993 the British government changed the education requirement for the British Gurkha applicants, from requiring no education to requiring a minimum of 8^{th} grade education. This change was instigated by the modernization of the British Army following the developments in Eastern Europe in the early 1990s and the growing use of technology in warfare, as indicated by the discussions in the House of Commons.[4] The reform focused on reducing service manpower and increasing technological capabilities, which were complemented by improving training and education of soldiers. Because this change was part of the broader restructuring of the British Army, the timing and the rationale for this change is exogenous to social, economic, or political characteristics of Nepal.

Using Nepal Census data from 2001, I identify individuals' ethnicity to determine whether they were affected by this rule change. Additionally, since age-invariant ethnic characteristics could affect education, I use their age at the time of the rule change as the second criteria to determine their exposure. Given the recruits must be between the age of $17\frac{1}{2}$ and 21 years old, only men who were 21 or younger in 1993 could be affected by the rule change. I refer to these cohorts as the "eligible" cohort and older cohorts as the "ineligible" cohort in this paper. The difference-in-difference strategy controls for all age-varying characteristics and age-invariant ethnic characteristics that could be correlated with education and provides an unbiased estimate of the rule change on education outcomes of eligible Gurkha men living in Nepal.

"non-Gurkha" ethnic group for the remainder of this paper.

[3]For detailed documentation for the cultural significance and the financial contribution of the British Gurkha among Gurkha communities of Nepal, see Hitchcock (1966); Caplan (1995).

[4]For detailed documentation of the strategic defense reviews presented to the House of Commons regarding the restructuring of the British Army in early 1990s, together with the debate and discussions that followed, see the Eighth Defense Review. http://www.parliament.the-stationery-office.co.uk/pa/cm199798/cmselect/cmdfence/138/13802.htm

My empirical approach improves identification compared to the strategies used in previous studies. The problem in estimating the impact of skilled emigration prospects on education arises because of two reasons: first, unobserved characteristics, such as cultural norms and values, affect both migration and schooling decisions; and second, an increase in human capital raises migration incentives by reducing the domestic wage for skilled workers. Beine et al. (2006) addressed this by instrumenting current migration prospects with the past emigrant stock. But the same time-invariant characteristics that affect migration prospects and necessitate the use of an instrumental variable strategy are also likely to have affected migration in the past, thus undermining the validity of their historical instrument. While McKenzie and Rapoport (2006) argued that historical migration rates within Mexico are the outcome of early 20^{th} century railroad networks, it could still be problematic if past migration led to a better assimilation of foreign ideas, such as value of education, or if individuals with similar characteristics came to live together in regions with better access to railroads. Therefore, the ideal experiment would require two groups of individuals from developing countries that are identical except that skilled emigration prospects exogenously increase for one of them. The change in education requirement of the British Gurkha created such an experiment, as Gurkha men of eligible cohorts experienced an exogenous increase in skilled emigration prospect relative to unskilled emigration to a foreign labor market i.e. the British Army.[5]

The results suggest that the change in the education requirement induced Gurkha men of cohorts aged 6 to 12 at the time of the rule change to raise their education by 1.11 years and cohorts aged 13 to 21 by 0.39 years, highlighting the strong positive im-

[5]To my knowledge, the only previous study to use a historical event for identification is Chand and Clemens (2008). They use the unexpected coup in Fiji as a source of variation to study the effect of emigration prospects on education. However, in contrast to my experiment, emigration prospects for the treatment group did not change exogenously but instead they argue that the decline in economic opportunity at home due to political instability created greater incentive for them to emigrate.

pact of migration prospects on schooling. Starting with Bhagwati and Hamada (1974), the early literature in skilled emigration has ignored this relationship and focused on the loss of social externalities related to educated workers from their emigration, leading to a loss in welfare.[6] Similarly, the endogenous growth models of Miyagiwa (1991) and Haque and Kim (1995), by assuming that productivity increases with greater concentration of skilled workers, also predicted negative impacts on economic growth. However, if successful emigration is not a certainty, endogenizing human capital accumulation on migration prospects could overturn the pessimistic outcome of these earlier models, as shown by Mountford (1997). In fact, my findings show that in reality individuals' education choices are affected by their emigration prospects and therefore provide evidence for Mountford (1997)'s argument, that skilled emigration could raise the net human capital stock of low-income countries and improve their welfare and economic growth, in contrast to earlier predictions.

An important implication of my findings is that low-income countries do not have to wait for improvements in their local productivity to stimulate human capital investment because high wages in developed countries can motivate individuals in developing countries to invest in education. While there is little doubt that low levels of schooling deter economic growth, Schultz (1975) showed that returns to schooling are low in a stagnant economy, hinting at the possibility of a poverty trap. More recently, Oyelere (2009) argued that poor institutions and political instability, characteristics that are common across many developing countries, lead to low returns to education. Therefore, developing countries are compelled to spend large sums of money on increasing human capital investment, in order to overcome low returns and push themselves out of

[6]Given that social marginal product exceeds the private marginal product of skilled labor due to strong positive externanlities and that education is often publicly funded, emigration of skilled workers is thought to be welfare diminishing. This negative view of brain drain prompted Bhagwati and Hamada (1974) to propose the brain drain tax to compensate for the loss incurred by developing countries due to skilled emigration.

the poverty trap, if it exists. For example, Mexico's Progresa Program, which provides cash incentive to increase school attendance, costs almost 20 percent of its GDP. Given skilled emigration prospects raise educational returns in developing countries, it could either replace expensive policy interventions or complement these programs, making them more attractive to their potential recipients.

The rest of the paper is structured as follows: Section 2 describes the natural experiment. Section 3 presents a theoretical framework that forms the basis of brain gain models. Section 4 explains the empirical strategy and the data used for causal estimation. Section 5 presents the empirical results. Section 6 presents robustness for the identification strategy and Section 7 concludes.

2 Background

Nepal is a landlocked country surrounded by India on three sides and China to its north. Its geographical position historically made it a melting ground for people and cultures from both north and south of its border (Shrestha, 2001). The 1996 National Living Standard Survey categorizes the population of Nepal into 15 ethnic groups. Out of them, the Gurkha ethnic group is comprised of 5 Monglo-Tibeto tribal groups– the Rai, Limbu, Gurung, Magar, and Tamang, who settled in the eastern and central hills of Nepal during the initial wave of migration from the north.

2.1 British Brigade of Gurkha

The British Brigade of Gurkha is the unit in the British Army that is composed of Nepali soldiers. Following the Anglo-Gurkha war (1814-1816), the British East India company and the Government of Nepal signed the treaty of Sugauli on March 4, 1816. The treaty transferred one-third of the territories previously held by Nepal to the

British and allowed them to set up three Gurkha regiments in the British Indian Army.[7] The early recruits of the British Gurkha Army included ethnic groups such as the Rajput, Thakuri, Chetri, and Brahman, who migrated from the south and were closely associated with the ethnicities of India. In 1857, Indian soldiers serving in the British Indian Army led a mutiny against British rule in South Asia. Although the rebellion was eventually contained in 1858, the British became wary of Indian nationals serving in their army. Rathaur (2001) and Caplan (1995) argue that, as a result, the British stopped recruiting Nepali individuals belonging to the ethnicities that originated from India into the British Gurkha Army. According to Rathaur (2001) after 1857, the new Nepali recruits were mainly drawn from the Rai, Limbu, Gurung, Magar, and Tamang ethnic groups who, unlike other ethnicities in Nepal, had migrated from north and had no cultural or historical ties with India.[8]

This ethnicity bias in the recruitment of British Gurkha Army continues to exist to the present day as the majority of the current British Gurkha soldiers are comprised of these 5 Monglo-Tibeto tribes. Moreover, this British colonial tradition has evolved into an important cultural identity and lucrative economic opportunity for the individuals of the Gurkha ethnic group. The present value of the lifetime income from serving in the British Gurkha Army for 25 years is estimated to be $ 1,334,091.81.[9] This includes a starting salary of $ 21,000 and a lifelong annual pension of about $ 15,000 after retirement. According to Caplan (1995), remittances from Gurkha soldiers and pensions for ex-Gurkha soldiers were the country's largest earner of foreign currency until the recent development of tourism and other sources of migration. More importantly, the pay and pensions of the servicemen are the major source of capital in most Monglo-

[7] For details of the Sugauli Treaty see Rathaur (2001).

[8] The preference for Gurkha ethnic men is evident from the letter sent by the British Commanding Officer to Colonel Berkely, the British Resident at Kathmandu, in which he writes, "I first consider his caste. If he is of the right caste, though his physique is weak, I take him" (Banskota, 1994).

[9] See Table 7 for the detailed calculation of the lifetime income for Gurkha soldiers.

Tibeto communities in the hills of Nepal whose main alternative employment is limited to farming.[10] The financial benefits of the British Gurkha Army in these communities is evident from quotes from the Gurkha households documented by Caplan (1995) such as, "One of my boys has gone to the Army, we have only that hope."

Although the appeal of joining the British Gurkha Army is driven by economic benefits, it also brings cultural prestige to Gurkha communities. Caplan (1995) points out that Gurkha ex-servicemen as well as their wives are known in their villages by their titles of the British Army and acquire considerable reputations to become the new elite in their communities. Hitchcock (1966) reports that many Gurkha villages are named after the title of their highest ranking British Gurkha officer, such as "the Captain's village." These narratives highlight the social, political, and economic stature wielded by the British Gurkha Army in Gurkha communities of Nepal.

2.2 Natural Experiment: A Change in Education Criteria

Education is an important aspect of the British Gurkha recruitment. Starting from 1993, recruits must have completed at least 8 years of education.[11] Prior to this, however, no formal education was required to join the British Army and the selection criteria was strictly limited to physical examinations. This change in the education requirement was instigated by the larger restructuring of the British Army in the early 1990s. Following the end of the cold war, a series of defense reviews termed "Option for Change" was conducted by the UK Ministry of Defense in order to evaluate the role of its army in the post-cold war era. It focused on reducing defense expenditure spurred by the economic benefits of the "peace dividend"[12] and, consequently, led to a

[10]The Defense Committee of the House of Commons in 1989 suggested that the annual salary of British Gurkha soldier was 100 times the average income in the hills from where they come from.

[11]In 1997, the education requirement was further increased to a minimum of 10 years of education.

[12]Peace dividend is a political slogan popularized by US president George H.W. Bush and UK Prime Minister Margaret Thatcher after the end of the cold war. It describes the reduction in defense

reduction in service manpower of the British Army by 18 percent. Furthermore, this reduction was accompanied by the emphasis on a flexible and modernized force. This was achieved by incorporating new technologies in weapon systems, communications, reconnaissance missions, and intelligence gathering, and by improving education and training of soldiers. The Option for Change outlined the use of technology in future warfare and the importance of education for soldiers who use it, and concluded that "strong defense requires military capability of fighting in a high-technology warfare; the aim is smaller forces, better equipped, and properly trained" (Eighth Defense Report, 1997). In fact, the trend towards educated soldiers had already begun in the US Army, as its recruits with a high school diploma increased by 30 percent in the late 1980s.[13] Hence, the increase in educational requirement for the British Gurkha was induced by the modernization of the British Army in response to the increasing role of technology and the political changes in Eastern Europe and, therefore, it was exogenous to the socio-political events in Nepal.

3 Theoretical Model

Becker's model of human capital views education as an investment, where individuals compare their costs to future benefits. The future benefits from investing in education is an increase in lifetime income earned domestically when there is no opportunity to emigrate. Given positive emigration prospects, however, the future benefits should additionally include expected increase in income earned abroad. Furthermore, the latter could be larger if either the wage rate per human capital is higher abroad, or income

spending undertaken by many western nations, including as the US and the UK, and the subsequent redirection of those resources into social programs and a decrease in tax rates.

[13]According to the Tenth Quadrennial Review of US Military Compensation, the recruits who scored better than the median in the Armed Forces Qualification Test (AFQT) increased by 10% in early 1990s.

abroad at all levels of education is greater and education is required to emigrate, or both. The following theoretical model, based on Docquier et al. (2007), highlights these positive effects of higher skilled emigration prospects on expected returns to education and, consequently, on human capital investment.

Consider a small developing economy, where labor is an important factor of production and is measured in efficiency units. All individuals at birth are endowed with a unit of efficiency. They live for two periods, youth and adulthood. There is an education program which if opted into during youth, increases the individual's efficiency in adulthood to $h > 1$. Furthermore, the heterogeneity among individuals is highlighted by the differences in their cost of the education program, denoted by c, which has a cumulative distribution $F(c)$ and density function $f(c)$ defined on R^+. Suppose the domestic economy is perfectly competitive so that workers are paid their marginal product, denoted by w. In youth, uneducated workers earn w and educated workers earn $w - c$. In adulthood, individuals can choose to work abroad, where the wage rate per efficiency unit is $\hat{w} > w$ and the income premium is $I > 0$. In adulthood, uneducated workers can either earn $\hat{w} + I$ if they migrate or w if they don't. Likewise, educated workers can earn $\hat{w}h + I$ if they migrate and wh if they don't migrate. Individuals incur a fixed cost in adulthood if they attempt to emigrate, denoted by M. Let the probability of migration, denoted by p, be the same for both educated and uneducated workers. Suppose $(\hat{w} + I - w) \geq \frac{M}{p}$, which implies that all individual would choose to emigrate.[14]

If individuals are risk neutral so that they choose their education to maximize life-

[14]The condition for all educated workers to choose to migrate is $\hat{w}h + I - wh \geq \frac{M}{p}$ and for uneducated worker, it is $\hat{w} + I - w \geq \frac{M}{p}$. These conditions imply that an increase in income due to migration should be greater or equal to the ratio of the cost and probability of migration. According to the UK Defense Committee, the annual salary of a British Gurkha soldier in 1989 was 100 times the average income in Nepal. Furthermore, the financial cost of applying for the British Gurkha is minimal as there is no application fee and the recruiters visit most Gurkha villages every year during the first stage of selection process. Moreover, the empirical estimate is interpreted as the average treatment effect on all age eligible Gurkha men, regardless of their future intention of applying to the British Gurkha.

time income, then the condition for investing in education becomes:

$$w - c \ + (1-p)\, wh \ + p\, (\hat{w}h + I) \ - M \quad > \quad w \ + (1-p)\, w \ + p\, (\hat{w} + I) \ - M$$

and individuals will invest in education if and only if:

$$c \ < c_p \ \equiv w(h-1) \ + p\, (\hat{w} - w)\, (h-1) \tag{1}$$

The critical threshold c_p is increasing in the probability of migration p, which implies that migration prospects raise the expected return to education and induce more individuals in developing countries to invest in education. Furthermore, this incentive effect is larger, greater the international wage difference $(\hat{w} - w)$. Now, suppose the migration probability changes differentially across educated and uneducated workers.[15] In line with the change in the British Gurkha education requirement, the migration probability is assumed to be still p for educated workers but $\underline{p}$ for unskilled workers, where $\underline{p}$ equals zero. The probability p is assumed to be be independent of schooling decisions of other individuals at home.[16] Uneducated workers remain at home and therefore earn domestic wage w in both periods. In contrast, educated workers earn $w - c$ in their youth and once adult they can earn either $\hat{w}h + I - M$ if they migrate

[15]Prior to the rule change in 1993, both educated and uneducated workers had equal probability of joining the British Gurkha Army. Furthermore, since the selection criteria were solely based on physical attributes, education did not increase one's chance of getting selected. Following the rule change in 1993, however, only individuals with required education level could apply; whereas, individuals with less than 8 years of education could no longer apply to the British Gurkha.

[16]The probability p can be a decreasing function of $c_s(p)$ in (2), defining an implicit solution for p. The response to the rule change is partly determined by individual's expectation of how others would response to the rule change, which in turn affect their perceived p. The perceived and actual probability after the rule change will either stay the same or increase.

or $wh - M$ if they don't.[17] The new condition for investing in education is:

$$w - c \; + (1-p) \; wh \; + p \; (\hat{w}h + I) \; - M \quad > \quad w \; + w$$

and individuals will opt for education if and only if:

$$c \; < c_s \; \equiv w(h-1) \; + p \; (\hat{w} - w) \; h \; + p \, I \; - M \tag{2}$$

The new critical threshold c_s is increasing in skilled emigration probability p, the difference in wage $(\hat{w} - w)$, and the foreign income premium I. If $I \geq \frac{M}{p}$, it implies that $c_s > c_p$ because individuals who could emigrate without education previously, are now prompted to invest in education in order to earn income premium abroad. So to sum up, emigration prospects raise expected returns to education because of higher wage rate abroad, and skilled emigration relative to unskilled emigration prospects further increase expected returns to education because only skilled workers can emigrate and earn the higher income premium.

4 Identification Strategy

The change in the educational requirement in 1993 compelled new recruits to complete at least 8 years of education in order to be eligible for the British Gurkha and, thereby, increased their skilled emigration prospect relative to unskilled emigration. The theoretical analysis above suggests that this rule change would increase expected returns to education and induce individuals to invest in human capital. Furthermore, because the rule change was exogenous to the socio-economic characteristics of Nepal, the empirical strategy of comparing the education outcome of individuals who were

[17] Similar to the previous case, assume $\hat{w}h + I - wh \geq \frac{M}{p}$, so that all educated workers would choose to migrate.

affected to those who were not affected by the rule change gives an unbiased estimate of its effect on domestic schooling.

The individuals' exposure is jointly determined by their sex, ethnicity, and age. First, the British Gurkha, in contrast to the other regiments of the British Army, is exclusively made up of men; therefore, women were not affected. Second, because recruits must be between $17\frac{1}{2}$ and 21 years old, men who were 22 or older in 1993 were not affected by the rule change.[18] Third, considering most British Gurkha soldiers since 1857 have been Gurkha ethnic men, non-Gurkha men were also not affected. Hence, the effect of rule change on age eligible Gurkha ethnic men is identified via difference-in-difference estimation, comparing male education between eligible and ineligible cohorts, within Gurkha and non-Gurkha ethnic groups. The difference in education between the two cohorts in the Gurkha ethnic group could be correlated with the age-varying unobserved variables. Therefore, subtracting from this the cohort difference in education for non-Gurkha ethnic men would net out all age-varying characteristics as well as age-invariant ethnic characteristics that could directly affect education. The identification assumption is that in absence of this rule change in 1993, the evolution of education outcomes of men between the two cohorts would not have systematically differed across Gurkha and non-Gurkha ethnic groups. Furthermore, the difference-in-difference estimate of female education between the two ethnic groups and cohorts serves as a false experiment to test this identification assumption.

The above identification strategy can be expressed using the following regression framework:

$$\begin{aligned} Y_{ikml} \quad = \quad & c + \alpha_{1k} + \beta_{1m} + \eta_{1l} + \gamma\,(\,T_{ik} * G_{im}\,) + \\ & \sum_j (\,P_{ij} * R_m\,) * \delta_j + \sum_j (\,P_{ij} * K_l) * \lambda_j + \epsilon \end{aligned} \tag{3}$$

[18]As mentioned earlier, cohorts 22 and older are referred to as the "ineligible" cohort and cohorts 21 and younger are referred to as the "eligible" cohort.

where Y_{ikml} is the education outcome for individual i of age k and ethnicity m, born in district l; α_{1k} is an age dummy for each k; β_{1m} is an ethnicity dummy for each m; η_{1l} is a district of birth dummy for each l; G_{im} is a dummy indicating whether individual belongs to the Gurkha ethnic group; T_{ik} is a dummy indicating whether the individual belongs to eligible cohort; P_{ij} is a dummy indicating whether individual is age j for $j \in \{age\ cohorts\}$; R_m is a vector of ethnicity-specific variables; and K_l is a vector of district-specific variables.

The above reduced form specification nets out any positive or negative externatilities that affect both Gurkha and non-Gurkha ethnic groups. On one hand, higher school enrollment among age eligible Gurkha men could decrease quality of education, which in turn could negatively impact schooling. On the other hand, higher school enrollment could create positive peer effects, encouraging schooling among Gurkha and non-Gurkha ethnic men who have no intention of joining the British Gurkha. Hence, the coefficient from the above specification should be interpreted as the net effect of the rule change on age eligible Gurkha ethnic men. Furthermore, since the information regarding individual's decision to apply for the British Gurkha are not available, the coefficient is also the average treatment effect from the rule change on all age eligible Gurkha men, regardless of their future intention of applying for the British Gurkha.

The identification strategy can also be generalized to examine the impact of the rule change for each birth-year cohort in the following regression framework:

$$\begin{aligned} Y_{iklm} \quad = \quad & c + \alpha_{1k} + \beta_{1m} + \eta_{1l} + \sum_{x} (\, P_{ix} * G_{im} \,) * \gamma_x + \\ & \sum_{j} (\, P_{ij} * R_m \,) * \delta_j + \sum_{j} (\, P_{ij} * K_l) * \lambda_j + \epsilon \end{aligned} \qquad (4)$$

Each γ_x can be interpreted as the effect of the rule change on Gurkha men of age x. Since men who were 22 and older were not affected, the coefficients γ_x should be 0 for $x \geq 22$. Additionally, the coefficients γ_x should increase as x decreases for $x < 22$. Younger age eligible Gurkha men were more likely to be enrolled in school at the time of the rule change and had more time to complete 8^{th} grade education, putting them in a better position to respond to the rule change compared to older age eligible men.

The data required for the above identification strategy are obtained from 2001 Nepal Census for individuals aged 6 to 44 in 1993. The census data are supplemented with Nepal Living Standard Survey (NLSS) from 1996, which is a household sample survey with greater detail. Table 1 presents summary statistics for the 1,389,705 individuals from the 2001 Census and the 3,373 households from the 1996 NLSS. The averages for some socio-economic characteristics are provided for the entire sample as well as separately for the Gurkha and non-Gurkha ethnic groups. The Gurkha ethnic group comprises of 16 percent of the samples in both surveys. Panel A shows that the average level of education for the Gurkha ethnic group is 3.28, which is slightly lower than the non-Gurkha average of 4.24. Similarly, 18.2% of Gurkha individuals were born in urban districts compared to 34.1% of non-Gurkhas. Panel B suggests that around the time of the rule change, non-Gurkha households had better access to school facilities than Gurkha households and 46.9% of non-Gurkha households were living in poverty compared to 48.5% of Gurkha households.

5 Results

The identification strategy can be illustrated with a simple difference-in-difference table between the eligible and ineligible cohorts in the Gurkha and non-Gurkha ethnic groups. Table 2 compares educational attainment of Gurkha and non-Gurkha men who were not affected by the rule change (age 22 - 28) to those who were affected, either cohort aged 6 to 12 or cohort aged 13 to 21. I use eligible cohort aged 6 to 12 as the preferred cohort of analysis because this younger eligible cohort is most likely to be enrolled in primary school in 1993 and also have enough time to change their education in line with the new rule by the time they apply to the British Gurkha. On the contrary, the ability of older eligible men aged 13 to 21 to respond to the rule change is determined by the years of education that they have had completed in 1993. For example, a Gurkha men of age 20 would only be able to successfully respond to the rule change, if he had at least 7 years of education in 1993. Given the data on their education in 1993 are not available, the older eligible cohort includes Gurkha men some of whom were affected by the rule change and others who were not.

In both ethnic groups, average education increased over time; but it increased more in the Gurkha ethnic group. The simple difference-in-difference estimation shows that Gurkha men of younger eligible cohort (aged 6-12) completed an average of 1.2 more years of education. This is significantly difference from zero at the 1% level. Panel B shows that Gurkha men of older eligible cohort (aged 13-21) also raised their education by 0.28 years, which is less compared to younger eligible cohort but also expected due to the reasons discussed earlier. Nevertheless, the estimate is also statistically significant at the 1% level. The two estimates are large in magnitude especially for younger eligible cohort with an increase in education of 32% over the ineligible cohort. The large impact of the rule change indicates that the British Gurkha constitutes an attractive foreign labor market opportunity for Gurkha men. Furthermore, it highlights the role of skilled emigration prospects on increasing returns to education among individuals who might otherwise have limited opportunity to benefit from education in the domestic labor market. This is especially true for Gurkha recruitment as Caplan (1995) notes that most of the potential recruits come from rural villages of Nepal and if not for the British Gurkha Army their best alternative source of income is farming.

The above results rely on the assumption that in absence of the rule change, the difference of educational outcomes between the eligible and ineligible cohorts would not have systematically differed across Gurkha and non-Gurkha ethnic groups. Table 3 presents a series of control experiments that compare educational attainment between cohorts and ethnic groups that were not affected by the rule change and therefore, in contrast to the results in Table 2, should produce difference-in-difference estimates of zero. Panel A compares education of ineligible cohort aged 22 to 28 with another ineligible cohort aged 29 to 35 across Gurkha and non-Gurkha men. The difference-in-difference estimate is 0.28 and not statistically different from zero at the conventional levels. The control experiment in panel B considers cohort aged 22 to 28 and cohort aged 38 to 44, so that the age difference between the two ineligible cohorts is consistent with the experiment in panel A of Table 2, in which the age difference between the younger eligible cohort and ineligible cohort is 9 years. The difference-in-difference is -0.05 and not statistically different from zero. Lastly, panel C compares education outcome for females aged 6 to 12 with 22 to 28, in Gurkha and non-Gurkha ethnic groups. The difference-in-difference estimate of the effect of the rule change on Gurkha women of younger eligible cohort is not statistically different from zero, which is expected given that women are not eligible for the British Gurkha. These three results, or moreover the lack of significant results, support the validity of the identification assumption and suggest that the increase in education for age eligible Gurkha men in Table 2 is likely caused by the change in the educational requirement for the British Gurkha recruitment.

Tables 4 and 5 present the difference-in-difference analysis by estimating coefficient γ in equation (3). The specification in column 1 controls for age dummies and ethnicity dummies and the specification in column 2 additionally controls for district of birth dummies. Figure 1 shows that Gurkha ethnic groups are concentrated in the northern central region and north east corner of Nepal. If time-varying regional characteristics are correlated with education, it could bias the above estimates. I control for differential evolution of geographic regions in columns 3, 4, and 5 by including interactions of age dummies and district of birth dummies, for all ages and districts. The specification in columns 4 and 5 also include interactions of age dummies and district-level characteristics– total number of primary and secondary teachers in 1994. Moreover, the specification in column 5 controls for additional time-varying ethnic characteristic by including the interaction of age dummies and ethnicity-level variable measuring the access to school, obtained from 1996 NLSS.

The estimates in Table 4, column 1 suggest that an increase in educational requirement for the British Gurkha raised the education among younger eligible cohort by 1.19 years and older eligible cohort by 0.42 years, and both estimates are statistically significant at the 1% level. More importantly, controlling for various time-varying regional and ethnic characteristics do not change the magnitude and the statistical significance of the estimates for both eligible cohorts, which makes it unlikely that the results are driven by time-varying characteristics that are correlated with education. The estimates in column 5, which includes all the controls mentioned earlier, suggest that Gurkha men from younger eligible cohort raised their education by 1.11 years and older eligible cohort by 0.39 years. In contrast, the estimates in the three control experiments presented in Table 5, are not statistically different from zero in all specifications, thereby strengthening the validity of the main results.

Table 6 shows the effect of the rule change for each eligible birth-year cohort by estimating γ_xs in equation (4) for $6 \leq x \leq 21$. The comparison group consists of ineligible cohort aged 22 to 28. In all specifications, the estimated effect is statistically significant at the 5% levels for Gurkha men 15 years or younger. The results in column 5 suggest that the rule change raised education for Gurkha men aged 15 by 0.69 years, aged 12 by 0.95 years, and aged 6 by 1.38 years. Furthermore, in line with the natural experiment, the effect of the rule change increases with younger age due to the reasons discussed in the earlier section. If the results are driven by the response to the rule change, the estimated effects would decrease with age for Gurkha men of eligible cohort and be zero for all ineligible birth-year cohorts. I test this hypothesis by estimating γ_xs in equation (4) for $6 \leq x \leq 35$. The control group comprises of men aged 36 and 37. The estimates of γ_xs are plotted in Figure 2. γ_xs fluctuate around zero and statistically insignificant for all $x \geq 22$ and increase as age decreases for $x \leq 21$, providing further support for the internal validity of the natural experiment. Moreover, I estimate γ_xs for females and plot it in Figure 3. In contrast to Figure 2, the estimates of γ_ss are statistically insignificant for all eligible and ineligible birth-year cohorts.

The rule change induced eligible Gurkha men who had no formal education at the time of the rule change, to enroll in school for the first time. Table 7 presents the effect at the extensive margin, by estimating the coefficient γ in equation (3) for younger eligible cohort, where the dependent variable is a dummy indicating years of education completed greater than zero. The results in column 5 suggest that the proportion of young eligible Gurkha men with at least 1 year of education increased by 10 percentage points. Given 51% of age ineligible Gurkha men have no formal education, the rule change induced 19.5 percent of young eligible Gurkha men who would not have received any formal education in the absence of the rule change, to enroll in school. In comparison, Schultz (2004) estimates that the Mexican Progresa Program induced 10 percent of individuals who had no prior education to enroll in school by reducing educational cost by as much as 75%.[19]

Individuals who were induced to enroll in school by the rule change and who had already enrolled prior to the rule change, were further promoted to raise their education

[19]These two results might not be directly comparable as PROGRESA started from higher enrollment base and targeted poorest students. Because of these reasons, increasing schooling might have been harder to achieve in the case of PROGRESA.

because the new rule required 8 years of education. I estimate the impact at different education levels by estimating the difference in differences in the cumulative distribution function of education between young eligible and ineligible cohorts across Gurkha and non-Gurkha men who have at least one year of education. Figure 4 depicts the estimates of γ^ss from equation (4), with a dummy dependent variable indicating the level of education completed greater than s, for each $s = 1$ to 15. Among Gurkha men of young eligible cohort with at least one year of education, the share of those with 5 or more years (primary education) increased by 3 percentage points, 8 or more years (the requirement cutoff) increased by 6 percentage points, and 13 or more years (tertiary education) increased by 9 percentage points.

The large impact at upper end of the education distribution is particularly significant, given Jensen (2010) points out that in developing countries a combination of costs, low family income, and credit constraints provides a relatively greater hindrance to secondary schooling compared to primary education as it requires a longer term and more costly investment. For example, while 67% of Nepali boys in 1996 were enrolled in primary school, the net enrollment rate in lower secondary level (6-8 years) was merely 23% (1996 NLSS). Additionally, the positive impact on education above 8 years could be due to the further increase in the British Gurkha educational requirement from 8 to 10 years in 1997 or because eligible Gurkha men who completed 8 years of education to comply with the new rule continued into higher education. Angrist and Imbens (1995) find similar positive spillover effects in the United States, where the compulsory attendance laws induced a fraction of the sample to complete some college as a consequence of constraining them to complete high school.

In developing countries, socio-economic factors such as access to schools, costs, credit constraints, and family income, limit individuals from attending school even when they want to. I examine the effect of these factors on individuals' response to the rule change, by separately estimating equation (3) across different population characteristics. The results in columns 2 and 3 of Table 8 indicate that the effect of the rule change did not vary across districts with and without easy access to schooling. However, the difference in average travel time to school between the bottom and top quantile districts is only 0.3 hours, which reflects the emphasis put by the government on improving access to school in remote areas of Nepal. The results in columns 4 and 5 indicate that the impact of the rule change was smaller for individuals living in households that are involved in agricultural production, which could be due to labor constraints in agriculture. Furthermore, columns 6 and 7 separately estimate the effect of the rule change across household income, using ownership of television set as a proxy for family wealth. In households that own a television set, Gurkha men of young eligible cohort raised their education by 1.28 years; whereas, their counterparts living in the household without a television set only raised their education by 0.76 years. The F-test suggests that estimates are statistically different at the 10% level. While these results should be interpreted with caution due to omitted variable bias, the stratified results, nevertheless, could be potentially informative given they document the role of poverty and credit constraints in limiting schooling in developing countries.

6 Robustness

In the above empirical estimation, the non-Gurkha ethnic group may not be a valid comparison for the Gurkha ethnic group because ineligible Gurkha cohorts have significantly lower level of education than their non-Gurkha counterparts. To refute the possibility that the results could be driven by age-varying unobserved ethnic characteristics, I use a data-driven procedure developed by Abadie and Gardeazabal (2003) to construct a different comparison group. The new counterfactual– the synthetic Gurkha ethnic group– is the convex combination of all non-Gurkha ethnicities that most closely resemble the Gurkha ethnic group based on the education of age ineligible men. For each non-Gurkha ethnicity, the average years of education is calculated for each birth cohort and then ethnicity-weights are assigned to minimize the difference between education of Gurkha and synthetic Gurkha ethnic groups across ineligible cohorts aged 22 to 44.[20] Table 10 displays the weights of each non-Gurkha ethnicity in the synthetic Gurkha ethnic group.

Figure 5 depicts the years of education completed for Gurkha and synthetic Gurkha ethnic groups across birth cohorts aged 6 to 44. Education of the synthetic Gurkha ethnic group closely matches that of the Gurkha ethnic group for ineligible cohorts aged 22 to 44, suggesting that the eligible cohort of synthetic Gurkha ethnic group provide a close approximation to the eligible cohort of Gurkha ethnic group in the absence of the rule change. The difference in education between Gurkha and synthetic Gurkha ethnic groups for cohorts aged 6 to 21 could be interpreted as the effect of the increase in the British Gurkha education requirement. Figure 6 shows that education between Gurkha and synthetic Gurkha ethnic groups diverges considerably for eligible cohorts and the gap, depicted in Figure 6, becomes larger for younger cohorts, which is consistent with the results from the difference-in-difference estimation.

The results could have also been obtained entirely by chance. Following Bertrand et al. (2004), I iteratively apply the synthetic control method to all the non-Gurkha ethnicities to examine whether assigning treatment at random produces results of similar magnitude. In each case, the synthetic control is composed of the weighted combination of the remaining non-Gurkha ethnicities. Figure 7 displays the results of the placebo

[20] The ethnicity-weights are calculated from the minimization problem: Choose W to minimize $(X_G - X_N W)(X_G - X_N W)$, where $W = \{(w_1, ...w_J)'$ subject to $w_1 + ... + w_J = 1,\ w_J \geq 0\}$. X_G is a $(k\ X\ 1)$ vector of average years of education at each age ineligible birth cohorts for the Gurkha ethnic group, where $21 \leq k \leq 44$. X_N is a $(k\ X\ J)$ matrix with average years of education for k ineligible birth cohorts and J non-Gurkha ethnicities.

iterations for 10 non-Gurkha ethnicities. The faded lines show the gap in education between each non-Gurkha ethnicity and its corresponding synthetic version. The gap for Gurkha ethnic group, depicted by the dark line, is largest compared to any non-Gurkha ethnicities. More importantly, the education gap between Gurkha and synthetic Gurkha for eligible cohort is four times larger than the similar gap for ineligible cohort. Figure 8 shows that this is largest among all ethnicities. Given there are 11 different ethnicities, including Gurkha ethnic group, and thereby 11 different results, the probability of obtaining the largest effect for Gurkha ethnic group entirely by chance is 1/11 = 0.09. Therefore, it is unlikely that the estimated effect of the rule change on age eligible Gurkha men could have occurred entirely by chance.

7 Conclusion

I utilize the change in the educational requirement for the British Gurkha to study the effect of skilled emigration prospects on domestic schooling. This unique natural experiment allows me to avoid the problems of omitted variable bias and reverse causality that have plagued previous studies to establish this causal relationship. First, because the rule change was instigated by the restructuring of the British Army, it led to an exogenous increase in skilled emigration prospect for Nepali men who were exposed to this rule change. Second, I can control for all age-varying characteristics and age-invariant ethnic characteristics correlated with education because the exposure to the rule change is jointly determined by individual's ethnicity and age. The difference in difference strategy estimates that in response to the increase in skilled emigration relative to unskilled emigration prospect to join the British Army, Gurkha men of eligible cohort aged 6 to 12 raised their education by 1.1 years, more than 30% increase over the average education of Gurkha men aged 22 to 28.

Economists and policymakers have emphasized the loss incurred by developing countries due to brain drain by relying on figures like 10 percent to skilled labors of the Caribbean and the Pacific islands live abroad. Now my findings shed a new light into brain drain by suggesting that skilled emigration might also have created the incentive in the first place for natives of these countries to invest in their education. Moreover, if this incentive effect dominates the actual loss of skilled workers due to brain drain, the developing countries could still raise their net human capital stock relative to when skilled emigration is prohibited. These findings are significant because skilled emigration is most likely to increase in the future because of widening international wage gaps and the recent introduction of skill-biased immigration policies in developed countries.

Skilled emigration prospects allow regions with low returns to schooling to improve their human capital investment because their natives could be motivated by higher income abroad. This is especially true for the British Gurkha recruitment since most recruits come from remote regions of Nepal that have seen very little economic and technological growth. While the knowledge of the British Gurkha rule change was widespread, information regarding skilled emigration prospects to other foreign labor markets may not be as readily available. Given the lack of information regarding returns to education could lead to under-investment in human capital, as shown by Jensen (2010), in order for individuals at home to know the educational returns abroad requires efficient flow of information, possibly through an active government intervention.

An interesting future research include investigating the welfare impact on Gurkha men who raised their education, especially among those who could not join the British Gurkha. Similarly, the rule change also created numerous positive and negative externalities on other populations that were not directly affected by it. First, an increase in education by Gurkha men could directly affect their peers' education decisions. On one hand, it decrease the quality of education by crowding-out classrooms; whereas, on the other hand, greater class participation could lead to positive learning experience for other classmates. This provides a useful experiment to investigate the peer effects, which has been an integral part of education research. Second, raising Gurkha men's education could affect education of their siblings, mainly female siblings who were not affected by the rule change. Because important socio-economic decisions, such as children's education, are made by the households in developing countries, it provides a useful opportunity to investigate the intra-hosuehold tradeoffs among siblings and, in the process, allows for better evaluation of existing household interventions and development of more effective policies in the future.

References

Abadie, Alberto and Javier Gardeazabal, "The Economic Costs of Conflict: A Case Study for the Basque Country," *The American Economic Review*, 2003, *93* (1), 113–132.

Angrist, Joshua D. and Guido W. Imbens, "Two-Stage Least Squares Estimation of Average Causal Effects in Models with Variable Treatment Intensity," *Journal of the American Statistical Association*, June 1995, *90* (430), 431–442.

Banskota, Purushottam, *The Gurkha Connection: A History of the Gurkha Recruitment in the British Indian Army*, Nirala Publications, 1994.

Beine, Michel, Frederic Docquier, and Hillel Rapoport, "Brain Drain and Human Capital Formation in Developing Countries : Winners and Losers," 2006. University catholique de Louvain, Departement des Sciences Economiques.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan, "How Much Should We Trust Differences-in-Differences Estimates?," *Quarterly Journal of Economics*, 2004, *119* (1), 249–275.

Bhagwati, J.N. and K. Hamada, "The Brain Drain, International Integration of Makets for Professionals and Unemployment," *Journal of Development Economics*, 1974, *1*, 19–42.

Borjas, George, "Self-Selection and the Earnings of Immigrants," *The American Economic Review*, 1987, *77.*

Caplan, Lionel, *Warrior Gentlemen: Gurkhas in the Western Imagination*, Berghahn Books, 1995.

Chand, Satish and Michael A. Clemens, "Skilled Emigration and Skill Creation: A Quasi-Experiment," 2008.

Docquier, Frederic, Oliver Lohest, and Abdeslam Marfouk, "Brain Drain in Developing Countries," *World Bank Economic Review*, 2007, *21* (2), 193–218.

Duflo, Esther, "School and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusal Policy Experiment," *The American Economic Review*, 2001, *91*, 795–813.

Foster, Andrew D. and Mark R. Rosenzweig, "Technical Change and Human-Capital Returns and Investments: Evidence from the Green Revolution," *The American Economic Review*, Sept 1996, *86* (4), 931–953.

Haque, Nadeem U. and Se-Jik Kim, "Human Capital Flight: Impact of Migration on Income and Growth," *IMF Staff Papers*, 1995, *42 (3)*, 577–607.

Hitchcock, John Thayer, *The Magars of Banyan Hill*, Holt, Rinehart, and Winston, 1966.

Jensen, Robert, "The (Perceived) Returns to Education and the Demand for Schooling," *The Quarterly Journal of Economics*, 2010, *125* (2), 515–548.

Kansakar, V.B.S., *Effectiveness of Planned Resettlement Programme in Nepal*, CEDA, 1979.

Kochar, Anjini, "Urban Influences on Rural Schooling in India," *Journal of Development Economics*, 2004, *74*, 113–136.

Marchiori, Luca, I-Ling Shen, and Frederic Docquier, "Brain Drain in Globalization: A General Equilibrium Analysis from the Sending Countries' Perspective," *IZA Discussion Paper 4207*, 2009.

McKenzie, David and Hillel Rapoport, "Can Migration Reduce Educational Attainment? Evidence from Mexico," *World Bank Policy Research Working Paper 3952*, 2006.

Mincer, Jacob, "HUman Capital and Ecnomic Growth," *Economics of Education Review*, 1984, *3* (3), 195–205.

Miyagiwa, Kaz, "Scale Economies in Education and the Brain Drain Problem," *International Economic Review*, August 1991, *32* (3), 743–759.

Mountford, Andrew, "Can a Brain Drain Be Good for Growth in the Source Country?," *Journal of Development Economics*, 1997, *53(2)*, 287–303.

Oyelere, Ruth Uwaifo, "Understanding Low Average returns to Education in Africa: The Role of Heterogeneity across Education Levels and the Importance of Political and Economic Reforms," July 2009.

Rathaur, Kamal Raj Singh, "British Gurkha Recruitment: A Historical Perspective," *Voice of History*, 2001, *16(2)*, 19–24.

Schultz, T. Paul, "School Subsidies for the Poor: Evaluating the Mexican Progresa Poverty Program," *Journal of Development Economics*, June 2004, *74* (1), 199–250.

Schultz, Theodore W., "The Value of the Ability to Deal with Disequilibria," *Journal of Economic Literature*, September 1975, *13* (3), 827–846.

Shrestha, Nanda R., *The Political Economy of Land, Landlessness and Migration in Nepal*, Nirala Series, 2001.

Yang, Dean, "International Migration, Remittances, and Household Investment: Evidence from Philippine Migrants' Exchange Rate Shocks," *The Economic Journal*, 2008, *118*, 591–630.

Table 1: Descriptive Statistics

	Whole Sample	Gurkha	Non-Gurkha
Panel A: Individual Level Means			
2001 Census of Nepal			
Total Sample	1389705	245148	1144557
% of sample	-	17.6%	82.4%
Literacy Rate	55.2%	53.2%	55.6%
male	69.5%	66.9%	70.0%
female	41.3%	41.0%	41.4%
Level of Education	4.07	3.28	4.24
aged 6-12 in 1993	5.41	5.08	5.48
male	6.17	5.74	6.26
female	4.64	4.46	4.68
aged 13-21 in 1993	4.89	3.96	5.08
male	6.38	5.20	6.61
female	3.53	2.95	3.66
aged 22-28 in 1993	3.41	2.33	3.62
male	5.08	3.64	5.34
female	1.82	1.22	1.95
aged 29-37 in 1993	2.49	1.46	2.71
male	3.97	2.44	4.28
female	1.02	0.55	1.12
aged 38-44 in 1993	1.88	1.03	2.10
male	3.10	1.76	3.42
female	0.60	0.30	0.67
Percent of Population Born in Urban	31.3%	18.2%	34.1%
aged 6-12	34.7%	21.1%	37.8%
aged 13-21	32.7%	19.6%	35.4%
aged 22-28	30.3%	17.3%	32.9%
aged 29-37	27.8%	15.0%	30.5%
aged 38-44	25.6%	13.2%	29.0%
Panel B: Household Level Means			
1996 NLSS			
Total Sample	3373	544	2829
% of Sample	-	16.1%	83.9%
Household Size	5.59	5.27	5.65
Access to School	0.38 Hrs	0.54 Hrs	0.35 Hrs
Access to Paved Road	9.30 Hrs	14.45 Hrs	8.30 Hrs
Percent of Household in Poverty	33.5%	48.5%	46.9%

Table 2: Mean Education by Cohort and Ethnicity

	Level of Education Completed		
	Gurkha	Non-Gurkha	Difference
Panel A: Experiment 1			
Male aged 6 to 12 in 1993	5.74	6.26	-0.53
	(0.018)	(0.009)	(0.610)
Male aged 22 to 28 in 1993	3.64	5.34	-1.71
	(0.031)	(0.016)	(0.922)
Difference	2.10**	0.92**	1.18**
	(0.181)	(0.286)	(0.329)
Panel B: Experiment 2			
Male aged 13 to 21 in 1993	5.20	6.61	-1.41**
	(0.026)	(0.013)	(0.029)
Male aged 22 to 28 in 1993	3.64	5.34	-1.71**
	(0.031)	(0.016)	(0.035)
Difference	1.56**	1.27**	0.29**
	(0.041)	(0.020)	(0.082)

Notes: This table reports the mean education completed as of 2001 for men of different cohorts and ethnic groups. While Gurkha ethnic men of age 21 and younger were affected by the rule change, those who were 6 -12 years old were more likely to have been enrolled in school at the time of the rule change and, thereby, be in a better position to change their education. On the other hand, the ability of older eligible men aged 13 to 21 to respond to the rule change is determined by the years of education that they have had completed in 1993. Hence, this older eligible cohort includes Gurkha men some of whom were affected by the rule change and others who were not.

The standard errors are reported in parentheses and are adjusted for within-ethnicity correlation between individuals.

* indicates significance at the 5 percent level

** indicates significance at the 1 percent level

Table 3: Mean Education by Cohort and Ethnicity (Falsification Tests)

	Level of Education Completed		
	Gurkha	Non-Gurkha	Difference
Panel A: Control Experiment 1			
Male aged 22 to 28 in 1993	3.64	5.34	-1.71
	(0.031)	(0.016)	(0.922)
Male aged 29 to 35 in 1993	2.58	4.56	-1.98*
	(0.031)	(0.019)	(0.767)
Difference	1.05**	0.78**	0.28
	(0.163)	(0.124)	(0.192)
Panel B: Control Experiment 2			
Male aged 22 to 28 in 1993	3.64	5.34	-1.71
	(0.031)	(0.016)	(0.922)
Male aged 38 to 44 in 1993	1.76	3.42	-1.66**
	(0.030)	(0.021)	(0.620)
Difference	1.88**	1.93**	-0.05
	(0.260)	(0.271)	(0.358)
Panel C: Control Experiment 3			
Female aged 6 to 12 in 1993	4.46	4.68	-0.22
	(0.019)	(0.010)	(0.823)
Female aged 22 to 28 in 1993	1.22	1.95	-0.73
	(0.019)	(0.012)	(0.507)
Difference	3.24**	2.73**	0.51
	(0.293)	(0.248)	(0.362)

Notes: This table reports the difference in differences of average education completed as of 2001 for three control experiments. Gurkha men who were 22 or older and all Gurkha women were not affected by the rule change.

The standard errors are reported in parentheses and are adjusted for within-ethnicity correlation between individuals.

* indicates significance at the 5 percent level

** indicates significance at the 1 percent level

Table 4: Effect on Younger and Older Eligible Gurkha Men

	Obs	(1)	(2)	(3)	(4)	(5)
Panel A: Experiment 1						
Sample: males aged 6 to 12 or 22 to 28	325,876	1.27**	1.19**	1.17**	1.20**	1.11**
(Eligible Cohort: Males aged 6 to 12)		(0.340)	(0.342)	(0.364)	(0.386)	(0.342)
Panel B: Experiment 2						
Sample: males aged 13 to 28	300,327	0.45**	0.42**	0.42**	0.46**	0.39**
(Eligible Cohort: Males aged 13 to 21)		(0.108)	(0.115)	(0.100)	(0.104)	(0.114)
Control Variables:						
Age Fixed Effects		Yes	Yes	Yes	Yes	Yes
Ethnicity Fixed Effects		Yes	Yes	Yes	Yes	Yes
District of Birth Fixed Effects		No	Yes	Yes	Yes	Yes
Age Dummies*District of Birth Dummies		No	No	Yes	Yes	Yes
Age Dummies*Rural Birth Dummy		No	No	Yes	Yes	Yes
Age Dummies*Primary School Teacher[a]		No	No	No	Yes	Yes
Age Dummies*Secondary School Teacher[b]		No	No	No	Yes	Yes
Age Dummies*Access to School[c]		No	No	No	No	Yes

Notes: This table reports the estimates of γ, the coefficient of interaction between Gurkha dummy and eligible cohort dummy from equation (3). The dependent variable is the years of education completed as of 2001. Specifications correct for various time-varying geographic and ethnic characteristics that could be correlated with education and bias the estimate. Gurkha men aged 6 -12 years old were more likely to have been enrolled in primary school at the time of the rule change and, thereby, be in a better position to change their education compared to older eligible men aged 13 to 21. Hence, I use the younger eligible cohort (Panel A) as the preferred cohort of analysis.

[a]**Primary School Teacher** is district-level total number of primary school teachers in pubic schools in 1994.

[b]**Secondary School Teacher** is district-level total number of secondary school teachers in pubic schools in 1994.

[c]**Access to School** is ethnicity-level average distance-time to school in 1996 calculated using 1996 NLSS.

The standard errors are reported in parentheses and are adjusted for within-ethnicity correlation between individuals.

* indicates significance at the 5 percent level

** indicates significance at the 1 percent level

Table 5: Effect on Ineligible Gurkha Men and Eligible Gurkha Women (Falsification Tests)

	Obs	(1)	(2)	(3)	(4)	(5)
Panel A: Control Experiment 1						
Sample: Males aged 22 to 35	214,315	0.23	0.23	-0.02	0.03	0.01
(Eligible Cohort: Males aged 22 to 28)		(0.213)	(0.224)	(0.186)	(0.176)	(0.166)
Panel B: Control Experiment 2						
Sample: males aged 22 to 28 or 38 to 44	192,046	-0.09	-0.06	-0.48	-0.43	-0.62
(Eligible Cohort: Males aged 22 to 28)		(0.241)	(0.428)	(0.261)	(0.467)	(0.466)
Panel C: Control Experiment 3						
Sample: females aged 6 to 12 or 22 to 28	333,055	0.57	0.54	0.12	0.17	-0.09
(Eligible Cohort: Females aged 6 to 12)		(0.408)	(0.407)	(0.345)	(0.332)	(0.351)
Control Variables:						
Age Fixed Effects		Yes	Yes	Yes	Yes	Yes
Ethnicity Fixed Effects		Yes	Yes	Yes	Yes	Yes
District of Birth Fixed Effects		No	Yes	Yes	Yes	Yes
Age Dummies*District of Birth Dummies		No	No	Yes	Yes	Yes
Age Dummies*Rural Birth Dummy		No	No	Yes	Yes	Yes
Age Dummies*Primary School Teacher[a]		No	No	No	Yes	Yes
Age Dummies*Secondary School Teacher[b]		No	No	No	Yes	Yes
Age Dummies*Access to School[c]		No	No	No	No	Yes

Notes: This table reports the estimates of γ, the coefficient of interaction between Gurkha dummy and eligible cohort dummy from equation (3). All three experiments estimate the effect on individuals who were not affected by the rule change. Panel A and B estimates the effect on Gurkha men of ineligible cohorts, aged 22 to 28. In panel B, the age difference between the two cohorts aged 22 to 28 and aged 38 to 44 is same as the difference between younger eligible cohort aged 6 to 12 and ineligible cohort aged 22 to 28 in panel A of Table 4. Panel C estimates the effect of Gurkha women of eligible cohort aged 6 to 12, but none of the Gurkha women were affected because the recruitment of British Gurkha is limited to men. The lack of significant results in these control experiments provide support for the validity of the identification assumption used in Table 4 that the difference in education between the cohorts would have been same across Gurkha and non-Gurkha ethnic groups in the absence of the rule change.

[a]**Primary School Teacher** is district-level total number of primary school teachers in pubic schools in 1994.

[b]**Secondary School Teacher** is district-level total number of secondary school teachers in pubic schools in 1994.

[c]**Access to School** is ethnicity-level average distance-time to school in 1996 calculated using 1996 NLSS.

The standard errors are reported in parentheses and are adjusted for within-ethnicity correlation between individuals.

* indicates significance at the 5 percent level

** indicates significance at the 1 percent level

Table 6: Effect on Eligible Gurkha Men at Each Birth Cohort

	(1)	(2)	(3)	(4)	(5)
Gurkha*Age 21	-0.30	-0.32	-0.18	-0.14	-0.20
	(0.162)	(0.167)	(0.119)	(0.120)	(0.149)
Gurkha*Age 20	0.21	0.19	0.16	0.18	0.18
	(0.115)	(0.132)	(0.119)	(0.122)	(0.189)
Gurkha*Age 19	0.31*	0.30*	0.32**	0.36**	0.34**
	(0.104)	(0.110)	(0.070)	(0.062)	(0.079)
Gurkha*Age 18	0.20	0.17	0.25*	0.30*	0.27
	(0.118)	(0.121)	(0.094)	(0.093)	(0.142)
Gurkha*Age 17	0.86**	0.85**	0.54*	0.59*	0.40
	(0.192)	(0.188)	(0.184)	(0.181)	(0.188)
Gurkha*Age 16	0.23	0.22	0.31	0.34	0.36
	(0.186)	(0.182)	(0.155)	(0.163)	(0.190)
Gurkha*Age 15	0.50*	0.49*	0.64**	0.69**	0.60**
	(0.196)	(0.203)	(0.171)	(0.166)	(0.181)
Gurkha*Age 14	0.74**	0.71**	0.70**	0.72**	0.56**
	(0.138)	(0.136)	(0.161)	(0.180)	(0.182)
Gurkha*Age 13	0.65**	0.57*	0.65**	0.69**	0.68**
	(0.200)	(0.209)	(0.205)	(0.218)	(0.194)
Gurkha*Age 12	1.13**	1.09**	0.91**	0.95**	0.80**
	(0.223)	(0.220)	(0.214)	(0.227)	(0.213)
Gurkha*Age 11	0.94**	0.86*	0.94**	0.98**	0.81**
	(0.293)	(0.298)	(0.281)	(0.303)	(0.265)
Gurkha*Age 10	1.23**	1.12**	1.01*	1.06**	0.98**
	(0.224)	(0.229)	(0.276)	(0.297)	(0.256)
Gurkha*Age 9	1.08**	1.01*	1.06*	1.09*	1.04*
	(0.377)	(0.373)	(0.371)	(0.394)	(0.351)
Gurkha*Age 8	1.39**	1.27**	1.31**	1.33**	1.25**
	(0.409)	(0.413)	(0.405)	(0.428)	(0.418)
Gurkha*Age 7	1.51**	1.41**	1.38*	1.39*	1.34*
	(0.454)	(0.466)	(0.491)	(0.513)	(0.462)
Gurkha*Age 6	1.39*	1.30*	1.38*	1.38*	1.36*
	(0.601)	(0.598)	(0.557)	(0.579)	(0.541)
Control Variables:					
Age Fixed Effects	Yes	Yes	Yes	Yes	Yes
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes
District of Birth Fixed Effects	No	Yes	Yes	Yes	Yes
Age Dummies*District of Birth Dummies	No	No	Yes	Yes	Yes
Age Dummies*Rural Birth Dummy	No	No	Yes	Yes	Yes
Age Dummies*Primary School Teacher	No	No	No	Yes	Yes
Age Dummies*Secondary School Teacher	No	No	No	Yes	Yes
Age Dummies*Access to School	No	No	No	No	Yes

Notes: This table reports the estimates of γ_xs, the coefficients of interactions between Gurkha dummy and age dummies from equation (4). The control group includes cohort aged 22 to 28. The dependent variable is the years of education completed as of 2001. The standard errors are reported in parentheses and are adjusted for within-ethnicity correlation between individuals.
* indicates significance at the 5 percent level

Table 7: Effect on Younger Eligible Gurkha Men (Linear Probability Model)

		Obs	(1)	(2)	(3)	(4)	(5)
Extensive Margin							
Dep Var:	Dummy Indicating Years of Education >0	325,876	0.12**	0.12**	0.10**	0.10*	0.10*
			(0.033)	(0.034)	(0.034)	(0.035)	(0.034)
Control Variables:							
Age Fixed Effects			Yes	Yes	Yes	Yes	Yes
Ethnicity Fixed Effects			Yes	Yes	Yes	Yes	Yes
District of Birth Fixed Effects			No	Yes	Yes	Yes	Yes
Age Dummies*District of Birth Dummies			No	No	Yes	Yes	Yes
Age Dummies*Rural Birth Dummy			No	No	Yes	Yes	Yes
Age Dummies*Primary School Teacher			No	No	No	Yes	Yes
Age Dummies*Secondary School Teacher			No	No	No	Yes	Yes
Age Dummies*Access to School			No	No	No	No	Yes

Notes: This table reports the estimates of γ, the coefficient of interaction between Gurkha dummy and eligible cohort dummy, from equation (3) with a dummy dependent variable indicating the years of education completed greater zero. The sample includes men from younger eligible cohorts aged 6 to 12 or ineligible cohort aged 22 to 28. The standard errors are reported in parentheses and are adjusted for within-ethnicity correlation between individuals.

* indicates significance at the 5 percent level

** indicates significance at the 1 percent level

Table 8: Effect on Younger Eligible Gurkha Men (Differential Effect)

Dependent Variable	Whole	Distance to School[a]		Household Enterprise[b]		Household Income[c]	
	Sample (1)	≤Median (2)	>Median (3)	Agri Land (4)	No Agri Land (5)	Owns TV (6)	Does not own TV (7)
Years of Education	1.17** (0.364)	1.16* (0.416)	1.18** (0.347)	0.86* (0.284)	1.34** (0.391)	1.29** (0.320)	0.76** (0.269)
No of Obs	325,879	181,159	144,717	130,698	195,178	86,851	239,025

Notes: This table reports the estimates of γ, the coefficient of interaction between Gurkha dummy and eligible dummy from equation (3). The dependent variable is the years of education completed as of 2001. The sample includes men of eligible cohort aged 6 to 12 and ineligible cohort aged 22 to 28. All the columns use specification from column 3 from Table 4, which includes ethnicity dummies, age dummies, district of birth dummies, age dummies*district of birth dummies, and age dummies*rural birth dummies.

[a]**Distance to School:** Sample divided into two categories based on average distance-time to school in 1996: individuals born in districts with average distance-time to school $\leq$ median district-level time and districts with average distance-time to school $\geq$ median district-level time. The median district-level distance-time to school is 0.36 hours.

[b]**Household Enterprise:** Sample divided into two categories based on ownership of agricultural land and livestocks in 2001.

[c]**Household Income:** Sample divided into two categories based on ownership of a television set in 2001

The standard errors are reported in parentheses and are adjusted for within-ethnicity correlation between individuals.

* indicates significance at the 5 percent level

** indicates significance at the 1 percent level

Table 9: **Lifetime Earnings of British Gurkha Soldier**

Timeline	Income	Present Value of Income[a]
1. Recruitment into the British Gurkha at age 20[b]		
New Entrant	$20,880.00	$20,880.00
Rifleman (Level 1)	$26,037.00	$25,776.63
Rifleman (Level 2)	$28,068.00	$27,509.45
Rifleman (Level 3)	$31,000.00	$30,079.27
Rifleman (Level 4)	$33,320.00	$32,007.06
Rifleman (Level 5)	$36,842.00	$35,036.38
Lance Corporal (Level 1)	$38,634.00	$36,373.14
Lance Corporal (Level 2)	$40,407.00	$37,661.96
Lance Corporal (Level 3)	$42,224.00	$38,961.97
Lance Corporal (Level 4)	$44,256.00	$40,428.62
Lance Corporal (Level 5)	$44,256.00	$40,024.33
Corporal (Level 1)	$44,256.00	$39,624.09
Corporal (Level 2)	$44,286.00	$39,254.44
Corporal (Level 3)	$46,454.00	$40,764.36
Corporal (Level 4)	$47,539.00	$41,299.31
Corporal (Level 5)	$48,686.00	$41,872.80
Corporal (Level 6)	$49,694.00	$42,312.34
Corporal (Level 7)	$50,779.00	$42,803.81
Sergeant (Level 1)	$50,779.00	$42,375.77
Sergeant (Level 2)	$51,424.00	$42,484.90
Sergeant (Level 3)	$52,727.00	$43,125.78
Sergeant (Level 4)	$53,392.00	$43,232.99
Sergeant (Level 5)	$54,432.00	$43,634.36
Sergeant (Level 6)	$55,471.00	$44,022.58
Sergeant (Level 7)	$56,512.00	$44,400.24
Subtotal	$1,092,355.00	$955,946.58

2. Retirement from British Gurkha at age 45[c]		
(Between age 45 to 65, the pension is calculated under Early Departure Payments Structure)		
(i) Between 45 to 55:		
Highest Pensionable Salary*Years of Service*1/70*(50%+8.3335%)=		
56512*25*1/70*58.3335%=$11,773.37		
x 10=	$117,733.67	$87,562.87
1^{st} Lump Sum = 3 * Pension	$35,320.11	$27,472.74
Subtotal	$153,053.78	$115,035.61
(ii) Between 55 to 65:		
Highest Pensionable Salary*Years of Service*1/70*(75%)=		
56512*25*1/70*75%=$15,137.14		
x10=	$151,371.43	$101,815.75
Subtotal	$151,371.43	$101,815.75
(After age 65, the pension is calculated under AFPS 05)		
(iii) Between age 65 to 75[d]:		
Highest Pensionable Salary*Years of Service*1/70=		
56512*25*1/70=$20,182.85		
x10=	$201,828.57	$122,773.76
2^{nd} Lump Sum = 3 * Pension	$60,548.57	$38,520.11
Subtotal	$262,377.14	$161,293.87
Total	**$1,659,157.35**	**$1,334,091.81**

Notes: This table reports the lifetime income of a typical Gurkha soldier, including annual salary, benefits, and pensions.

[a] Present value of income is calculated using a discount factor of 0.99. If income in the third year of service is $28,068, then the present value of third year's income is 0.99^2*28,068 = $27,509.45

[b] Salary structure for British Gurkha soldier is based on "Rates of Pay as of April 2009" published by the UK Ministry of Defense

[c] Pension scheme is based on "Armed Forces Pension Scheme 05: Your Pension Scheme Explained" published by Service Personnel Policy (Pensions), The UK Ministry of Defense on January 2007.

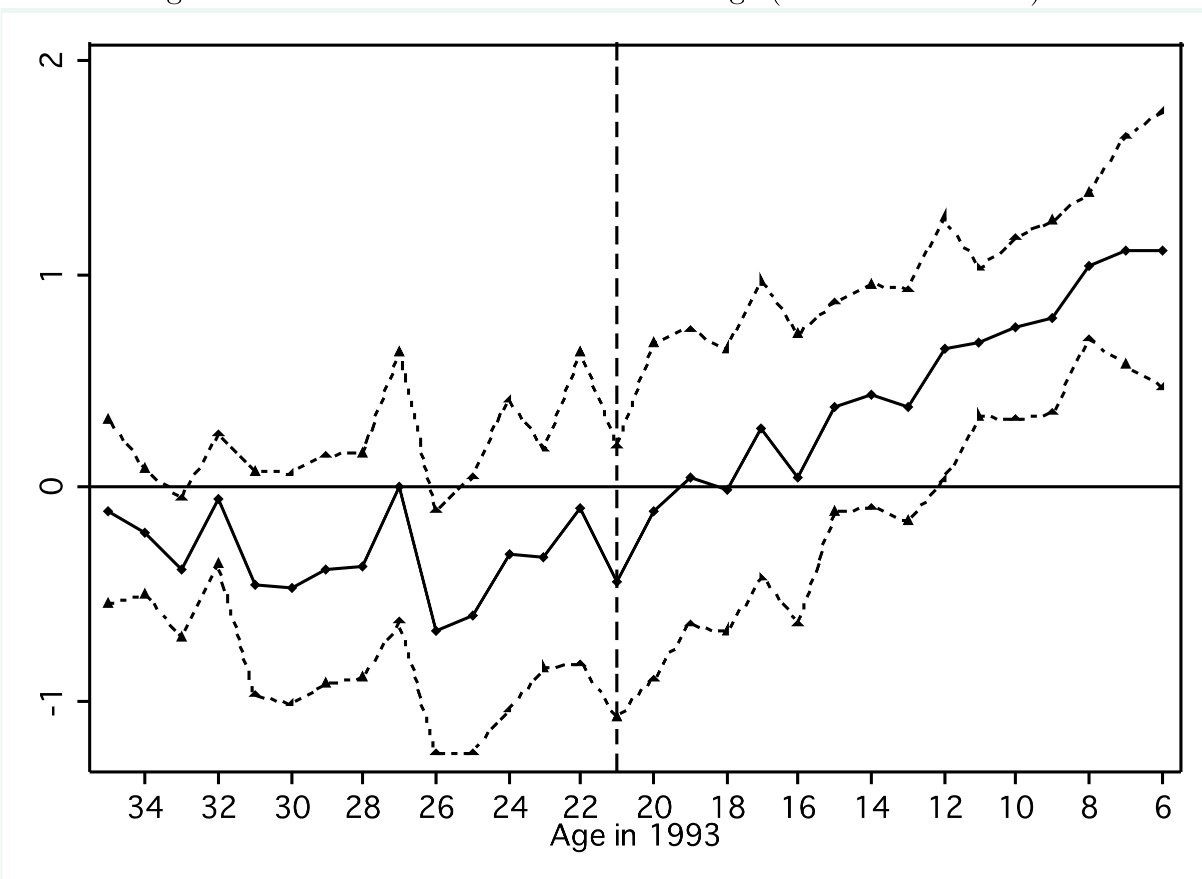
Table 10: Ethnicity Weights in the Synthetic Gurkha

Ethnicity[a]	Weight
Cheetry	0.063
Brahmin	0.034
Tharu	0.094
Newar	0.045
Kami	0.157
Yadav	0.074
Muslim	0.095
Damai	0.130
Sarki	0.233
Other	0.076

Notes: This table reports the weights on each non-Gurkha ethnicities in the synthetic Gurkha ethnic group. The weights are calculated to minimize the mean squared difference between the education of Gurkha and synthetic Gurkha ethnic groups across ages 22 to 44. Based on the mathematical algorithm provided by **?**, I choose W to minimize $(X_G - X_N W)(X_G - X_N W)$, where $W = \{(w_1, ...w_J)'$ subject to $w_1 + ... + w_J = 1,\ w_J \geq 0\}$. X_G is a $(k\ X\ 1)$ vector of average years of education at each age ineligible birth cohorts for the Gurkha ethnic group, where $21 \leq k \leq 44$. X_N is a $(k\ X\ J)$ matrix with average years of education for k ineligible birth cohorts and J non-Gurkha ethnicities.

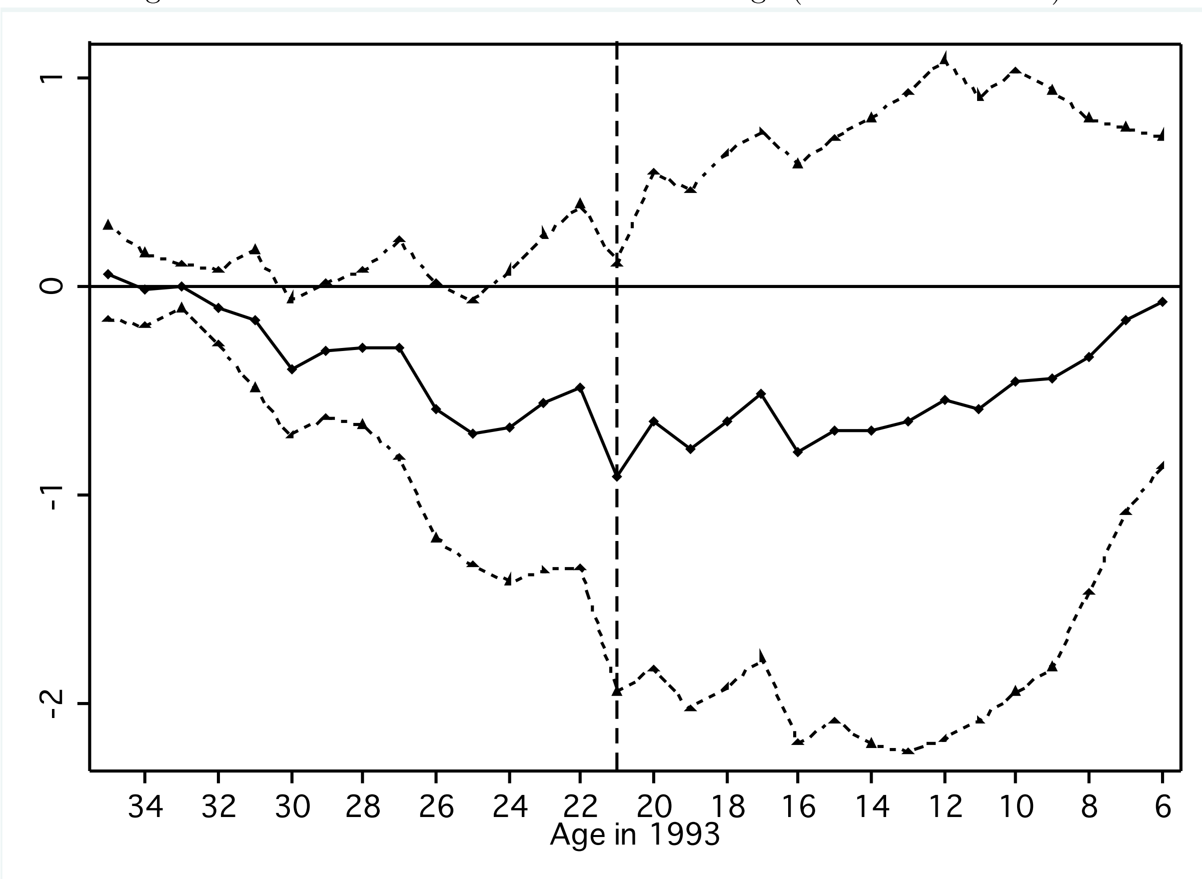
Figure 1: Map of Nepal with Concentration of Gurkha Ethnic Group and the British Gurkha Recruitment Centers

Figure 2: Effect on Gurkha Men at Each Age (Identification Test)



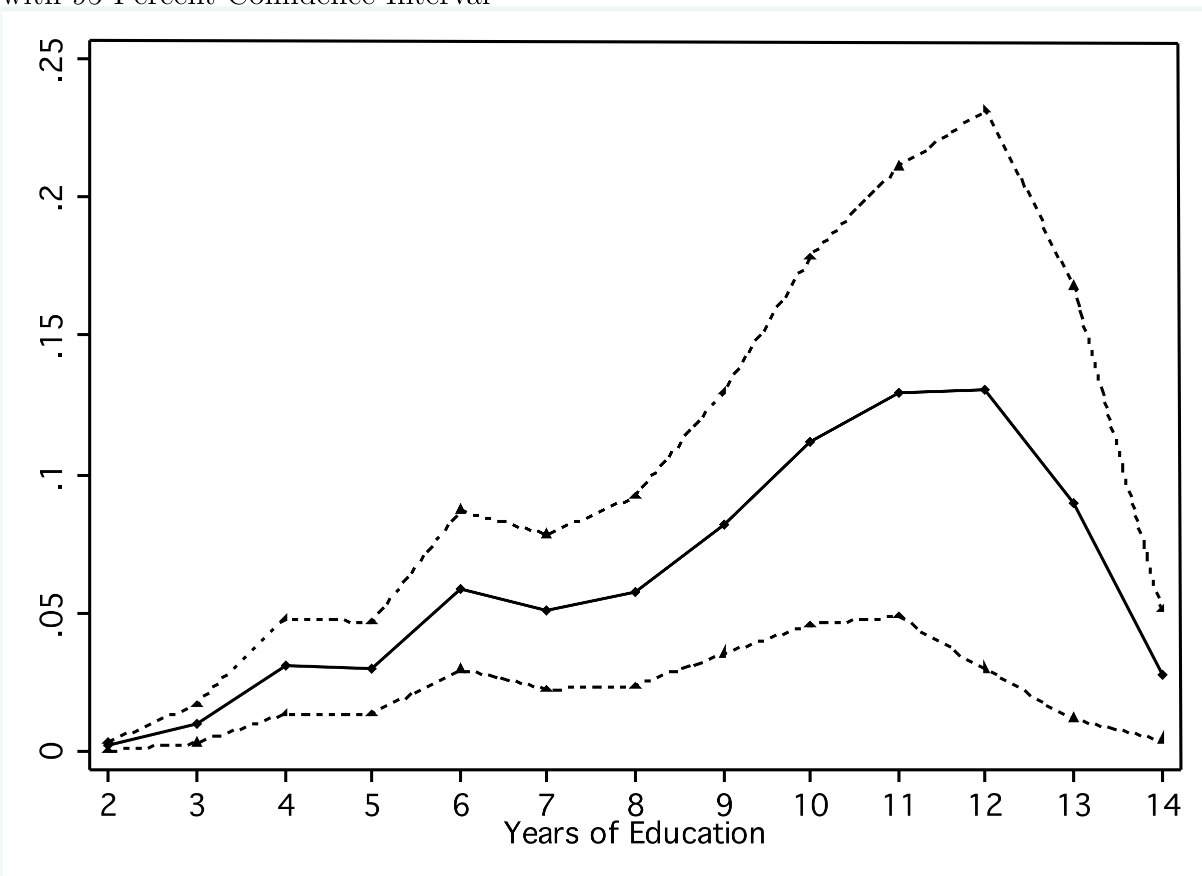
Notes: The figure above plots γ_xs for $6 \leq x \leq 35$ from equation (5). Since each γ_x estimates the effect of the rule change on Gurkha men of age x in 1993, γ_x should be zero for $x \geq 21$ and increase as x decreases for $x < 21$.

Figure 3: Effect on Gurkha Women at Each Age (Identification Test)



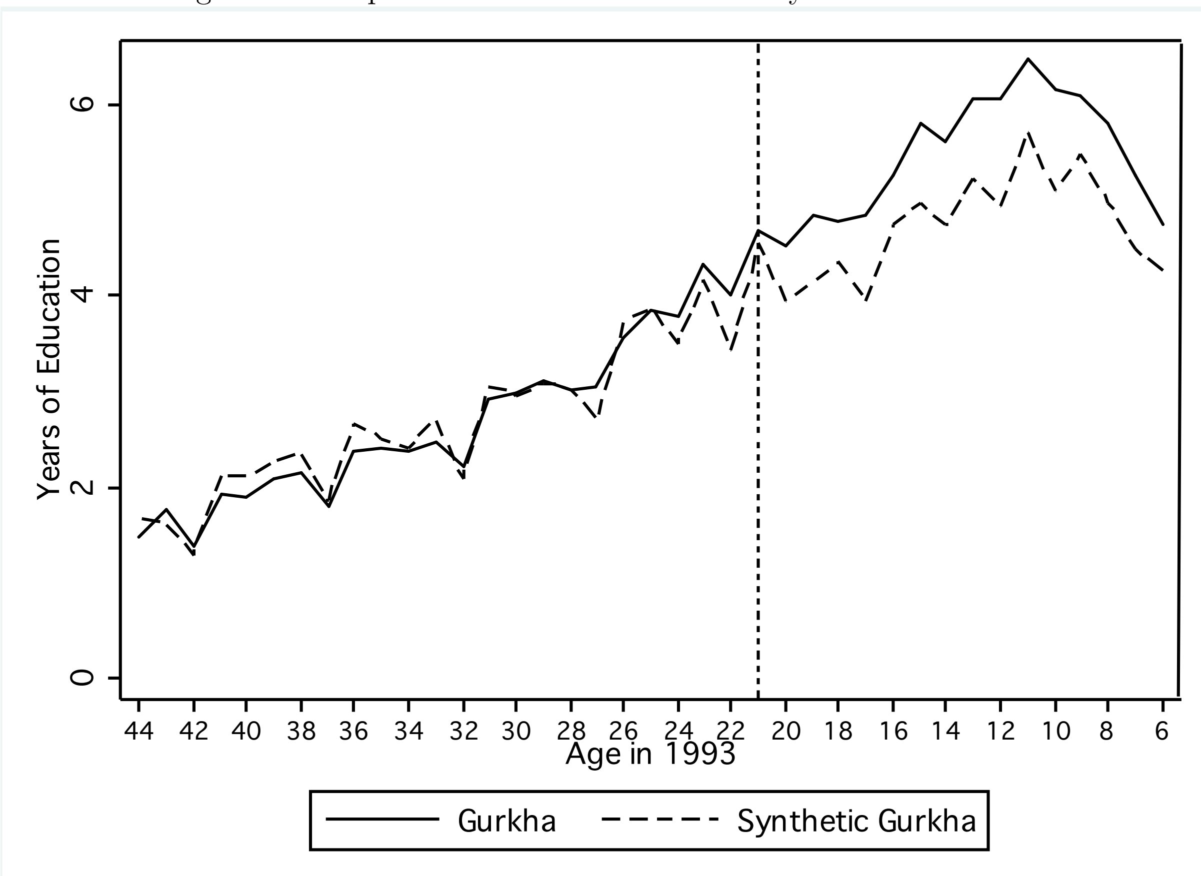
Notes: The figure above plots γ_xs for $6 \leq x \leq 35$ from equation (5) for females. Since each γ_x estimates the effect on Gurkha women of age x in 1993 and women were not affected by the rule change, γ_x should be zero for all xs.

Figure 4: Difference in Differences in CDF (Estimated from Linear Probability Model) with 95-Percent Confidence Interval



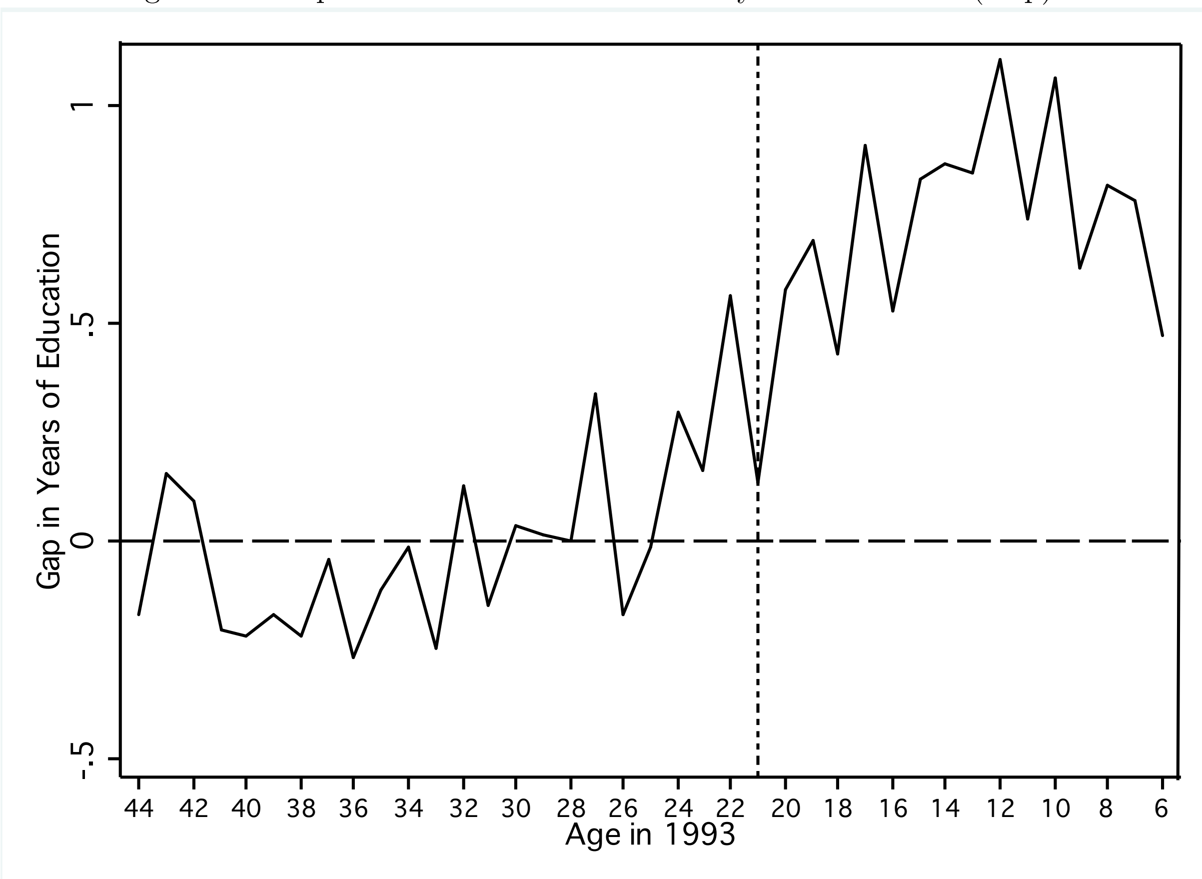
Notes: The figure plots γ^s estimated from equation (4) with a dummy dependent variable indicating the years of education completed greater than or equal to s, for each s = 2 to 14. The sample includes men from younger eligible cohorts aged 6 to 12 or ineligible cohort aged 22 to 28, with at least 1 year of education completed. Each γ^s indicate the impact of the rule change at the education level s among Gurkha men of younger eligible cohort who were induced to enroll in school for the first time due to the new rule or were already enrolled prior to the rule change.

Figure 5: Comparison between Gurkha and Synthetic Gurkha



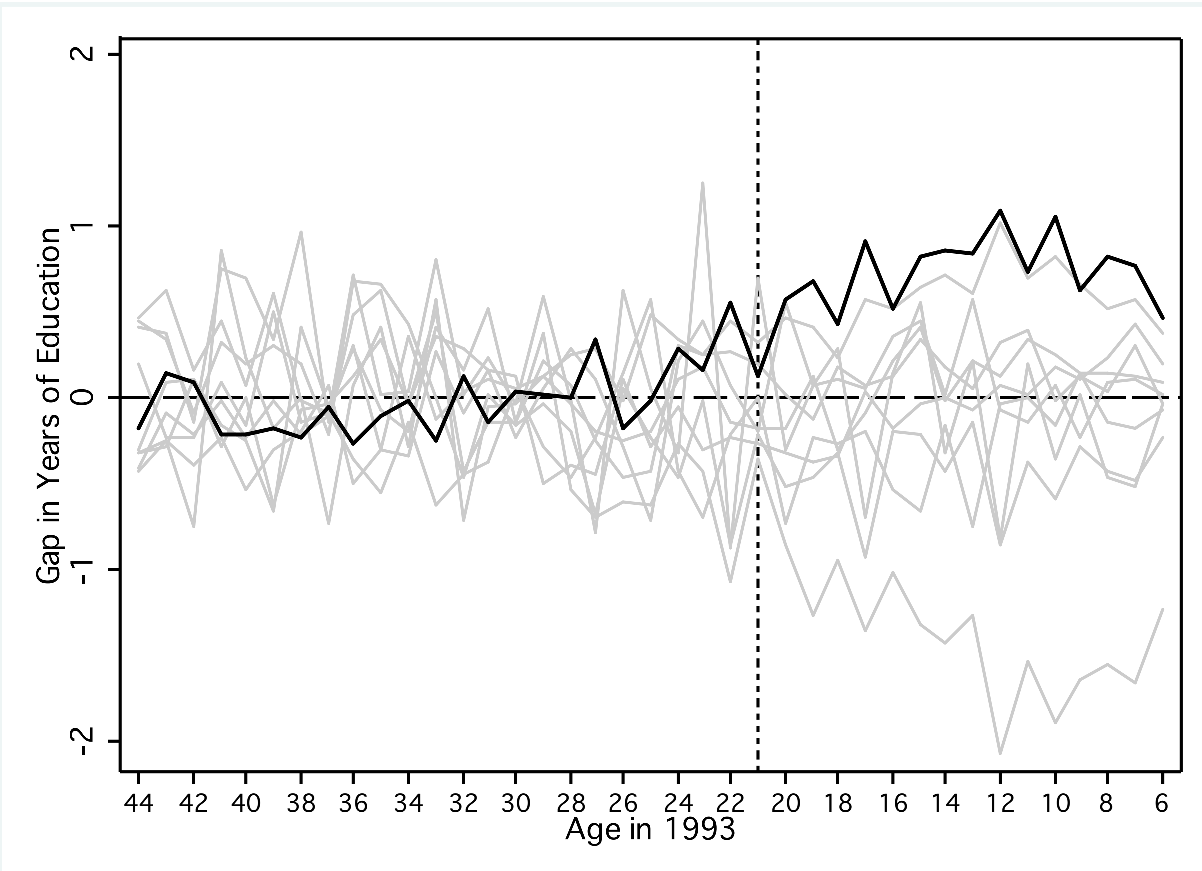
Notes: The Graph above plots the average years of education completed as of 2001 at each birth cohort for Gurkha and synthetic Gurkha ethnic groups. The synthetic Gurkha is a weighted sum of all the non-Gurkha ethnicities. The weights are calculated to minimize the squared difference in average education of Gurkha and synthetic Gurkha ethnic groups across birth cohorts aged 22 to 44. Based on the mathematical algorithm provided by **?**, I choose W to minimize $(X_G - X_N W)(X_G - X_N W)$, where $W = \{(w_1, ...w_J)'$ subject to $w_1 + ... + w_J = 1,\ w_J \geq 0\}$. X_G is a $(k\ X\ 1)$ vector of average years of education at each age ineligible birth cohorts for the Gurkha ethnic group, where $21 \leq k \leq 44$. X_N is a $(k\ X\ J)$ matrix with average years of education for k ineligible birth cohorts and J non-Gurkha ethnicities.

Figure 6: Comparison between Gurkha and Synthetic Gurkha (Gap)



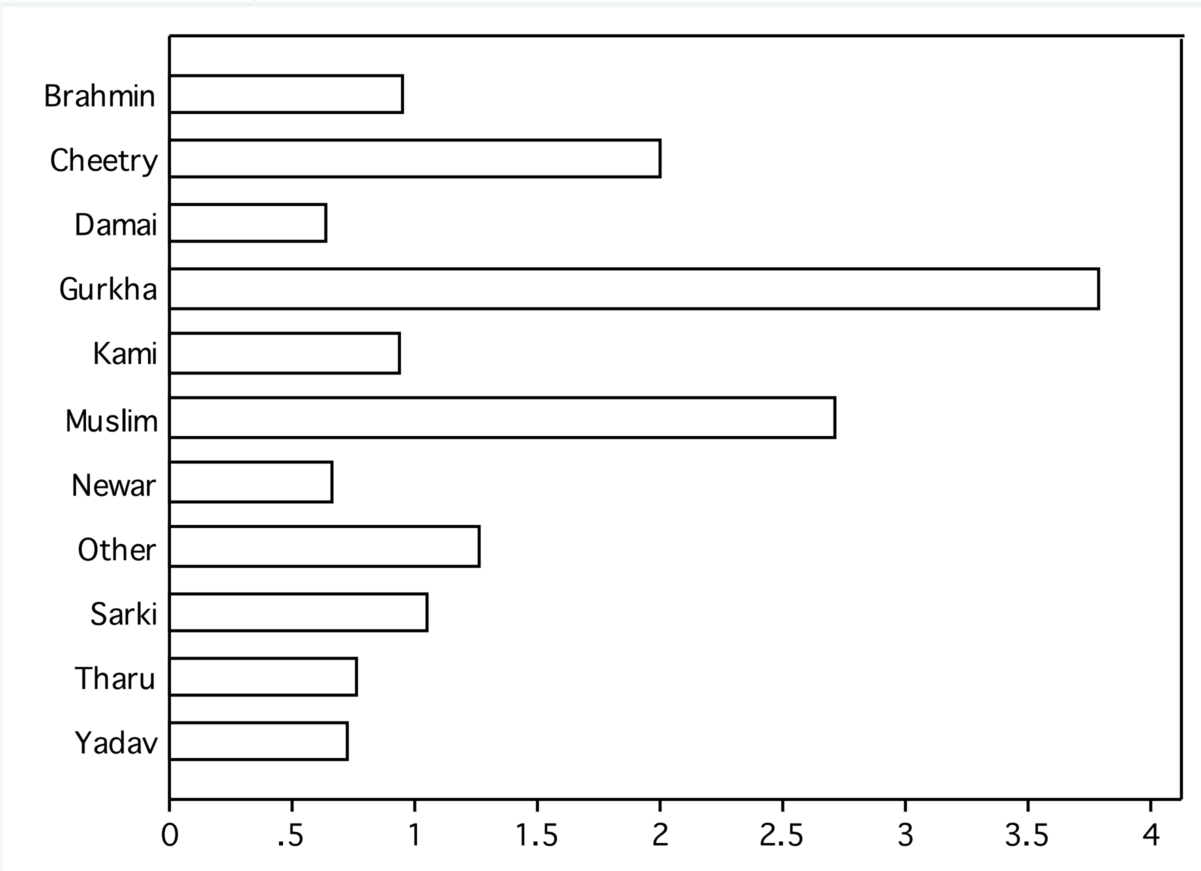
Notes: The figure plots the difference between average education of Gurkha and synthetic Gurkha ethnic groups for each birth cohorts aged 6 to 44, i.e. the difference between the education trends of the two groups from Figure 5.

Figure 7: Significance test: Gap for Gurkha and 10 Placebo Gaps for Non-Gurkha Ethnicities



Notes: The figure plots the gaps same as Figure 6 for Gurkha ethnicity in the dark line and similar gaps for 10 non-Gurkha ethnicities in faded lines. For each non-Gurkha ethnicity, its synthetic counterpart is calculated by assigning weights to the remaining non-Gurkha ethnicities in order to minimize the squared difference in average education between the two groups across birth cohorts aged 22 to 44.

Figure 8: Significance Test: Ratio of Eligible and Ineligible Cohort Education Gap for Gurkha and Non-Gurkha Ethnicities



Notes: The figure shows the ratio of average difference in education between ethnicity and its synthetic counterpart for eligible and ineligible cohorts i.e. $\frac{(Avg\ Education\ Gap)_{Eligible\ cohort}}{(Avg\ Education\ Gap)_{Ineligible\ cohort}}$. This is largest for Gurkha ethnicity, which means that the probability of getting this result by chance is $1/11 = 0.09$.