The World Bank Economic Review, 37(4), 2023, 659–674
https://doi.org10.1093/wber/lhad013
Article

Mind the Gap: Schooling, Informality, and Fiscal Externalities in Nepal

Hoyt Bleakley and Bhanu Gupta

Abstract

While increasing years of schooling has been a long-standing development priority, the associated fiscal costs and benefits have been less studied, because of a lack of appropriate data. Recently, an UNESCO-funded project measured subsidies, by levels of schooling, from all levels of government, in eight developing countries including Nepal. The household-level Nepal Living Standards Measurement Survey provides information to estimate the degree of formality, tax payments, and benefit receipts as a function of schooling years. Using a simple Mincer-like model, this study estimates the fiscal externality of an additional year of school. It finds that within primary school, fiscal benefits and costs, on the margin, are quite balanced, with subsidies close to the present value of future taxes minus benefits. At higher levels of schooling, however, marginal fiscal benefits exceed costs by 5 percent of per capita consumption. This contrasts with previous literature on social returns and assumptions underlying multilateral development goals.

JEL classification: I2, J2, H3

Keywords: taxation, subsidies, schooling decision, Nepal

Public Disclosure Authorized

1. Introduction

The promotion of human capital has been a development priority for over a half century. Most developing countries have seen spectacular gains in primary school enrollment and years of schooling over this time. A large literature considers how to continue this trend through incentives or nudges promoting school attendance. Such interventions can be compared using cost effectiveness, e.g. the increase in school attendance per dollar spent on the intervention (Dhaliwal et al. 2013). This does not mean that the intervention passes a cost-benefit test, however. Numerous studies demonstrate that schooling in developing countries is of poor quality, with low levels of learning and high levels of absenteeism (Chaudhury et al. 2006). Low quality implies that the benefit of a marginal increase in schooling is also low, possibly lower than the associated private and fiscal costs. But demonstrating low quality does not resolve the cost-benefit test.

Hoyt Bleakley is a professor at the Department of Economics and Population Research Center, University of Michigan, Ann Arbor, USA; his email address is hoytb@umich.edu. Bhanu Gupta (corresponding author) is an assistant professor at the Department of Economics, Ashoka University, Sonepat, India; his email address is bhanu.gupta@ashoka.edu.in. The authors thank the Central Bureau of Statistics (CBS) of Nepal for providing the household data and are grateful to the handling editor Eric Edmonds, anonymous referees, Achyuta Adhvaryu, James Hines, Naureen Karachiwalla, Upasana Khadka, Nishaad Rao, Joel Slemrod, and several conference discussants and participants for helpful comments. A supplementary online appendix is available with this article at *The World Bank Economic Review* website.

Instead, measurement of benefits and costs is required. Indeed, as developing countries have limited fiscal capacity, measurement of *fiscal* benefits and costs is required.

Governments incur fiscal costs in the form of subsidies to encourage school attendance. Numerous studies (cf. Psacharopoulos and Patrinos (2018)) show that children who get more years of schooling earn more as adults. Therefore, the government's education spending might be thought of as an investment in expanding the future tax base. This combination describes a fiscal externality: "fiscal" because the government's taxes and spending are involved, and "externality" because the student (plus their family) do not pay the full cost of additional schooling nor receive the full benefit. Is there a gap between these benefits and costs, and, if so, how large is it?

It must be stressed that there may be significant externalities outside the government's remit, such as productivity spillovers that cannot be internalized by firms, or education differences in criminal activity. There are no precise estimates of the monetary value of these externalities and their gradient with education. Thus, this paper restricts the analysis to direct citizen–government fiscal interactions that are recorded in published accounts. Its estimates are useful in conducting a cost-benefit analysis of spending government monies across various levels of education and across competing welfare programs (Hendren and Sprung-Keyser 2020). Furthermore, the fiscal externality represents, for some levels, a substantial wedge between private and public incentives for education.

The challenge in quantifying the fiscal gap has been the incomplete measurement of the extent of education subsidies in less developed countries. Recently, however, the UNESCO Institute for Statistics (UIS) organized a pilot project for "National Education Accounts (NEA)" in eight countries (UIS 2016). The NEA reports measure public educational spending from all levels of government and decompose by all levels of schooling. Two of the eight countries (Nepal and Uganda) also had contemporaneous household budget surveys, which permit comparison of public and private spending.

This paper complements the subsidy data with estimated tax payments, made from a Nepalese budget survey. In these data, more-educated workers have higher purchasing power, consistent with the literature. To this, this paper adds a less-documented result: workers with more education also have substantially higher probabilities of being in the formal sector. Of workers with zero to two years of schooling, the percentage in the formal sector is in the low single digits. The fraction of formality rises to approximately half of workers with post-secondary education. Thus, more-educated workers contribute more to the government's coffers because they spend more (higher value added tax (VAT)) and because their earnings are higher and more likely to be in the formal sector (higher income taxes). The analysis also accounts for cash and in-kind benefits, although their gradient with respect to education is tiny by comparison to formality and tax gradients.

To motivate the empirical analysis, this study develops a model in the spirit of Mincer (1958) to compare fiscal costs and benefits of an additional year of school. In the model, the student receives a marginal benefit in the form of higher future earnings, but pays contemporary marginal costs in the form of direct costs (tuition, books, transport, etc.) and of opportunity costs (foregone earnings). The government's problem is qualitatively similar, with higher future taxes (from higher future wages) being the marginal benefit and subsidies plus foregone taxes on foregone earnings being the marginal costs. With both linear and quantile regressions, the paper estimates the relationship between tax payments and years of schooling. These estimates combine with the subsidy data and an interest rate to form the estimated gap, or fiscal externality.

This study finds substantial fiscal costs and benefits associated with another year of schooling, although how the two balance varies by level. For finishing primary school, subsidies are close to the present value of future taxes, with a deficit of less than a few US$ per year, itself about 0.5 percent of household consumption per capita (among those with primary school only). For secondary school, the gap leans negative as well, especially at lower quantiles of distribution, although the mean effect is an even smaller fraction of household consumption than it is for primary school. For tertiary (university/higher) education,

the findings are opposite: positive gaps (benefits in excess of costs) for the mean and especially for the upper part of the distribution. This gap amounts to 5 percent of household consumption, a significant surplus. The difference by level makes intuitive sense. The lower levels of education are highly subsidized and most of the workers with such education have low labor-market formality; therefore, the government recoups its investment mainly through the 13 percent VAT. In contrast, higher education, while more costly, is less proportionately subsidized, and its graduates earn more in formal employment and thus are subject to the income tax.

These results contrast with an earlier literature on the "social rate of return" to schooling. Schultz (1988, page 547) summarizes this literature as finding that such returns were "insufficient to warrant further expansion of subsidized public higher education," but this was "rarely the case at the primary and secondary level." He notes that such comparisons accounted for subsidies, but rarely for taxes, which he states was justified if taxes were proportional to income. The patterns of formality by education in developing economies challenge this assumption; higher rates of formality among the more educated bring a higher tax rate too. (Soares and Haanwinckel (2017) show this to be true for Latin America.) This study's results are therefore more similar to Johnson's (2006) argument that higher-education subsidies in the United States are progressive because higher-income households both make greater use of higher education and pay higher taxes.

This result is not sensitive to alternate definitions of subsidies, taxes or household. The result is also robust to the effects of emigration. While the analysis uses 3 percent as the default interest rate, it would have to be drastically lower to convert all of the estimated gaps to positive. (Several additional robustness checks are presented in supplementary online appendix S4.) This study finds similar results for disadvantaged groups (women and lower castes), although the fiscal gap for tertiary becomes insignificant. Both groups, conditional on education, have lower formality rates, and therefore pay less income tax.

2. Data and Descriptive Statistics

To estimate the fiscal externalities, data on household-level tax payments, education level, and non-household expenditure on schooling is required. Information on the latter is not readily available, especially for developing countries, as aggregating data across multiple stakeholders involved in education financing has been a challenge. The National Education Accounts, piloted by UNESCO, address this challenge. This paper combines these with nationally representative household survey data and the Nepalese tax schedule to conduct the empirical analysis.

Education Subsidies

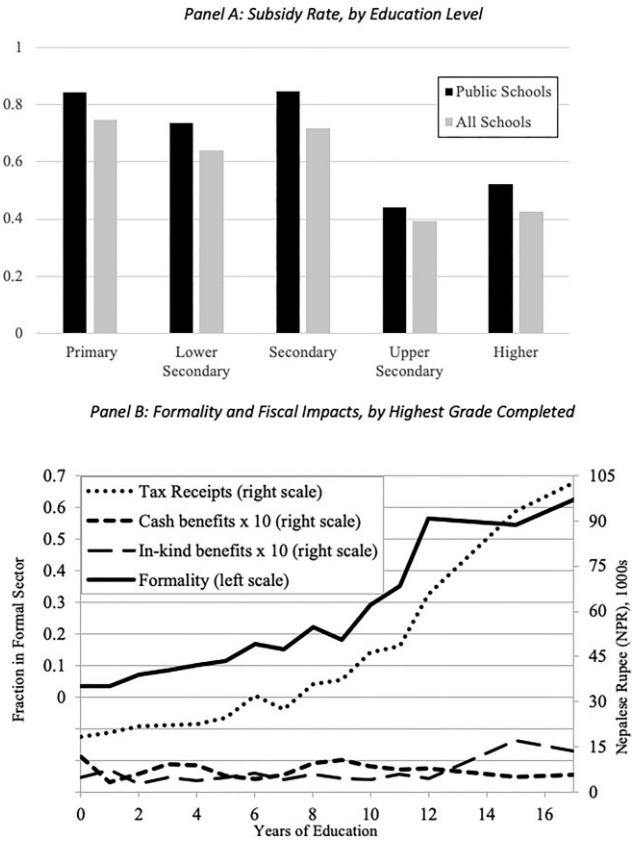
The National Education Accounts (NEA) of Nepal has information on expenditure by all the financial stakeholders—household and non-household—at different levels of education.[1] This information has been compiled by UNESCO Institute for Statistics (UIS), International Institute for Educational Planning (IIEP), and Global Partnership for Education (GPE), not just for Nepal but for seven other developing countries (UIS 2016; IIEP, UIS, and IIEP Pôle de Dakar 2016).[2]

Nepal's NEA data capture education expenditure per student across seven levels of education. These are pre-primary, primary (1–5 grade), lower secondary (5–8), secondary (8–10), higher secondary(10–12), technical education, and higher education (college education). The main providers of educational

1 These data are compiled in UIS National Education Accounts Database (2016).

2 The seven other countries are Côte d'Ivoire, Guinea, Lao PDR, Senegal, Uganda, Vietnam, and Zimbabwe. Only the Nepal and Uganda data distinguish the per student government expenditure between public and private schools and also include household expenditure. This paper chooses the setting of the analysis to be Nepal over Uganda because the data from Uganda do not permit certain robustness checks.

Figure 1. Formality and Fiscal Transfers, by Education Level.



Source: For Panel A, data come from the national education accounts compiled by UNESCO and can be accessed using the link http://uis.unesco.org/en/news/national-education-accounts. To construct Panel B, we use data from the Nepal Living Standards Measurement Survey 2010.

Note: In panel A, primary education level is from grades 1–5, lower secondary from 6–8, secondary from 9–10, upper secondary from 11–12, and higher education's duration is three years. The left-hand scale of Panel B shows the proportion of labor force in the formal sector who pay income taxes. A wage earner is in the formal sector if their income is reported to the government by the employer or if they receive benefits from the social security net. Additionally, businesses registered with the government are also included in the formal sector. The informal sector consists of the rest of the workforce, including workers engaged in agriculture. The right-hand scale shows tax payments and average benefits received under various cash-transfer and in-kind schemes according to the education level. The taxes are graphed in thousands of Nepalese rupees. The benefits are multiplied by 10 to be legible. Supplementary online appendix S6 describes the methodology used to estimate the value of in-kind benefits.

resources are governments (central, state, and local), households, NGOs, and schools. The expenditure per student depends on whether the student is in a public or private school. The main analysis uses the total non-household education expenditure, be it from the government, NGOs, or the school.

Figure 1, Panel A, shows the ratio of annual non-household expenditure to total expenditure by level. For public schools, this ratio is high. At the primary level, the non-household expenditure is NPR 7,209 per student, which is 84 percent of the total expenditure. The government subsidy accounts for 95 percent of the total subsidy. At the higher education level, the subsidy rate declines to 52 percent, although it increases in levels to NPR 30,385. This pattern is markedly different for private schools, with households accounting for the bulk of the expenditure. Accordingly, at the primary level, the non-household expenditure is NPR 1,106, which is 6 percent of the total expenditure. For the higher-level private institutions, the non-household expenditure is NPR 14,337 per student, or 17 percent of the total expenditure.

Table 1. Summary Statistics

	HH consumption per capita	Direct tax	VAT	Subsidy at end point of the interval	Schooling of HH head (in years)	Proportion of HH head in formal sector
			Panel A: Primary education (grades 0–5)			
Count	3,787	3,787	3,787	353	3,787	3,787
Median	26,768	0	15,296	7,209	0	0
25th percentile	18,292	0	10,710	7,209	0	0
75th percentile	40,345	0	22,692	7,209	2	0
Mean	33,859	1,061	18,833	7,192	1.09	0.05
Standard deviation	26,132	9,187	14,267	325	1.78	0.22
			Panel B: Secondary education (grades 6–10)			
Count	1,081	1,081	1,081	292	1,081	1,081
Median	38,760	0	22,877	30,510	8	0
25th percentile	25,950	0	15,331	30,510	7	0
75th percentile	59,864	0	33,747	30,510	10	0
Mean	49,303	7,766	28,653	29,816	8.16	0.21
Standard deviation	40,675	36,016	27,315	4,438	1.41	0.41
			Panel C: Higher education (grade 11 to bachelor's degree)			
Count	893	893	893	222	893	893
Median	64,898	0	32,969	30,385	12	0
25th percentile	43,100	0	21,547	30,385	11	0
75th percentile	97,275	16,105	49,276	30,385	15	1
Mean	80,091	23,718	40,877	27,277	12.29	0.46
Standard deviation	58,555	61,512	30,782	6,356	1.62	0.50

Source: The primary data source is the Nepal Living Standards Measurement Survey 2010. The subsidy data come from the National Education Accounts reports compiled by the International Institute for Educational Planning (IIEP), UNESCO Institute for Statistics (UIS), and Global Partnership for Education. These data can be accessed at http://uis.unesco.org/en/news/national-education-accounts.

Note: This table presents the summary statistics of the main variables used in the analysis. The rest of the variables are described in the supplementary online appendix table S5.1. The unit of measurement is Nepalese rupees unless stated otherwise. While the subsidy is measured for each student, both direct taxes and VAT are reported at the household level.

Household Data

This study uses the third round of the nationally representative Nepal Living Standards Measurement Survey (LSMS), which was conducted in 2010–11 by the Central Bureau of Statistics of Nepal (CBS) and the World Bank to capture the demographic and consumption details of 5,988 households (28,760 individuals). It contains individual-level information on education, business, and job characteristics, benefits received, and migration status of the household members (CBS 2011)[3]. The final sample consists of 5,886 households whose heads are aged between 20 and 80 years and education details are not missing.

The total household consumption is used to impute the tax payments as described in the next subsection. There is a positive consumption gradient with education. The median per capita annual consumption of households whose head has finished primary education is around NPR 27,000, and this increases to NPR 65,000 if the household head has finished a bachelors degree (table 1).

The main independent variable in the empirical model is the years of education completed by the household head. The household heads with bachelor's and masters degrees' are coded as having completed 15 and 17 years of education because the duration of these programs in Nepal is of 3 and 2 years respectively. Table 1 shows that around 65 percent of the household heads have a highest education grade that lies within the primary education category, 18 percent have secondary education, and the rest have higher education. Additionally, the educational level of the household members besides the household head is

3 This paper does not use the Nepal Labor Force Surveys because they do not contain information on total consumption, the type of school attended by the individual, or benefits received from the government. The national census (2011) is also not appropriate because it does not record consumption or income.

measured in two ways—total years of education of all the remaining members, and the maximum educational grade achieved by a member excluding the household head. Both measures are used to account for household's educational stock in the regression analysis.

Taxes, Formality, and Benefits

This section briefly describes imputation of a household's tax payments which consist of income tax and VAT. The income tax payments are adjusted based on formality status of the household. This section also describes estimation of fiscal expenditures on various welfare programs in Nepal.

Due to the lack of administrative tax data that can be linked to education levels of the taxpayers, this study assigns imputed tax payments to households based on their reported consumption in the LSMS. The first step is to construct an income tax table that calculates income tax liability and post-tax income for every possible level of pre-tax income by using the Nepalese tax schedule.[4] Over a lifetime, if consumption equals the post-tax income of a household, then one can impute the tax payments of every household by matching the household consumption observed in the LSMS to the tax table. This matching is possible because there is a strictly monotonic relation between pre-tax income and income tax liability, as the average tax rate of Nepal does not decrease with pre-tax income. Finally, based on the nature of economic activity and the relationship with the employer, some households are assigned to the informal sector where they do not pay any income tax.

To define tax formality, this study relies on the result that wage earners whose income is subject to third-party reporting are more likely to pay taxes (Slemrod 2007; Kleven et al. 2011). Therefore, anyone whose income is reported to the government by the employer or who benefits from social security is considered to be in the formal sector (Azuara and Marinescu 2013; Camacho et al. 2014). As per the definition of formality used in the analysis, a wage earner is in the formal sector if any job that they do displays at least one of the following features: tax is deducted by the employer, employee contributes to the provident fund, pension on retirement, or subsidized medical care. As the self-employed are less likely to pay taxes, the preferred definition considers only registered businesses as tax payers. (In an alternate definition, even these businesses are considered to be in the informal sector. Refer to supplementary online Appendix S2.) All other economic activity, in particular agriculture, forms the informal sector. In the sample, around 16 percent of 5,886 household heads are in the formal sector.[5] No matter which definition of formality is used, the rate of formality increases with years of schooling (see fig. S1.1). For example, about 4 percent of people without school education are employed in the formal sector, while 62 percent of people with a master's degree are engaged in the formal sector (Panel B of fig. 1).

The VAT rate in Nepal is 13 percent, although some commodities like essential food items are zero rated. The main specification assumes that VAT is paid on the entire household consumption, although food consumption is excluded from the VAT tax base in the sensitivity analysis.

The total tax contribution of the households is the sum of income tax and VAT.[6] Panel B of fig. 1 shows a steep positive gradient of total taxes with education. The positive slope comes from the increase in the tax base and in formality levels. People with higher education tend to be in the formal sector and thus pay both income and value-added tax to the exchequer. Conversely, those with low education are mostly

4 Nepal has separate income tax schedules for single and married taxpayers. The details of these schedules, as well as a more detailed description of income tax imputation, can be found in supplementary online appendix S3.

5 Of the 16 percent, 11.6 percent of the household heads have an income that is subject to a non-trivial marginal income tax rate. (Unlike most countries, the marginal tax rate of the lowest income bracket in Nepal is non-zero and equal to 1 percent.) By comparison, registered taxpayers in Nepal are an estimated 10 percent of total households (Inland Revenue Report 2016 and CBS 2012).

6 Contributory deductions from income under programs such as the provident fund are not included in the total tax payments of an individual, because the taxpayer will receive returns on these contributions over their lifetime. As a result, such deductions do not cause fiscal externality within the life cycle.

engaged in the informal sector and end up paying only VAT. For instance, people with no education on average pay NPR 18,757 in total taxes, of which the VAT represents 95 percent. In contrast, people with higher education pay NPR 68,607 as taxes, of which VAT is only 60 percent.

The net fiscal transfers must also include the government's expenditure on various welfare programs. The LSMS survey documents the payments received by the households under seven major cash-transfer programs[7] and take-up rates of various in-kind transfer programs. This paper estimates the value of benefits received under these in-kind programs using different data sources and verifies that the take-up rates of these programs, as documented in the LSMS, are consistent with those published elsewhere. (See supplementary online appendix S6.) The magnitudes of both cash and in-kind benefits are much lower than the taxes remitted (Panel B, fig. 1). Hence, these transfers are only included in the sensitivity analysis.

3. Model

This section presents a stylized model, based on the seminal work described in Mincer (1958), to analyze the choice of years of schooling. The framework includes taxes and subsidies and derives the fiscal externality (the gap) associated with an additional year of school. An individual starts school at $t = 0$ and faces an interest rate of r. The direct cost of schooling in year t is $c(t)$, which includes tuition, transport, uniforms, books, etc. The government contributes a subsidy of $\gamma(t)$, so the student only sees the net cost. The student leaves school at time s, which also represents the total years of schooling accumulated. At that time, the person starts earning $f(s)$, for $f'(s) > 0$. (Primes denote first derivatives.) The wages per worker grow at a rate of g per annum. Once working, the person has to pay a tax of $\tau(s)$. (Taxes are functions of earnings that depend on years of schooling.)

The person's lifetime income, net of taxes and direct costs, is

$$\int_s^{\infty} e^{-(r-g)t}\left[f(s)-\tau(s)\right]dt - \int_0^{s} e^{-(r-g)t}\left[c(t)-\gamma(t)\right]dt,$$

where we assume an infinite horizon for simplicity. From the individual's perspective, this object is the present value of his/her human capital. Let $\tilde{r} \equiv r - g$, which is the required rate of return, adjusted for wage growth.

What choice of years of school maximizes the individual's human capital? The derivative with respect to s yields the following first-order condition (FOC) for optimality:

$$(f' - \tau')/\tilde{r} = (f - \tau) + (c - \gamma). \tag{1}$$

The left-hand side is the marginal benefit associated with additional time in school. This includes the increase in labor productivity (f'), but also the change in taxes (τ'). These changes apply to future flows, and the interest rate accounts for the accumulation of these flows over time. The marginal costs are found on the right-hand side of the equation and are grouped into two concepts. The first is the opportunity cost. While a person is in school, they are not working, but neither do they pay taxes on income that they do not earn. The second is the direct cost, net of the subsidy. This equation has an intuitive interpretation. If a dollar's worth of time invested today yields a future flow of payments greater than $\tilde{r}$, then the student should continue in school. When the flow payment per dollar drops below $\tilde{r}$, the student should leave school.

Government policies shift the choice of schooling, although some combinations of taxes and subsidies also deliver the socially optimal decision. If taxes and subsidies are both zero, the FOC reduces to

$$f'/\tilde{r} = (f + c),$$

7 These programs are the old age pension, widow pension, disability allowance, endangered ethnicity's pension, maternal incentive scheme, martyr's family benefits, and people's movement victim benefits.

which defines the undistorted optimum for s. But other, nonzero combinations also leave this choice undistorted. If

$$\tau'/\tilde{r} = \tau + \gamma, \tag{2}$$

then these terms drop out of equation (1), which leaves the choice undistorted locally.

In general, however, there is a gap between the government's marginal benefits and costs. This represents a fiscal externality: a person's choice of schooling spills over onto the government's budget. The marginal benefit for the government is $\tau'/\tilde{r}$, the taxes received per unit increase in schooling. But an additional year of education costs the government $\tau + \gamma$, the fiscal opportunity and direct-subsidy costs. If this gap is positive (MB > MC), then the government receives more revenue per marginal year of school than it incurs in costs. Policies that raise schooling, such as compulsory attendance or higher subsidies, might well relax the government's budget constraint and bring schooling closer to optimum. In contrast, a negative gap has the opposite implication.

To estimate the gap for various years of schooling, calibrations of the tax (τ) and subsidy (γ) functions are required. The NEA data give information about subsidies for different levels of school, both public and private. The data from the LSMS expenditure survey are used to compute taxes and then calibrate $\tau(s)$.

A few words about causality are in order. The subsidy is a matter of accounting: What fraction of another year of school would be paid for by the government? Similarly, the fiscal opportunity cost measures the tax contributions of those at a given number of years of schooling. However, when one estimates the marginal increase in tax contributions with the sample at one more year of schooling, this is a causal assumption. Because this comparison is tightly related to the relationship between earnings and schooling, this assumption inherits the same problems (and solutions) from the large literature on (Mincerian) returns to schooling. On the one hand, the typical assumption is that such returns are biased upwards by ability bias. (Griliches (1977) discusses the direction of the ability bias under various conditions.) Thus, the fiscal gains might be smaller (more negative) than estimated. On the other hand, improvements in school quality could increase earnings and hence the tax contributions per year of education, which might increase fiscal gap, but it depends on the opportunity cost.[8] The sensitivity analysis reports how the fiscal gap responds to a bounding exercise on the estimates of tax returns to education.

4. Empirical Model and Results

This section describes the empirical models which use quantile regressions to examine the effect of education on tax payment at the median, as well as at the 25th and 75th percentiles. They also use an ordinary least squares (OLS) regression to consider effects at the mean. These methods provide a convenient estimate of the level and (conditional) gradient of tax with respect to years of schooling for the various summary statistics. Let τ_h be the total tax payments of the household h. The primary dependent variable is the number of years spent in school, Eduyears_{ih}, by the household head i living in the household h. The term X_{ih} is a vector of other demographic characteristics of the head such as age, and Z_h is a vector of household characteristics like the total years of education of other household members. Then, the θth quantile of the conditional distribution of τ_h, given the covariates, is a linear function

$$Q_\theta(\tau_h|\text{Eduyears}_{ih}, X_{ih}, Z_h) = \alpha_{0\theta} + \beta_{1\theta}\text{Eduyears}_{ih} + \mathbf{X}'_{ih}\delta_{1\theta} + \mathbf{Z}'_h\delta_{2\theta} + u_{\theta ih}. \tag{3}$$

Now, it is possible to test how far the fiscal gap in Nepal is from the condition defined in equation (2) and hence the undistorted optimal choice of schooling. The fiscal gap, defined as the difference between

8 An increase in tax returns to education would also increase the fiscal opportunity cost at any given level of education as the slope is more positive. Thus, the total impact on the net fiscal gap is ambiguous.

the marginal benefit and the marginal cost, is calculated by using the following formula:

$$\hat{\beta}_{1\theta} - \tilde{r}(\hat{\alpha}_{0\theta} + \hat{\beta}_{1\theta} * S + \bar{\mathbf{X}}'_{ih}\hat{\delta}_{1\theta} + \bar{\mathbf{Z}}'_{h}\hat{\delta}_{2\theta} + \text{subsidy}_{S\theta}), \quad (4)$$

where $\tilde{r}$ is the discount rate and S is the point at which the fiscal balance is calculated. The term $\hat{\beta}_{1\theta}$ represents the marginal benefit (τ'), while the term in the parentheses represents the fiscal opportunity and direct-subsidy cost ($\tau + \gamma$).[9] The subsidy cost is the value of the θth quantile of subsidy at grade S.

This model is estimated separately by education level: primary (grades 0–5), secondary (grades 6–10), and higher education (grades 11–17). The OLS regressions use the same set of controls to estimate the mean fiscal gap.

The main analysis uses a 3 percent net discount rate ($\tilde{r} \equiv r - g$) as the default, but also includes results for higher and lower rates as robustness checks. A natural benchmark for the interest rate (r) would be the market yield on Nepal's sovereign debt, but Nepal did not issue sovereign bonds during the study period. Warusawitharana (2014) reports an implied r of around 5.1 percent on dollar-denominated sovereign bonds issued by select developing countries. Nepal likely faces a higher r insofar as the comparison countries have higher income per capita and more exportable natural resources. GDP per worker proxies the growth of wages (g). Combined information on labor force (World Bank 2020) and GDP (International Monetary Fund 2020) shows that real GDP per worker has grown at an average rate of 2.6 percent from 1994 to 2018. We take 3 percent as the approximate difference of the two rates. This measure, based on opportunity cost, is similar to numbers based on intergenerational equity, as estimated by Lopez (2008) for Latin America.

An additional year of school is associated with substantial government spending and revenue. For an interest rate of 3 percent, these fiscal costs and benefits are approximately balanced, though tilting negative, for primary school and secondary school. For higher (tertiary) education, they instead tilt positive. For primary school, fiscal marginal benefits are generally less than fiscal marginal costs, although only by a small margin. The first column in Panel A of table 2 shows the median outcomes. Another year of school is associated with a median tax payment that is higher by NPR 610 (US$8.47). This fiscal benefit is akin to a dividend that is paid continually in the future. But there are two upfront costs. One is the opportunity cost: tax payments that are foregone because the student is in school instead of working. This is estimated to be almost NPR 18,750, which is the model's prediction for tax remittances by someone with five years of schooling and the mean of the other observables. The other fiscal cost is the school subsidy itself, which is estimated as NPR 7,209. These two costs are multiplied by the 3 percent discount rate and subtracted from the benefit to obtain a fiscal gap of NPR 169 (US$2.35). This is not economically significant and equals 0.5 of a percent of household consumption per capita.

Given the simplicity of this calculation, we discuss the effect of a few small modifications. First, getting fiscal costs and benefits to exactly balance in this calculation would imply a break-even interest rate of 2.35 percent. This calculation is for an infinitely lived person, and therefore an even lower interest rate to break even would be required if mortality and retirement were taken into account. (Bleakley (2018) discusses incorporating mortality and retirement into return calculations for human capital. For modern life tables in developing countries, required rates of return would need to be higher by around 100 basis points.)

Another simple modification is to evaluate the fiscal gap for a student stopping at four rather than five years of school. By assumption, the marginal benefit and marginal subsidy cost would be the same, but the opportunity cost would be lower by NPR 610. This would only close the discounted gap, however, by NPR 18 (610 times 0.03), approximately a 10th of the total gap.

9 In the actual calculations, the controls included in the vectors X_{ih} and Z_h are demeaned, so that the term in the parentheses reduces to $\hat{\alpha}_{0\theta} + \hat{\beta}_{1\theta} * S + \text{subsidy}_{S\theta}$, where $\hat{\alpha}_{0\theta} + \hat{\beta}_{1\theta} * S$ is the fiscal opportunity cost. In other words, the intercept $\hat{\alpha}_{0\theta}$ can be interpreted as θth quantile of tax payments of the household whose head has zero years of schooling and mean value of other observables.

Table 2. Estimated Fiscal Benefits and Costs for a Year of Education

	Median	25th %ile	75th %ile	Mean
Panel A: Primary education (grades 0–5), N = 3, 787				
Years of schooling	610***	511***	836***	870***
	(92)	(74)	(176)	(188)
Opportunity cost at grade 5	18,747***	14,199***	26,069***	23,294***
	(392)	(315)	(751)	(841)
Subsidy at grade 5	7,209	7,209	7,209	7,192
Diff between MB and MC	−169**	−131**	−163	−44
	(81)	(65)	(156)	(165)
(MB−MC)/consumption per capita	−0.005	−0.006	−0.003	−0.001
Panel B: Secondary education (grades 6–10), N = 1, 081				
Years of schooling	547	220	1,354	2,221*
	(415)	(224)	(830)	(1,172)
Opportunity cost at grade 10	26,415***	18,445***	41,544***	40,505***
	(959)	(516)	(1,917)	(3,023)
Subsidy at grade 10	30,510	30,510	30,510	29,816
Diff between MB and MC	−1,161***	−1,249***	−808	111
	(393)	(211)	(785)	(1,094)
(MB−MC)/consumption per capita	−0.026	−0.039	−0.012	0.002
Panel C: Higher education (grade 11 to bachelor's degree), N = 893				
Years of schooling	3,737***	2,000***	7,623***	8,875***
	(941)	(489)	(2,398)	(1,937)
Opportunity cost at grade 15	52,675***	33,080***	99,141***	88,647***
	(2,945)	(1,532)	(7,508)	(6,658)
Subsidy at grade 15	30,385	30,385	30,385	27,277
Diff between MB and MC	1,245	96	3,737*	5,398***
	(865)	(450)	(2,206)	(1,752)
(MB−MC)/consumption per capita	0.014	0.002	0.027	0.05

Source: The primary data source is the Nepal Living Standards Measurement Survey 2010. The subsidy data come from the National Education Accounts reports compiled by the International Institute for Educational Planning (IIEP), UNESCO Institute for Statistics (UIS), and Global Partnership for Education. These data can be accessed at http://uis.unesco.org/en/news/national-education-accounts.

Note: This table calculates the difference (fiscal gap) between marginal benefit (MB) and marginal cost (MC) at the endpoint of each level of education. The dependent variable is total tax payments—income and consumption tax (VAT). It is assumed that only people in the formal sector pay income tax. Everyone pays VAT. The main coefficient of interest is "years of schooling" of the household head which is equal to the MB. It represents the tax gain to the government because of an additional year of schooling. "Opportunity cost" is the tax forgone due to an additional year of schooling at the endpoint of the interval. "Subsidy" is non-household expenditure per student, which includes central and local government expenditure, international and local NGO, external loans and grants, off-budget assistance, and internally generated funds by the schools. Other controls include quadratic terms of the age of the household head and the sum of education level of all the other family members. All the controls are demeaned so that the marginal cost is the discounted value of the sum of opportunity cost and subsidy. The discount rate is 3 percent. In the final row of each panel, we take the average per capita consumption of households whose head has education level equal to the endpoint of the interval, and use it to standardize the fiscal gap. In 2010–11, the year of the analysis, 1 USD was equal to 72 Nepalese rupees. Standard errors are shown in parentheses. Three stars denotes significance at the 1 percent level, two stars 5 percent, and one star 10 percent.

For other statistics of the distribution, fiscal gaps are also slightly negative. These are found in the remaining columns of Panel A, where we consider the 25th percentile, 75th percentile, and mean as outcomes. In all cases, years of schooling predict higher tax payments, with the larger effects being at the higher percentiles and for the mean. As before, however, this flow of future benefits is arrayed against substantial costs in the beginning.[10] For a 3 percent discount rate, the net fiscal balance remains negative; however it is closer to zero than it was at the median. These numbers also reflect relatively small gaps

10 The subsidy level differs between private and public schools. As the majority of household heads with primary education attend public schools, the subsidy amount is the same across the three quartiles. Because a small number did report attending private schools, the mean subsidy is slightly lower.

when compared to household consumption per capita. Indeed, at the mean, this gap is less than 1 part in 1,000 of household consumption.

Next, the discussion focuses on secondary education, for which fiscal balances turn somewhat more negative. See Panel B of table 2. Tax payments rise with education for all four of the statistics considered. Marginal fiscal gaps come in between NPR 111 and NPR 1,249 (US$1.5 and US$17). These gaps are over 1 percent of the value of household consumption per person, except at the mean.

Finally, consider higher (tertiary) education, which starts at grade 11 in Nepal. These results are found in Panel C. An additional year of education is associated with higher tax payments. This arises in part because of higher income, but what distinguishes this group from the others is the higher rate of formality (fig. 1). As a result, this group pays more in direct taxes on the margin as its income rises. The fiscal gaps are substantial. At the 75th percentile, the gap is almost NPR 3,737, which represents over 2.5 percent of household consumption per capita. At the mean, this is even larger: the gap is almost NPR 5,400 (US$75), or over 5 percent of consumption. This represents a fiscal benefit to encouraging higher education. (These findings contrast with the results from primary and secondary education, where the net fiscal impact is likely negative, albeit often economically insignificant.) Viewed in a different way, this represents a significant disincentive to attain higher education.

A potential concern is that the subsidies given in a lower grade have spillover effects at higher grades. For instance, investments in primary education might improve learning outcomes at tertiary level. In the model's context, this implies redistribution of the fiscal gap measured at a particular grade among all the lower grades. Such redistribution requires estimates of cost elasticities of various dimensions of schooling such as enrollment and learning, among others, at each school grade, which are not available in the context of Nepal. One can calculate, however, the *cumulative* fiscal gaps separately for primary, secondary, and tertiary levels. These estimates, found in supplementary online appendix S8.1, account for spillover effects within each level but not across levels. Similar to the main results, the estimated cumulative gains are economically meaningful only at the tertiary level. Another informative exercise is to calculate the *marginal* spillover effect of subsidies. Specifically, the analysis described in supplementary online appendix S8.2 shows that a rupee subsidy incentivizing a person, on the margin, from secondary (where the fiscal gap is negative) to tertiary level (where the fiscal gap is positive) results in a fiscal gain of only 83 paise.

5. Sensitivity Analysis

The above results are qualitatively robust to alternate strategies for measurement and modeling. The main set of robustness checks are found in table 3, which contains estimates of the gap between fiscal marginal benefits and costs.

The first check repeats the analysis from table 2, but only with household heads who reported attending public schools. Further, it considers only the government's contribution to the public-school subsidy. This moves the fiscal balance associated with schooling in a positive direction, with the exception of primary school, but only by a little bit. This is because non-government subsidies to schools are dwarfed by those from the government.

The next series of checks tweak the model for taxes. VAT in Nepal excludes certain food items, although the survey did not provide enough information to separate non-covered expenditures. In Row 2, all food expenditures are excluded from the VAT calculation. This makes essentially no difference to the results. The next row reports the fiscal gap using the self-reported expenditure on land, property, housing, and income taxes, instead of imputed income taxes. The self-reported measure might be lower than actual tax payments made by the formal sector workers because they may not perceive tax payments, which are remitted by the employer, as expenditure. For instance, workers like government employees, whose income

Table 3. Alternate Estimates of the Gap

		Primary				*Secondary*				*Higher*			
		Median	25th %ile	75th %ile	Mean	Median	25th %ile	75th %ile	Mean	Median	25th %ile	75th %ile	Mean
1	Only public schools and only government subsidy	−483** (206)	−211 (177)	−311 (456)	−259 (350)	−1,091*** (419)	−1,151*** (206)	−715 (783)	245 (1,112)	1,275 (953)	206 (469)	4,175* (2,339)	5,745*** (2,022)
2	VAT only on non-food consumption	-76* (43)	−152*** (22)	171* (91)	147 (145)	−684** (268)	−646*** (141)	−506 (730)	429 (1,032)	977 (650)	232 (374)	4,741** (2,175)	5,567*** (1,673)
3	Regressand is self-reported instead of imputed tax	−185** (80)	−129** (65)	−205 (138)	−215* (112)	−1,116*** (336)	−1,272*** (207)	−871* (495)	−464 (525)	86 (428)	−587* (323)	1,556** (611)	1,182** (582)
4	MB is equal to taxes net of cash and in-kind benefits	−190** (77)	−109* (66)	−152 (131)	4 (168)	−1,040*** (314)	−1,156*** (239)	−601 (530)	380 (1,215)	2,046* (1,158)	578 (618)	6,124** (2,879)	7,929*** (2,330)
5	Using random working-age member instead of HH head	−164* (88)	−160** (68)	−143 (174)	77 (208)	−849** (406)	−970*** (257)	−657 (679)	186 (676)	853 (597)	289 (387)	2,925* (1,562)	5,007*** (1,710)
6	Discount rate of 1%	350*** (88)	297*** (71)	503*** (169)	565*** (180)	−23 (408)	−270 (219)	633 (815)	1,518 (1,146)	2,906*** (915)	1,365*** (476)	6,328*** (2,333)	7,716*** (1,875)
7	Discount rate of 6.4% (r = 9%, g = 2.6%)	−1,051*** (70)	−859*** (56)	−1,294*** (133)	−1,081*** (138)	−3,097*** (368)	−2,913*** (198)	−3,258*** (736)	−2,280** (1,008)	−1,579** (783)	−2,062*** (407)	−667 (1,997)	1,456 (1,545)
8	Adjusted for migration and remittances	−381*** (74)	−224*** (61)	−503*** (135)	−443*** (141)	−866*** (301)	−869*** (162)	−700 (612)	31 (850)	1,437** (699)	23 (379)	4,306** (1,817)	5,506*** (1,506)
9	Using random working-age woman	−283*** (104)	−146* (84)	−318 (200)	−250 (169)	−827* (478)	−964*** (287)	−473 (715)	−737 (751)	−307 (779)	−138 (447)	1,129 (1,917)	−843 (3,564)
10	Sample of Dalit and Janjati household heads	−219** (110)	−197** (93)	−153 (201)	−267 (205)	−1,618** (668)	−1,477*** (395)	−1,020 (1,506)	−1,993 (1,876)	−986 (1,228)	−263 (942)	3,235 (3,196)	1,533 (1,815)
11	Slope coefficient scaled up by 30%	−13 (105)	−1 (84)	51 (200)	178 (213)	−1,046** (480)	−1,203*** (258)	−523 (959)	578 (1,340)	1,862* (1,020)	426 (531)	4,995* (2,601)	6,862*** (2,071)
12	Slope coefficient scaled down by 30%	−324*** (58)	−262*** (46)	−376*** (111)	−266** (117)	−1,276*** (306)	−1,295*** (164)	−1,092* (611)	−355 (848)	629 (710)	−234 (369)	2,480 (1,811)	3,933*** (1,432)

Source: The primary data source is the Nepal Living Standards Measurement Survey 2010. The subsidy data come from the National Education Accounts reports compiled by the International Institute for Educational Planning (IIEP), UNESCO Institute for Statistics (UIS), and Global Partnership for Education. These data can be accessed at http://uis.unesco.org/en/news/national-education-accounts.

Note: This table calculates the difference (fiscal gap) between marginal benefit (MB) and marginal cost (MC) at the endpoint of each level of education. The dependent variable is total tax payments—income and consumption tax (VAT). It is assumed that only people in the formal sector pay income tax. Everyone pays VAT. MB is the tax gradient with years of schooling of the household head. MC consists of opportunity cost and fiscal subsidies. Opportunity cost is the tax forgone due to an additional year of schooling at the endpoint of the interval. Subsidy is non-household expenditure per student which includes central and local government expenditure, international and local NGO, external loans and grants, off-budget assistance, and internally generated funds by the schools. Other controls include quadratic terms of the age of the household head and the sum of education level of all the other family members. The discount rate is 3 percent, unless stated otherwise. The discount rate is equal to interest rate (r) after adjusting for annual wage growth (g). In 2010–11, the year of the analysis, 1 USD was equal to 72 Nepalese rupees. Standard errors are shown in parentheses. Three stars denotes significance at the 1 percent level, two stars 5 percent, and one star 10 percent.

is subject to third-party reporting[11], report less than 1 percent of their consumption in tax payments, as opposed to 13 percent according to the tax schedule. The fiscal gaps at the primary and secondary levels remain unchanged because income tax is a small proportion of the total taxes at those levels. For higher education, the fiscal gap reduces because self-reported taxes are lower than imputed taxes.

Education should affect not just tax payments, but also receipt of benefits, although this latter channel is comparatively small. Panel B of fig. 1 shows why. While the slope of taxes with respect to education is evident in the graph, the relationship between benefits and education is, in fact, quite small and sometimes not even sloping upwards.[12] The LSMS has information on benefits received under various cash-transfer programs and take-up rates of in-kind transfer programs. The first step is to verify that the take-up rate is consistent with other published estimates and then to calculate the rupee amount spent per beneficiary. (Please refer to supplementary online appendix S6. for details.) The analysis uses net tax payments (taxes minus benefits) to estimate the marginal benefit. However, to calculate the fiscal opportunity cost the tax gradient is used, instead of the net tax gradient, because the student might get access to benefits even when they are in school. The fiscal gap estimates are hardly different from baseline. See Row 4.

The empirical strategy assumed household consumption and tax payments as a function of the household head's education after controlling for the sum of education of the rest of members. Is this assumption critical? To answer this, the model is modified to use the education level of a random working-age member of the household, instead of the household head, and control for the sum of education of the remaining members. Row 5 shows that the results remain statistically indistinguishable from the baseline.

Rows 6 and 7 report the sensitivity of the results to alternate discount rates. Once the discount rate is dropped to 1 percent, expectedly, the fiscal gap improves. For tertiary, the fiscal gap is now positive and significant at all the moments of the distribution. For primary and secondary levels, the fiscal balance is quite balanced in the majority of specifications. Another possible discount rate is the pre-tax real return on private investment based on the assumption that public investment crowds out private investment. For Nepal, this is around 6.5 percent.[13] If such a high level of discount rate is used, then the marginal fiscal cost is higher than the marginal benefit except for the mean of the distribution at higher education level.

Next, the analysis considers how migration would affect these calculations. (In the sample, around 32 percent of the households report having a member outside Nepal.) Migrants who leave Nepal after their school years take with them their (subsidized) human capital. Neither do they pay income taxes nor is there a fiscal opportunity cost if the migrants leave the country right after school. Nevertheless, those migrants might very well send back remittances, which expand the national tax base. The magnitudes of these effects can be characterized by using information on migrant's education and remittances.

The objective is to compute migration-adjusted tax payments for each household head. (See supplementary online appendix table S5.2.) This involves assigning a probability of migration, P, to each head based on years of schooling.[14] For example, if 7 out of 146 people with one year of education and in the working-age group migrate out of Nepal, then the migration probability of a household head with

11 Kleven et al. (2011) shows that the tax evasion rate is low for people whose income is subject to third-party reporting.

12 The almost flat gradient of benefits with education might be because of two countervailing effects. If education increases awareness about legal rights, then the take-up of benefits might increase with schooling. Only 16 percent of households receive money under any cash-transfer program, suggesting poor access. Conversely, if the program benefits are an insignificant proportion of consumption, then the take-up will fall as incomes rise with schooling. For instance, the average payments under the old-age pension program are only 3 percent of the total consumption of the household where the head has finished higher education.

13 The Asian Development Bank uses a discount rate of 9 percent in the cost-benefit analysis for infrastructure projects (Asian Development Bank 2017) such as road construction (Asian Development Bank 2018). The growth rate of GDP per worker (2.6 percent) is subtracted from it to get an alternate measure of $\tilde{r}$.

14 In the LSMS data, the household head, by definition, cannot be away from the household for more than 6 months in the last year and hence, is not classified as a migrant (CBS 2011).

similar education is 5 percent. In the case of migration, no income tax is paid. However, the government gets VAT equal to 13 percent of remittances (R) once they are consumed by the households. In the case of no migration, there are no changes to the tax payments. Thus, the migration-adjusted tax payments (M) are calculated using the following formula:

$$M = (1 - P)\tau(s) + 0.13 \times PR.$$

Replacing $\tau(s)$ with M in the empirical specifications does not change the results qualitatively. The fiscal balance improves a little for both higher and secondary levels in most of the specifications, while it worsens a bit for the primary level.

Next, this study compares fiscal gaps for subsets of the population: by sex and by caste. As reported in Rows 9 and 10, it finds that the fiscal gap is insignificant at higher education levels for women and lower-caste households.[15] The reduction in fiscal gap is driven by a decrease in income tax payments as these subgroups are less likely to find a formal job. Figure S2.1 shows that, conditional on education, both women and lower castes are less likely to secure formal jobs than the comparison groups. This finding is consistent with the cross-country analysis by Bue et al. (2022) who find women to be more likely in vulnerable employment because of marriage and parenting.

Finally, it is important to check for the sensitivity of the main results to deviations in the tax returns to education because of confounding factors. To estimate the impact of such deviations, the estimated coefficients of tax returns to education are inflated (and deflated) by 30 percent. These adjustments are larger than the typical differences between IV and OLS estimates of returns to schooling. Rows 11 and 12 show the effect on the fiscal gap. The findings suggest that if the tax returns to education are larger, either because of confounding factors or better school quality, the overall fiscal gap improves despite an increase in opportunity cost. The converse is true if tax returns are smaller.

Supplementary online appendix S4 contains a discussion of several additional checks. Among other things, they test for alternate levels of subsidies, conservative definition of formality, changes in household composition, and alternate definitions of education levels. An important check is to relax the assumption of infinite horizon and calculate the average present value of lifetime tax payments by imputing the income and consumption stream of a person during their working life. This essentially relaxes the assumption that the marginal tax rate does not change for a person during their work life and tests the robustness of the main results.

6. Conclusion

This study analyzes school enrollment choice in terms of fiscal externalities. These externalities exist because the individual neither bears the full cost of education, because of subsidies, nor realizes the full benefit of education, because of taxes. Nepal provides a suitable context. On average, the fiscal distortions create a minimal gap between the benefits and costs at the primary and secondary levels. However, at the tertiary level, the fiscal gap is positive and significant. This study provides a novel explanation for this: people with higher education are more likely to be in the formal sector and hence pay income taxes. The main results remain robust to a variety of sensitivity analyses, including the effects of emigration.

The positive fiscal gap at the tertiary level implies that the government receives more revenue per marginal year of school than it incurs in costs, all else held fixed. In contrast, fiscal gaps are quite small for lower levels of schooling. Consequently, policies made to increase primary or secondary schooling

15 We follow Shrestha and Shrestha (2020) to categorize castes according to the social hierarchy. We also refer to Bennett et al. (2008) and Bhattachan, Sunar, and Bhattachan (2009) for ambiguous cases. Supplementary online appendix S9 provides details of caste classification.

cannot be justified based on these estimates of the fiscal externality, while policies to increase higher education might be. While such estimates provide a useful comparison, an optimal subsidy regime would need to account for general equilibrium effects. The analysis also finds lower (less positive) fiscal gaps among women and disadvantaged castes. This suggests that optimal distribution of schooling subsidies would also involve the usual equity–efficiency trade-off. This study's estimates of the fiscal gap represent a crucial yardstick to measure one side of the trade-off, i.e. efficiency.

Lastly, this study would not have been possible without access to information on aggregate government spending per student at different levels of education. To the best of our knowledge, disaggregated information on subsidies is not available for a majority of developing countries. This study demonstrates the usefulness of properly measuring education subsidies for calculating the fiscal returns to education, and therefore recommends constructing such data for a wider range of countries.

Data Availability Statement

There are two sources of data used to support the findings of this study.

The data on educational subsidies are publicly available in UNESCO Institute for Statistics at http://uis.unesco.org/sites/default/files/nepal-nea-tables-2009-2015.xlsx.

The Nepalese household-level survey data are available in The World Bank Microdata Library at https://microdata.worldbank.org/index.php/catalog/1000/study-description, and can be accessed with Reference ID NPL_2010_LSS-III_v01_M after following the data access and payment procedure mentioned on the website.

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