Estimation of the Economic Opportunity Cost of Labor: An Operational guide for Ghana

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Abstract

This report employs the supply price approach to the estimation of the economic opportunity cost of labor (EOCL) for a number of labor market situations in Ghana. This is applied as an instrument
for the economic evaluation of public projects to be implemented.

The relevant literature refers to the significant heterogeneity of labor, which leads to a consideration of different types of labor. Accordingly, the EOCL will vary by skill, location, and labor market conditions, and these factors need to be incorporated in its estimation. In this analysis, the estimation has been carried out to quantify the EOCL and the conversion factor corresponding to the two types of labor: skilled and unskilled. Furthermore, these estimates refer to groups of labor according to areas of residence (urban/rural).

Keywords: Economic Cost, Labor, Supply Price, Protected Wage, Investment Appraisal

JEL Classification: J43, H43

1. Introduction

The economic evaluation of projects (cost-benefit analysis) is a study area that allows us, among other things, to generate economic prices, mechanisms, and methodologies to allocate resources efficiently between different alternative uses.

Determining the most economically desirable project is one of the major concerns for governments and development planners. In order to evaluate projects, it is thus important to have appropriate measures for the economic opportunity costs of the primary factors of production. The purpose of this study is to analyze the appropriate economic opportunity cost of labor (EOCL), which is one of the key inputs used for evaluating public investment projects, to represent the true cost to society of employing an additional unit of labor (unskilled and skilled) in a new project.

The EOCL is the value to the economy of the set of activities given up by the workers, including the non-market costs (or benefits) associated with the change in employment (Jenkins, 1995). The rationale for calculating the EOCL is that the prevailing market wage does not necessarily reflect the correct economic cost of labor, due to the presence of distortions in the labor market.

Public projects may affect employment by directly creating jobs or facilitating job creation. Such employment changes may have significant net economic benefits, which should be included in cost-benefit analysis. The benefits accruing to the economy from the employment of the worker by a project is the labor externality (LE), and this can be defined as the difference between the wage paid on the project W_p and the EOCL:

$$\mathrm{LE} = W_p - \mathrm{EOCL} \qquad (1)$$

When this value is positive, it implies that the financial cost of labor will be greater than its economic cost. The magnitude of labor externality is related to several factors, including the supply conditions of the type of labor being employed, and it can be split between the worker and the government.

In the practice of cost-benefit analysis, observed financial (market) wages can be translated into economic price using conversion factors. These are coefficients defined as the ratio between the EOCL and the financial cost of labor. If the total compensation for the employee is, for example,

GHS 1,000 and the conversion factor is 0.80, then the financial cost of labor is greater than the EOCL, which is only GHS 800; hence, the economic profitability of the public project is greater when labor is correctly evaluated at its economic opportunity cost. For many public investment projects, ignoring this correction may lead to an underestimation of the economic benefits of public investment.

In this study, the empirical computation of the EOCL and the conversion factors for public projects account for the structural characteristics and the labor market conditions in Ghana.

We argue that the EOCL differs by the skill type and location of the employment. Overall, labor is a highly heterogeneous factor of production. Typically, labor markets experience different dynamics across occupations, skills, working environments, labor market conditions, and regions. Here, we propose to develop an operational estimation methodology that quantifies this opportunity cost across occupational groups and different labor markets. At the same time, these estimations need to be able to be carried out easily with national statistical data and with an acceptable degree of accuracy. In this vein, the current work provides an operational guide to estimating the EOCL for various skills and labor market types applicable to Ghana.

The work consists of five sections, including the introduction. The second section gives an overview of the Ghanaian labor market and some of its essential aspects. The third presents the methodology used to estimate the opportunity cost of labor. Section four presents eight case studies in the context of the Ghanaian labor market and the results obtained from applying the methodology. Finally, the conclusions are presented.

2. Labor Markets in Ghana

Over the past three decades, Ghana has experienced strong, sustained economic growth, which has contributed to a substantial reduction in the extent and depth of poverty.

Since 2000, the country has experienced a significant sectoral transformation of employment. The agricultural sector decreased from 55.03% of total employment in 2000 to an estimated 29.75% in 2019, a reduction of 25.28 percentage points. The service sector is estimated to have

increased by 18.24 percentage points from 30.97% to 49.21% in the period 2000–2019, and in the same period the industrial sector has increased slightly by 7 percentage points.[1]

Ghana's labor market is divided between the formal and informal sectors, with the latter being the source of the largest share of jobs in the country's economy. Working conditions in the informal sector are not as attractive as those in the formal sector. One way to exemplify what characterizes informality in the labor market is that labor regulations – including those on the minimum wage, the wage premium for overtime work, and social protection – are not applied in practice. Informal workers operate mainly in a cash economy; their earnings are usually low, making them non-liable for taxes, and they are not registered for social security.

According to an estimate by the Labor Force Survey (2015), a very high proportion of the employed population is in informality: almost eight in every ten employed persons (78.1%) are in informal employment and 21.9% are engaged in the formal sector.

Another piece of evidence that demonstrates the pervasiveness of the informal economy in Ghana is that according to GSS (2014), only one in four of those in wage employment comply with the pay as you earn (PAYE) tax requirement. Thus, 76% of workers do not pay tax on their earnings. The survey also shows that 70.9% of workers are not entitled to any social security, while 70.1% do not receive retirement benefits such as a pension. As a further demonstration of the size of the informal economy, the study indicates that 57.3% of those who are employed have no signed written contracts with their employer.

The formal wage sector appears stagnant, or even declining, as most new jobs are created in the informal sector. A total of 300,000 individuals enter the labor market every year, out of which about 2% are absorbed into the formal sector (Baah-Boateng and Ewusi, 2013). The remaining 98% seek employment in the informal economy.

As in most countries, especially in sub-Saharan Africa, the labor market in Ghana experiences internal rural–urban migration. The primary reason for most internal migration is to look for work or engage in various economic activities. The data shows that Ghana's population is experiencing rapid and continuing urbanization, driven by population growth and migration from

1 Data obtained from International Labour Organization, ILOSTAT database.

rural to urban areas. In 2010, the proportion of the population living in urban areas was 50.71%, compared with 43.92% in 2000. In 2020, the urban population in Ghana was 57.35%.[2]

According to Duplantier et al. (2017), the internal mobility of educated youths in Ghana is positively correlated with incomes in neighboring regions. They found that income and unemployment rate differentials between the regions of origin and destination have a significant impact on the probability of migrating, but that individuals assign considerably more weight to income differentials than to unemployment differentials. Furthermore, they noted that regions exercising the greatest attraction are the capital region, with nearly 58% of migrants, and the Ashanti region, with 16% of migrants. These are the regions with the highest mean incomes in Ghana.[3]

Transnational migration of skilled and unskilled workers from poor nations to more developed economies has reached high levels. Ghana, like other countries, has a long history of its citizens migrating to other countries to seek better opportunities. The overall skill level of Ghanaian emigrants is relatively high. It is estimated that in 2000, a staggering 46.9% of tertiary-educated Ghanaians emigrated, mostly to the United States and Europe (Docquier and Marfouk, 2006). According to estimates, 33.8% of Ghanaian migrants living in OECD countries at the time were classified as medium-skilled workers, while 27.6% were highly skilled. (Asare, 2012, citing the European Union, 2006).

Despite a large and growing supply of labor in general, foreign workers are brought in by corporations or the government for projects requiring their skills. For example, Chinese construction firms typically rely on foreign labor (mainly Chinese) in order to execute projects in Ghana (Owoo and Lambon-Quayefio, 2020).

In light of the aforementioned, the focus of this research is on a set of scenarios that explain how the EOCL should be determined in each of these scenarios. We now turn to a discussion of the methodology.

2 See, World Bank. (2021a), Urban population data. https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=GH.

3 Wage differentials between rural and urban areas encourage migrants to migrate away from the countryside. This is in line with Harris and Todaro (1970) and Lewis's classical theory (1954).

3. Methodology

The first step in calculating the EOCL is to decide which method will be utilized to calculate the initial labor cost. There are two different methods for identifying the starting point: (i) the value of a marginal product of labor forgone approach,[4] and (ii) supply price of labor approach. Although estimating the EOCL using either method will theoretically produce the same result, these two approaches have different data requirements, different levels of computational complexity, and, hence, different degrees of operational usefulness (Jenkins, 1995).

The fundamental consideration in the forgone product approach is to take the current technology and market structure as given and try to determine the value of the marginal product forgone when a worker is added to the public payroll. In the second approach, the fundamental determinant of the EOCL is the competitive supply price at which labor of a particular type will make itself available for employment in a specific project (Harberger, 1971; Jenkins and Montmarquette, 1979).

The value of the marginal product forgone approach would require the project analyst to estimate the monetary values of each of the components individually, and accordingly adjust the forgone wages for the equalizing differences in well-being and costs, as valued by the worker, between the employment and living conditions of the alternative employment situations facing the potential project employee. This generally cannot be done with an acceptable degree of accuracy, given the time constraints associated with the appraisal of the project.

Our analysis employs the supply price of labor approach as it is generally more straightforward and applicable across varying labor market conditions and has less stringent data requirements. The supply price is an ideal measure in the sense that it is location-specific and implicitly includes the value of a forgone product as well as the value of all other monetary and non-monetary sacrifices that workers make when they present themselves at the project site. The easiest way to think of the EOCL in a given area, occupation, industry, or other category is to start with the market wage required to attract sufficient people of the required skill level to work

4 This approach was initially proposed by Little and Mirrlees (1968).

on the project and make a series of adjustments. All the labor of each type earns its relevant market wage (Harberger, 1985).

The supply price of labor is the minimum wage rate that the project needs to pay to obtain sufficient supplies of labor with the appropriate skills. That wage accounts for the workers' preferences regarding location, working conditions, or any other factors that affect the desirability of working for the project.

If a project hires labor, we should expect some people who are already employed in other places to move to the project. These workers will migrate to the project if their project wage is at least as large as their required supply price. This labor market adjustment will decrease the quantity supply of labor supplied in the alternative labor markets. It is important to note that if a labor market is characterized by a high level of unemployment, this will tend to lower the supply price (gross-of-tax wage) that workers would require before offering their labor services to the project. The opposite is also the case when a particular labor type is in short supply. Here we would expect to find that the supply price of this type of labor will rise.

Once the gross-of-tax supply price (wage) for the project has been determined, it is adjusted to account for the various distortions present in the labor market. It is critical to incorporate all the relevant distortions to accurately estimate the EOCL. These distortions arise from the presence of income taxes, social security contributions, employment insurance, labor union monopoly power, enforced minimum wage laws, and any other type of tax or subsidy present in the project's labor markets. Furthermore, when workers move from an alternative job to work on the project, they will consider the net-of-tax wage they are giving up and the minimum net-of-tax wage they must receive to be willing to work for the project. If they pay taxes on the wages they earn in their alternative employment, they will not consider these taxes lost as a loss in economic welfare.

While the reduction in tax revenues from the reduction in employment is not in itself an economic welfare loss, workers must have been generating a value of a product in the alternative employment large enough so that the employer is willing to pay a gross-of-tax wage sufficient for the employees to earn their supply price for that job and at the same time be able to pay the tax on these wages. This component of the value of the marginal product of labor that serves to cover the cost of these taxes is an economic loss that workers do not consider when moving to

the project from alternative employment. Hence, two adjustments need to be made to the gross-of-tax supply price associated with the project. First, a subtraction must be made of the tax component of this supply price for the project site, and second, there must be an addition to an amount that is measured by the taxes no longer paid when a worker moves from the alternative place of employment.

When a project hires additional employees, it is natural that some new workers may represent new entrants to the formal labor force in response to the improved labor conditions created by the project. These new entrants will be responding to the opportunity to earn a net-of-tax wage that will be paid by the project. If no taxes or subsidies were associated with their prior non-formal market activities, the gross-of-tax wage rate reflecting the supply price to the new project only needs to be adjusted by the taxes that will be paid by the new labor force entrant earning this supply price wage. In the absence of taxation, worker migration for employment on a new project from employment in an alternative market requires no adjustment to drive the EOCL. The supply price captures exactly the lost benefits of the worker in the alternative market.

In summary, when labor markets are competitive, the estimation of the EOCL begins with the gross-of-tax supply price of labor, W_g^s for a particular type of labor skill that will be supplied to a specific project at a given location. W_g^s reflects the minimum wage that the project would need to offer in order to meet its labor needs. This simple measure captures a number of important factors. For instance, it already accounts for the worker's skill level, preferences regarding location, working conditions, the disutility of moving to the project, time spent away from family or household production, and the alternative employment opportunities available to the person. In a market with no distortions, this supply price wage for a type of labor captures the EOCL as it captures all of these forgone opportunities for the worker. This is, in essence, the advantage of the supply price approach to estimating the EOCL of labor.

3.1. Methodology for Estimating EOCL in the Presence of Taxes and Other Distortions

When distortions are present in the labor market, the supply price must be adjusted to account for them. Income and social security taxes are the two most common labor market distortions. Income tax is levied on the growth of income wage received by the employee. Typically, the

responsibility for the payment of income tax is on the individual employee. However, the employer might be required to withhold the estimated income tax at the time wages are paid. The tax base for social security tax is also the wage gross of income tax paid by the employer to the employee. However, the amount of this tax is calculated by the employer and paid to the government. From the perspective of the employer, the total employee compensation or payment is the project wage (W_p) plus the social security paid by the employer (T_s). These two are added together to become the total employee compensation:

$$W_p' = W_p(1 + T_s)$$

When the wages are subject to income taxes, the EOCL becomes the gross-of-tax supply price to the project less the income taxes paid by this worker on the project plus any tax lost as a consequence of the movement of labor to the project. We can denote the share of the project's labor sourced from currently employed workers as H^d. These workers earn the alternative wage $W_g{}^a$. The remainder of the project's labor would be sourced from the informal sector or non-market activities, and this does not require an adjustment for income taxes.[5] In what follows, the degree of distortions in the market is the most relevant factor (Jenkins, Kuo, & Harberger, 2019). In the case of the presence of distortions, the EOCL is:

$$\text{EOCL} = W_g^s - (W_g^s T - H^d W_g^a T') \quad (2)$$

where:

- $W_g{}^s$ denotes the gross-of-tax supply price of labor;
- $W_g{}^a$ denotes the gross-of-tax wage of labor from alternative sources;
- T denotes the income tax rate plus social security paid by employees corresponding to the supply price of labor;
- T' denotes the total effective tax rate, including both the income tax rate paid by the employee and the social security taxes paid by the employee and the employer ($T_s + T_{s1}$) corresponding to the alternative wage rate; and
- H^d denotes the proportion of the project's demand for labor obtained from taxed employment in the alternative market.

5 The tax structure applicable to labor income in Ghana is detailed in Appendix A.

In equation (2), the supply price of labor is adjusted (reduced) by the income tax rate levied on the wage paid to the project's labor force ($W_g^s T$) and is increased by the income and social security taxes lost from reduced employment in the alternative formal labor market ($H^d W_g^a T'$). In the case of Ghana, H^d is a particularly important parameter. Because the informal sector makes up such a large proportion of economic activity, it may be reasonable to assume that a great deal of labor comes from informal market activities as opposed to alternative formal markets. As such, we would expect a reasonable parameterization of H^d for Ghana to be lower than for a country where the informal sector is less substantial.

From equation (2), we can calculate the labor externality associated with a project when distortions are present. We present the general case here and illustrate the calculation of this externality alongside the estimation of the EOCL below. Again, from equation (1), the labor externality is:

$$\begin{aligned} \text{LE} &= W_p' - \text{EOCL} \\ &= W_p' - [W_g^s + (W_g^s T - H^d W_g^a T')] \\ &= W_p(1 + T_s) - [W_g^s + (W_g^s T - H^d W_g^a T')] \\ &= W_p + W_p * T_s - W_g^s - W_g^s T + H^d W_g^a T' \\ &= W_p T'' + W_p(1 - T'') + W_p * T_s - [W_g^s(1 - T) + H^d W_g^a T'] \end{aligned} \quad (3)$$

where:

- T'' denotes the income tax rate plus social security paid by employees corresponding to the project wage, levying on wages in the formal sector.

We can interpret each of the terms above as being benefits accruing to labor or taxes gained (+) or lost (−) by the government:

$$\text{Labor benefits} = W_p(1 - T'') - W_g^s(1 - T) \quad (4)$$

$$\text{Government benefits} = W_p T'' + W_p * T_s - H^d W_g^a T' \quad (5)$$

4. Economic Opportunity Cost of Labor

We will now apply the supply price of labor approach to estimate the EOCL used by projects for different situations relevant to Ghana. Firstly, we evaluate the EOCL on rural and urban projects, hiring skilled and unskilled labor from domestic markets. We also illustrate the EOCL for the

case of a project in Ghana hiring domestic labor who can alternatively work abroad. We then turn to the issue of hiring foreign labor employed in Ghana. We illustrate each case analytically, followed by an empirical illustration.

4.1. A Rural Project Employing Domestically Sourced Unskilled Labor

Estimating the economic opportunity cost of unskilled labor is relatively straightforward due to the lack of distortions in this sector of the labor market. In general, low-skilled occupations are traditional agriculture and elementary occupations. In the case of Ghana, the majority of rural dwellers (65.2%) are employed in the agricultural sector, compared with a lower proportion of urban dwellers (11.8%) (GSS, 2019). In our first case, the EOCL is estimated for an unskilled labor market in rural agricultural with no significant distortions, i.e. the employer (demand side) does not pay taxes, and the worker (supply side) does not pay income taxes. It is further assumed that wages and labor demand do not fluctuate over time.

Suppose an agricultural project in a rural region employs unskilled labor at the prevailing market monthly wage rate. To estimate the EOCL, a classical starting point is the gross-of-tax supply price of labor, W_g^s. Thus:

$$\text{EOCL} = W_g^s \tag{6}$$

Because no distortions are present, the market wage is the supply price that captures all the factors mentioned above and thus reflects the true EOCL for this type of labor.

Wages in the informal sector vary across the industries, locations, and occupations of the employees. In general, the agricultural sector is characterized by low earnings and high levels of poverty. According to Nyarko Otoo (2019), monthly earnings in agriculture are less than half (45.6%) of the average earnings in Ghana (GSS, 2014). Based on the data from GSS (2019), the nominal average monthly earning is estimated at GHS 1,009 for skilled agricultural, forestry, and fishery workers, who represent the least qualified group of paid employees. With regard to unskilled work, the same data source shows that "employed persons" in elementary occupations consisting of simple and routine tasks such as performing various simple farming activities earn on average GHS 597 per month. According to the Labor Force Report 2015 (GSS, 2016), about one tenth (11.5%) of persons in informal employment are "paid employees." We can therefore

say that the above earnings largely reflect the monthly income of the employed population in the formal sector.

Regarding the informal sector, those employed in this sector are generally paid low salaries and wages, largely because there is excess labor supply and a lack of skills that may attract higher wages. Based on Khalid (2017), the average earnings in the informal economy in Ghana are approximately 1.43 times lower than formal sector earnings.

For the purpose of this study, we suppose the approximate monthly market price of unskilled labor in a rural area in Ghana is GHS 417.48,[6] and the project will pay an amount equal to the supply price of labor ($W_g^s = W_p$). Thus:

$$\text{EOCL} = W_g^s = \text{GHS } 417.48$$

Using equation (1) for the estimation of labor externality, for this project:

$$\text{LE} = W_p' - \text{EOCL}$$

However, given that no social security payments would be applied, W_p' is equal to W_p, which results in no labor externality (LE=0).

As can be seen from the above, there is no labor externality in this first case. Because no distortions occur in this market, no externality is generated from the reallocation of labor to employment by the project from other activities. If unemployment is high in the region, the supply price of labor to the project as reflected by the market wage will be lower than it would be if the incidence of unemployment were less.

4.2. A Monthly Rural Project Employing Domestically Sourced Unskilled Labor from the Informal Sector to Rural Formal Sector Jobs

When a worker becomes employed in the formal sector of the economy, social security taxes must be paid on the wages they receive. Under the National Pensions Act 766 of 2008 with the administration of Ghana's Basic National Social Security Scheme, it is mandatory for employers to register their employees for the purpose of making social security contributions on their behalf. The employer is required to pay 13% of each employee's monthly basic pay (as the employer contribution) into the social security fund. The employer is also required to deduct

6 This amount is 1.43 times lower than the monthly wage rate in the formal sector.

5.5% of the employee's basic pay and pay it into the same fund every month (as the employee contribution).[7] Thus, in our study, the social security tax rates paid by the employer (T_s) and the employee (T_{s1}) are considered to be 13% and 5.5%, respectively.

The analysis will begin with the assumption that the formal sector project pays a competitive wage so that the equation of ($W_p(1 - T_{s1}) = W_g^s\ (1 - T_{s1})$) must be valid, where T_{s1} represents the social security tax rate of the pensionable wages made up from the employee. As the worker is moving from the informal sector to the formal sector, the social security tax rate T_{s1} levied on the supply price of labor in the informal sector is equal to zero.

With regard to the individuals in the formal sector, the employer must withhold 5.5% of each employee's salary. Hence, we have ($W_p(1 - T_{s1}) = W_g^s$). This equation states that the employee's wage net of social security is equal to the supply price of labor, which in turn is the prevailing market wage in the informal sector. Alternatively, the project wage W_p must be at least equal to $\frac{W_g^s}{1-T_{s1}}$. If the project were to pay less, the workers would be worse off working for the project than working in the informal sector.

The cost of this labor to the project will have to include the wage rate paid to the employee plus the 13% social contribution of the employee's wage that, by law, the employer must pay. For unskilled labor jobs, it is assumed that the wage rate is not high enough for the individual to be subject to income tax.[8] Hence, the project wage (employer's cost W_p') is higher than the supply price (W_g^s) of unskilled labor for this formal rural project by a total of 18.5%. In this case, EOCL is equal to W_g^s, but the labor externality is equal to W_p' – EOCL. Here, W_p' is equal to W_p*(1+13%).

7 Workers from the informal economy have negligible access to national social security schemes, with only 10,000 informal workers contributing to national social security schemes, mainly affiliated to the People Pension Trust from the Third Tier Pension Scheme. See Ghana Labour Market Profile 2020.

8 The personal income here is the chargeable income after taking into account the personal reliefs of one taxpayer with one dependent spouse, two children's education and one aged dependant, as well as considering that the contributions of individuals to the mandatory pension schemes qualify as tax reliefs under the National Pensions Act, 2008 (Act 766), as amended.

If the monthly market wage of unskilled labor in the informal sector (supply price W_g^s) is GHS 551,[9] the lowest acceptable project wage (W_p) for this unskilled labor in the formal sector is:

$$W_p = \frac{W_g^s}{1 - T_{s1}} = \frac{551}{1 - 0.055} = \text{GHS } 583$$

Thus, the labor cost to the project is:

$W_p' = 583 * 1.13 = \text{GHS } 658.79$

Given that EOCL= W_g^s = 551, the labor externality is:

$$\text{LE} = W_p' - \text{EOCL} = 658.79 - 551 = \text{GHS } 107.79 \text{ per month}$$

As can be seen, the monthly labor externality created in this case accrues to the government in the form of social security tax revenues.

The ratio of government benefits, which represents the benefits that accrue to the government (fiscal benefits), to the total compensation for the employee is:

$$\frac{W_p(T_s + T_{s1})}{W_p(1 + T_s)} = \frac{583 * 0.185}{583 * 1.13} = 0.16$$

The ratio of the EOCL relative to the total compensation for the employee (W_p') is called the conversion factor (CF) for this specific type of labor. This quantity can be used to convert a project wage to its EOCL. In the above case, the conversion factor is $\frac{\text{EOCL}}{W_p'} = \frac{551}{658.79} = 0.84$.

4.2.1. Monthly Wage in Formal Sector is Higher Than the Prevailing Market Wage Rate

Suppose this formal sector employer pays a monthly wage that is 15% higher than the prevailing market wage rate (supply price). W_p is now equal to 551*1.15 = GHS 633.65 per month. As a result, the project wage (employer's cost) (W_p') is equal to 1.13*633.65 = GHS 716 per month.

In this case, the level of income is not great enough to be subject to income taxes; however, we have the social security tax of T_{s1} = 5.5% paid by the employee.

9 According to GSS (2019), the average monthly earnings for workers in paid employees in elementary occupations is GHS 597. The WageIndicator Foundation statistics of gross monthly salaries shows that the average gross monthly salary of mining and construction laborers is GHS 643 and ranges from GHS 459 to GHS 1,476 due to a combination of factors, including education, region, employment status, company size and years of work. Taking into account the fact that workers in the informal sector in rural localities earn a lower income, we assume that the average monthly wage rate of unskilled labor in our case is the mean of the lowest wage rate (GHS 459) and the average wage rate (GHS 643) for this kind of laborer.

Similar to the case above, the EOCL is here taken as the private supply price irrespective of what financial wage the project pays.

Given that EOCL = W_g^s = 551, then:

LE $= W_p' - \text{EOCL} = 716 - 551 = \text{GHS } 165 \text{ per month}$

Labor benefits $= W_p(1 - T_{s1}) - W_g^s = 633.65 * (1 - 0.055) - 551 = \text{GHS } 47.8 \text{ per month}$

Fiscal benefits $= W_p T_{s1} + W_p * T_s = 633.65 * 0.055 + 633.65 * 0.13 = \text{GHS } 117.2 \text{ per month}$

In this case, the conversion factor is $\frac{\text{EOCL}}{W_p'} = \frac{551}{716} = 0.77$.

The conversion factor has been reduced as the project wage has surpassed the labor supply price.

Table 1 Summary Statistics for Rural Unskilled Labor in the Formal Sector

Case	Monthly project wage (W_p)	Monthly supply price of labor (W_g^s)	Total labor compensation (W_p')	Alternative wage rate (W_g^a)	EOCL	CF	Labor externality (LE)	Labor benefits (LB)	Fiscal benefits (FB)	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{FB}{W_p'}$
Rural, unskilled, formal sector	583	551	658.79	----	551	0.84	107.79	0	107.79	0.16	0	0.16
Rural, unskilled, formal sector	633.65	551	716	----	551	0.77	165	47.8	117.2	0.23	0.07	0.16

4.3. A Rural Project Employing Domestic Skilled Labor with Migration from Other Labor Markets

This case considers a project that demands skilled labor in a distant rural region where such labor may not be available. In this case, two points should be made with respect to skilled labor. First, skilled laborers are frequently subject to multiple distortions which must be identified and accounted for in the estimation of EOCL. For example, skilled labor needs to pay income taxes. In Ghana, personal income tax is charged on taxable income according to the rates in Table A1. Taxable income includes basic wages, overtime, and cash allowances and bonuses (excluding the annual bonus), after mandatory payroll deductions for the social security tax paid by the employee. Second, labor markets generally tend to be tighter for high-level skill occupations such as professionals, technicians and associate professionals, and managerial occupations. According to Baah-Boateng and Baffour-Awuah (2015), the average annual labor demand and

supply at different skill levels in Ghana yields a shortage of high-, semi-, and specialized-skill labor and an excess supply of low-skill labor.

When a project seeks to hire skilled labor, most positions are likely to be filled at the expense of other employers who give up these workers. Taxes paid by these workers in their previous employment are also a determinant of the EOCL.

The prevailing wage for this type of labor in this region may even be higher than that which this labor would have been earning in the alternative urban labor markets. Given that certain types of skilled labor are not available in every region and may need to be sourced from other urban areas, these skilled workers consider a number of factors before moving to the project region.

Such factors include differences in the cost and quality of living and workers' preferences. Skilled workers assess these factors to determine the minimum wage they are willing to accept in order to move from the current place to the new remote region.

The rural project's net-of-tax wage rate must be at least as high as the net-of-tax supply price of this labor. To improve the attraction and retention of skilled staff in remote areas, the project wage may in some cases be higher than the prevailing market wage for a given skill in the project's area. Because the new work is in the formal sector, social security contributions must be taken into account.

When workers are employed in a market where a personal income tax exists, the EOCL is determined by the value these individuals receive by supplying their labor services, which would be measured by the wage net of personal income taxes. In this case, the EOCL becomes the supply price less the amount of income taxes paid by an individual working at the supply price, plus the forgone income taxes that would have been generated elsewhere in the economy if the worker had not moved to the project region.

As a share of the project's labor, H^d will be sourced from taxed employed workers earning the alternative wage $W_g{}^a$, perhaps even in other parts of the country. The remainder of the project's labor would be sourced from the informal sector or non-market activities, which does not require adjusting for income taxes. As previously discussed, in the case of the presence of distortions:

$$\text{EOCL} = W_g^s - (W_g^s T - H^d W_g^a T')$$

From equation (3), we can calculate the labor externality associated with a project when distortions are present:

$$\text{LE} = W_p T'' + W_p(1 - T'') + W_p * T_s - [W_g^s(1 - T) + H^d W_g^a T']$$

Using equations (4) and (5) as presented in the methodology section, the benefits to labor and to the government are as follows:

Labor benefits $= W_p(1 - T'') - W_g^s(1 - T)$

Government benefits $= W_p T'' + W_p * T_s - H^d W_g^a T'$

As an illustrative example, we focus on a specific subset of skilled labor with a skill at the third to fourth International Standard Classification of Occupations (ISCO) level, such as professional services (engineers). Assume the skilled professional labor requires a monthly wage of GHS 3,528 gross of tax and social security contributions (the supply price (W_g^s)).[10] Suppose the alternative wage rate (W_a) is 80% of the supply price (GHS 2,822.4).

In addition to this, the supply price of labor (W_g^s) net of all taxes must be equal to the project wage (W_p) net of income and the social security taxes paid by the employee. This will be the lowest wage the project can pay and still expect to attract skilled labor to work for it. Incorporating the effective income tax rate and social security contribution rates described in Appendix A2, the individual (employee) would pay an income plus social security tax rate (T'') of 18.44% on the project wage (W_p). Also, the income tax rate of the supply price of labor (T) is 18.44% as the supply price is assumed to equal the project wage rate in this scenario. The tax rate corresponding to the alternative wage rate (T') reflecting the value of the income and social security (from the employee and employer) taxes lost from reduced employment in the alternative formal labor market is estimated at 30.30%. Hence, the relationship will hold that in this case, $W_p(1 - T'') = W_g^s(1 - T)$. Therefore, the total employee compensation (W_p') is equal to $W_p(1 + T_s)$, where T_s is the social security tax rate paid by the employer.

Accordingly, the total employee compensation (W_p') would be 3,528*1.13 = GHS 3,987 per month. We again assume that H^d = 0.9, given the relative tightness of the high-skilled labor

10 The wage rate is obtained from WageIndicator data and represents the average gross monthly salary for a civil engineer with a standard working week of 40 hours.

market. The EOCL for this skilled labor can then be estimated by combining the supply price for the worker with the tax gains and losses associated with this employment. Following equation (2):

$$\text{EOCL} = W_g^s - (W_g^s T - H^d W_g^a T') = 3{,}528 - (3{,}528 * 0.1844 - 0.9 * 2{,}822.4 * 0.3054) = \text{GHS } 3{,}653 \text{ per month}$$

Labor externality is estimated as the difference between the employer's financial cost and the EOCL for this type of skilled worker. The excess of financial wage over the economic cost reflects a net benefit to labor and government.

$$\text{Total LE} = W_p' - \text{EOCL} = 3{,}987 - 3{,}653 = \text{GHS } 334 \text{ per month}$$

From equations (4) and (5), we can calculate the benefits of the labor to the project and to the government, and thus the magnitude of the labor externality:

$$\text{Labor benefits} = W_p(1 - T'') - W_g^s(1 - T) = 3{,}528\ (1 - 0.1844) - 3{,}528\ (1 - 0.1844) = \text{GHS } 0$$

$$\text{Government benefits} = W_p T'' + W_p * T_s - H^d W_g^a T' = 3{,}528 * 0.1844 + 3{,}528 * 0.13 - 0.9 * 2{,}822.4 * 0.3054 = \text{GHS } 334$$

The sum of these two quantities is, by definition, the total labor externality, i.e. GHS 334 per month.

The entire externality is a net gain in government revenues; however, the labor benefits are equal to zero as the supply price of labor (W_g^s) equals the project wage (W_p).

In terms of the conversion factor, this is calculated by the ratio of the EOCL to total employee compensation (W_p'). In the above case, the conversion factor for labor when the project pays a wage equal to the gross-of-tax supply price adjusted for the social security tax is $\frac{3{,}653}{3{,}987} = 0.92$.

4.3.1. The Project Wage (W_p) is Above the Supply Price of Labor (W_g^s)

Suppose that the project wage (W_p) is slightly above the supply price of labor (W_g^s). Let us assume that the project wage is 15% more than the supply price of labor for workers employed by the project. Hence, we have:

$W_p = W_g^s(1 + 0.15) = 3{,}528 * 1.15 = \text{GHS } 4{,}057.2$

Accordingly, the total employee compensation must include the social security tax:

$$W_p' = 4{,}057.2 * 1.13 = \text{GHS } 4{,}585$$

The income tax plus the social security rate (T'') corresponding to the project wage is estimated to be 18.93%. In comparison, these combined income tax rates plus the social security for the supply price of labor (T) is 18.44%. The T', which is a tax rate (income tax plus social security) corresponding to the alternative wage as before, is 30.54%. Using these statistics in the example above, the EOCL can then be estimated as follows:

$$\begin{aligned}\text{EOCL} &= W_g^s - (W_g^s T - H^d W_g^a T') \\ &= 3{,}528 - (3{,}528 * 0.1844 - 0.9 * 2{,}822.4 * 0.3054) \\ &= \text{GHS } 3{,}653 \text{ per month}\end{aligned}$$

Accordingly, the conversion factor is $\frac{3{,}653}{4{,}585} = 0.80$.

There is a net gain of GHS 932 per month of employment of a skilled worker hired by the project because the EOCL for this type of labor is only GHS 3,653, while the financial wage paid by the project is GHS 4,585. The gains accrue in part to workers due to the higher wage paid by the project and in part to the government because of the gain in tax revenues.

Considering both components and applying equations (4) and (5):

$$\begin{aligned}\text{Labor benefits} &= W_p(1 - T'') - W_g^s(1 - T) \\ &= 4{,}057.2\ (1 - 0.1893) - 3{,}528\ (1 - 0.1844) \\ &= \text{GHS } 412\end{aligned}$$

$$\begin{aligned}\text{Government benefits} &= W_p T'' + W_p T_s - H^d W_g^a T' \\ &= 4{,}057.2 * 0.1893 + 4{,}057.2\ * 0.13 - 0.9 * 2822.4 * 0.3054 \\ &= \text{GHS } 520\end{aligned}$$

The labor and government benefits add up to the total labor externality: 412 + 520 = 932.

Table 2 Summary Statistics for Rural Skilled Labor in the Formal Sector

Case	Monthly project wage (Wp)	Monthly supply price of labor (W_g^s)	Total labor compensation (W_p')	Alternative wage rate (W_g^a)	EOCL	CF	Labor externality (LE)	Labor benefits (LB)	Fiscal benefits (FB)	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{FB}{W_p'}$
Rural, skilled, formal sector	3528	3528	3987	2822.4	3653	0.92	334	0	334	0.08	0	0.08
Rural, skilled, formal sector	4057.2	3528	4585	2822.4	3653	0.80	932	412	520	0.20	0.09	0.11

4.4. An Informal Urban Project Employing Locally Sourced Unskilled Labor at the Supply Price

The urban informal sector in Ghana, as elsewhere in Africa, is remarkable for its heterogeneity and variety. The sector provides the bulk of jobs and income to many Ghanaians (including poor rural–urban migrants).[11] Studies on the urban informal sector in Ghana reveal a wide range of operations that can be grouped under services, construction, and manufacturing (Osei-Boateng and Ampratwum, 2011).

An urban project draws on unskilled labor from the informal sector. In this case, we assume that the project pays a wage equal to the prevailing market wage, which is equal to the labor supply price ($W_p = W_g^s$).

Unskilled Ghanaian workers in the informal sector are typically not entitled to some fundamental social security incentives. Hence, they do not pay social security contribution on the gross-of-tax wage, W_p; moreover, the typical project wage is not enough to meet the income tax threshold level. Hence, the project wage (employer's cost, W_p') is equal to the project wage (W_p).

In our analysis of the EOCL for workers employed in the informal sector of an urban economy, we recognize a close relationship between the labor market conditions of urban areas and those of the rural economy. Migratory movement within Ghana has usually been from the north to the south and from the less developed rural areas to the relatively developed urban areas, serving as growth poles. People migrate from one place to another for a variety of reasons; these include having better access to public services or various recreational options, and for economic gain.

11 About seven in every ten (70.3%) of total employed persons were in informality in urban regions (GSS, 2019).

Therefore, differences in average income or wage levels between origin and destination areas are significant determinants of migration flows between two locations (GSS, 2014).

According to Appianing (2013), rural–urban migration is the dominant type of internal migration in Ghana. Although such domestic movement has some advantages for the development of the communities involved, rural–urban migration is typically seen as creating pressure on urban infrastructure, environment, and employment. These negative externalities may include increased congestion and required investment in public services and transportation; increased crime, resulting in additional security costs; and government subsidies associated with increased access to health services. For example, Deshingkar and Grimm (2005) identified that rural–urban migration in recent times has become a menace in Ghanaian society. Problems include the mass movement of energetic labor from the rural areas, congestion, poor housing conditions, and increased unemployment and crime rates in the urban centers.

These negative externalities or fiscal costs associated with the rural–urban migration process are not paid for by the unskilled informal sector workers, posing additional economic costs on society or the government that should be reflected in the EOCL. In our example, we account for these external costs simply as a percentage *K* of the gross-of-tax supply price of labor. In the example below, we assume that this negative externality equals 6% of the prevailing urban market wage for unskilled labor (Michaud and Vencatachellum, 2003). In this case:

$$\text{EOCL} = W_g^s + K * W_g^s$$

$$\text{LE} = W_p - \text{EOCL}$$

Because the cost of living, particularly transportation costs, is substantially higher for informal sector workers located in urban areas, it is expected that the market wage (the supply price) for unskilled labor in these areas will be higher than the wage for comparably unskilled workers in rural parts of the country. For example, the lowest average wage that unemployed persons residing in urban areas are willing to work for is higher (GHS 308.56) than those in rural areas (GHS 278.94), which can be explained by the higher living costs in the urban areas (GSS, 2016).

Suppose a project in an urban area hires an unskilled worker in the informal sector. The assumed monthly wage (supply price) of the individual is GHS 500,[12] and the labor cost to the project is therefore:

$$W_p' = W_p = \text{GHS } 500$$

$$\text{EOCL} = 500 + 0.06 * (500) = 530$$

Thus, the conversion factor is $\frac{530}{500} = 1.06$.

$$\text{LE} = W_p - \text{EOCL} = 500 - 530 = -\text{GSH } 30$$

This amount of externality is incurred as a fiscal cost by the government.

Table 3 Summary Statistics for Urban Unskilled Labor in the Informal Sector

Case	Monthly project wage (W_p)	Monthly supply price of labor (W_g^s)	Total labor compensation (W_p')	Alternative wage rate (W_g^a)	EOCL	CF	Labor externality (LE)	Labor benefits (LB)	Fiscal benefits (FB)	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{FB}{W_p'}$
Urban, unskilled, informal sector	500	500	500	---	530	1.06	−30	0	−30	−0.06	0	−0.06

4.5. A Formal Urban Project Employing Locally Sourced Unskilled Labor at the Supply Price

Suppose now we have a project in the formal sector in an urban area. Workers must be registered with social security, which provides contributors with state pensions and other benefits. Workers contribute 5.5% of their basic salary as a social security payment, while employers contribute 13%. We also assume that the gross project wage is enough to meet the income tax threshold level, which also takes into account a mandatory payroll deduction for social security amounting to 5.5% of pay.

The negative fiscal externality is associated with social or community costs arising in the urban areas as a result of rural–urban migration for which the migrants do not pay. Similar to the above case, we assume that this negative externality equals 6% of the prevailing market wage (supply price) for unskilled labor in the urban sector.

12 According to Nxumalo and Raju (2020), the average monthly earnings for wage-employed workers in urban areas is 1.198 times higher than counterparts in rural areas. In the first case we assumed that the average monthly wage rate of informal unskilled workers in rural areas is GHS 417.48; hence, the monthly wage rate of informal unskilled workers in urban areas is estimated to be GHS 500 (417.48*1.198).

For this type of labor, the minimum wage that can be paid to attract workers to this project must be such that the amount net of social security and personal income taxes at least equals the supply price demanded by this type of worker.

According to payroll data for October 2021, the gross monthly salary for general workers such as hand packers and assembly helpers in mining, construction, manufacturing, and transport (hours per week specified at 39) ranges from GHS 472 to GHS 1,581, with an average of GHS 672, depending on the company and the individual worker's occupation and years of work. Furthermore, the data shows that the average gross monthly salary of peers working in the Ashanti region is GHS 809. This means that although some of these types of workers who reside in urban areas and work in the formal sector are not subject to income tax, many of them are subject to income tax at the 5% and 10% rates, and some workers are subject to the 17.5% rate.[13]

If the monthly supply price of labor in the urban area, W_g^s, is GHS 809, the competitive monthly project wage must be:

$$W_p = \frac{W_g^s}{(1-T)} = \frac{809}{(1-0.0689)} = \text{GHS } 869$$

where T represents the effective income plus social security tax rate of 6.89% on the supply wage (W_g^s).

The EOCL is expressed as:

$$\begin{aligned}\text{EOCL} &= W_g^s + W_g^s K \\ &= 809 + (809 * (0.06)) \\ &= \text{GHS } 858\end{aligned}$$

As $W_p' = W_p(1+T_s) = 869 * (1.13) = \text{GHS } 982$, the conversion factor is $\frac{858}{982} = 0.87$.

The labor externality arises from differences in the financial wage paid by the project and the EOCL for this type of unskilled worker:

$$\text{LE} = 982 - 858 = 124$$

13 It is worth mentioning here that individuals must pay income tax if they earn income above GHS 319 per month. However, in arriving at the chargeable income of a resident individual, a deduction can be made for some personal reliefs. When the average of these reliefs is accounted for, the monthly income tax threshold level is approximately GHS 637.

The distribution of the labor externality and the benefits of the project to labor and the government would be calculated as follows:

$$\begin{aligned}\text{LE} &= W_p - \text{EOCL} \\ &= W_p(1+T_s) - (W_g^s + W_g^s K) \\ &= \frac{W_g^s}{(1-T)} * (1+T_s) - (W_g^s + W_g^s K)\end{aligned}$$

$$\begin{aligned}\text{Labor benefits} &= W_p(1-T) - W_g^s \\ &= 869 * (1 - 0.0689) - 809 \\ &= \text{GHS } 0\end{aligned}$$

$$\begin{aligned}\text{Government benefits} &= (W_p T + W_p T_s) - W_g^s K \\ &= (869 * 0.0689 + 869 * 0.13) - (809 * 0.06) \\ &= \text{GHS } 124\end{aligned}$$

Table 4 Summary Statistics for Urban Unskilled Labor in the Formal Sector

Case	Monthly project wage (W_p)	Monthly supply price of labor (W_g^s)	Total labor compensation (W_p')	Alternative wage rate (W_g^a)	EOCL	CF	Labor externality (LE)	Labor benefits (LB)	Fiscal benefits (FB)	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{FB}{W_p'}$
Urban, unskilled, formal sector	869	809	982	----	858	0.87	124	0	124	0.13	0	0.13

4.6. An Urban Project Employing Locally Sourced Skilled Labor at its Supply Price (Prevailing Market Wage)

Similar to the case of unskilled labor, the region in which the project is implemented is also an important determinant in estimating the EOCL of skilled labor. In this case, the EOCL is estimated for a project in an urban area that hires a local skilled worker and pays the market wage in the project region, which is GHS 2,328 and is subject to income tax. As the new job is in the formal sector, social security payments would be applied.[14]

Given the relative tightness of the labor market for this high occupational skill level, we can assume the proportion of the project's labor that will be hired away from other jobs, H^d, is 0.9.

14 The wage rate is obtained from WageIndicator and represents the average gross monthly salary for physical and engineering science technicians (with hours per week specified as 40). The wage information is provided from 707 observations for Technicians and associate professionals, 115 observations for Science and engineering associate professionals, and 41 observations for Physical and engineering science technicians.

Again, based on our assumption, the alternative wage rate (W_a) is 80% of the supply price (GHS 1,862.4).

In this regard, this individual (employee) would pay a personal income plus social security tax rate of 16.59% (T'') on the project wage (W_p), and 16.59% (T) on the supply price of labor (W_g^s). The total effective income plus social security tax rate (from the employee and the employer) corresponding to the alternative wage rate (T') is 28.22%.

The total labor compensation W_p' is:

$$W_p(1 + T_s) = 2{,}328(1 + 0.13) = \text{GHS } 2{,}630.64$$

Using equation (2):

$$\begin{aligned}\text{EOCL} &= W_g^s - (W_g^s T - H^d W_g^a T') \\ &= 2{,}328 - (2{,}328 * 0.1659 - 0.9 * 1{,}862.4 * 0.2822) \\ &= \text{GHS } 2{,}414.8\end{aligned}$$

The corresponding labor externality is:

$$\begin{aligned}\text{LE} &= W_p' - \text{EOCL} \\ &= 2{,}630.64 - 2{,}414.8 \\ &= \text{GHS } 216 \text{ per month}\end{aligned}$$

$$\begin{aligned}\text{Labor benefits} &= W_p(1 - T'') - W_g^s(1 - T) \\ &= 2{,}328 * (1 - 0.1659) - 2{,}328 * (1 - 0.1659) \\ &= \text{GHS } 0\end{aligned}$$

$$\begin{aligned}\text{Government benefits} &= W_p T'' + W_p T_s - H^d W_g^a T' \\ &= 2{,}328 * 0.1659 + 2{,}328 * 0.13 - 0.9 * 0.2822 \\ &= \text{GHS } 216 \text{ per month}\end{aligned}$$

The sum of these two quantities (labor benefits and government benefits) is, by definition, the total labor externality, such that 0 + 216 = GHS 216.

The conversion factor is $\frac{\text{EOCL}}{W_p'} = \frac{2414.8}{2{,}630.64} = 0.92$.

4.6.1 The Project Wage (Wp) is Greater Than the Supply Price of Labor (W_g^s)

Here we reconsider the case analyzed above (4.6) of an urban project employing locally sourced skilled labor. The only difference is that the project pays wages higher than the prevailing supply price in the region in this case. While the prevailing market wage in the region is GHS 2,328, the monthly wage paid by the project is GHS 2,794 (or 20% greater than the supply price). This

wage paid by the project will result in a different personal income tax liability for the worker hired by the project. The total labor compensation W_p' is 2,794*1.13 = GHS 3,157.

Similar to the above case, T is 16.59% and T' is 28.22%; however, the income tax plus social security rate corresponding to the project (T'') is 17.50% due to the higher project wage rate compared with the previous case (4.6). Using the same value for the alternative wage W_g^a as in the previous scenario:

$$\begin{aligned}\text{EOCL} &= W_g^s - (W_g^s T - H^d W_g^a T') \\ &= 2{,}328 - (2{,}328 * 0.1659 - 0.9 * 1{,}862.4 * 0.2822) \\ &= \text{GHS } 2{,}414.8\end{aligned}$$

In this case, the EOCL is no different from that in the previous case (4.6), where the project paid the prevailing market wage. The EOCL is based on the supply price and the taxes paid on this supply price and in alternative employment. The EOCL is independent of the financial wage that the project pays.

The corresponding labor externality is:

$$\begin{aligned}\text{LE} &= W_p' - \text{EOCL} \\ &= 3{,}157 - 2{,}414.8 \\ &= \text{GHS } 742.2 \text{ per month}\end{aligned}$$

This externality accrues in part to workers due to the higher wage paid by the project and in part to the government because of the gain in tax revenues.

In this case, the benefits to labor and government are:

$$\begin{aligned}\text{Labor benefits} &= W_p(1 - T'') - W_g^s(1 - T) \\ &= 2{,}794 * (1 - 0.175) - 2{,}328 * (1 - 0.1659) \\ &= \text{GHS } 363.2\end{aligned}$$

$$\begin{aligned}\text{Government benefits} &= W_p T'' + W_p T_s - H^d W_g^a T' \\ &= 2{,}794 * 0.175 + 2{,}794 * 0.13 - 0.9 * 1{,}862.4 * 0.2822 \\ &= \text{GHS } 379 \text{ per month}\end{aligned}$$

Labor and government benefits together add up to the total labor externality: 363.2 + 379 = GHS 742.2.

The corresponding conversion factor is $\frac{2414.8}{3{,}157} = 0.76$.

Table 5 Summary Statistics for Urban Skilled labor in the Formal Sector

Case	Monthly project wage (W_p)	Monthly supply price of labor (W_g^s)	Total labor compensation (W_p')	Alternative wage rate (W_g^a)	EOCL	CF	Labor externality (LE)	Labor benefits (LB)	Fiscal benefits (FB)	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{FB}{W_p'}$
Urban, skilled, formal sector	2328	2328	2630.64	1862.4	2414.8	0.92	216	0	216	0.08	0.00	0.08
Urban, skilled, formal sector	2794	2328	3157	1862.4	2414.8	0.76	742.2	363.2	379	0.23	0.11	0.12

4.7. An Urban Project Employing Local Skilled Labor That to a Degree Would Have Migrated Abroad

Given that the wage differentials between domestic employment and other options could be driving high-skilled workers to leave the domestic market, often for jobs in high-income countries, and remittances from overseas workers are an important source of earnings and foreign exchange, it is necessary to estimate the impact of international migration on the EOCL.

As for many low- and middle-income countries, remittances are an important source of income for Ghana. In 2020, Ghana received an estimated USD 3.5 billion in informal remittances (around 5.2% of its GDP) and has become the second-largest recipient of remittances in sub-Saharan Africa (World Bank, 2021b). The most significant countries of origin of remittances in 2017 were the United States, Nigeria, and the United Kingdom (IOM, 2020).

When a project is created in Ghana and additional labor hired for certain occupations, part of this labor comes from a reduction in the outflow of international migration.[15] When this occurs, the EOCL must take into account any distortions associated with the retention or return of Ghanaian workers who would have been employed abroad as well as the adjustment of the demand and supply of labor in the local markets.

A common phenomenon associated with having a country's citizens work abroad is the stream of remittances sent back home to relatives, communities, and institutions in the country of origin. Following the supply price approach to the EOCL, the reduction in remittances itself is not an economic cost, as this will be factored into the worker's supply price to the project.

15 In the simplest migration models, an increase in home country wages reduces the probability that an individual will migrate by reducing the 'push' effect of a large wage gap (Borjas, 1987).

A further adjustment needs to be made to the supply price; however, this is for the premium on foreign exchange that would have been remitted and is now forgone. Taking both the local and international labor market adjustments into consideration, the expression for the EOCL becomes:

$$\text{EOCL} = W_g^s * (1 - T) + H^d * W_g^a * T' + H^f * R * (\frac{E^e}{E^m} - 1) \quad (8)$$

where:

- H^d denotes the proportion of the project's demand for a given type of labor obtained from taxed employment activities in the domestic market;
- H^f denotes the proportion of the project's local demand for a given type of labor sourced from reduced international out-migration;
- R denotes the average amount of remittances if this worker were employed abroad;
- $(E^e/E^m - 1)$ denotes the foreign exchange premium.

According to the 2019 Recruitment Cost Pilot Survey (GSS, 2020), overall, migrant workers from Ghana earn, on average, GHS 3,798 abroad, with male migrant workers earning slightly more than their female counterparts (GHS 3,848 and GHS 3,665, respectively). Those in occupations in the high-skilled category earn far more than other migrant workers. The survey shows that low-skilled migrant workers earn GHS 3,484, close to two thirds the monthly earnings (GHS 5,643) of high-skilled migrant workers. High-skilled male migrant workers earn more than their female counterparts (GHS 5,750 and GHS 5,330, respectively).

According to Nxumalo and Raju, (2020), most returnees to Ghana live in the major urban centers, known for their concentrations of return migrants. These include the two largest cities in Ghana (Accra and Kumasi metropolitan areas) and the Dormaa/Berekum and New Juabeng municipal areas.

To illustrate the situation, we consider an example in which labor is internationally mobile. The prevailing market wage rate of high-skilled labor in an urban area (Greater Accra) is about GHS 5,643 per month. The mean annual amount of cash remittances received from migrants living abroad is GHS 5,026.63 (GHS 418.88 per month) (GSS, 2019).

Taking into account all costs and benefits of returning to Ghana, a high-skilled professional migrant who decides to return to Ghana to work on the project is willing to accept a job that

offers a wage rate of GHS 6,593.[16] The effective tax income rate, including the social security paid by the employee (T'') corresponding to this project, is 22.85%.

To estimate the EOCL for returned migrants, we need some additional information. The labor market for this skill level is very tight, and, as a result, 70% of the project's requirement will be met by a cutback in other employment in the region, and 30% will be met by workers who would have migrated abroad.

Given that the monthly project wage would be GHS 6,593, the total labor compensation, W_p', is equal to 6,593*1.13 = GHS 7,450.[17] We also assume that the gross-of-tax wage of labor from alternative sources (W_g^a) is equal to 80% of W_g^s, which is equal to 0.80*5,643 = GHS 4,514.4. The total income plus social security tax rates corresponding to the alternative wage rate (T') is 32.96%, and the income tax rate, including the social security corresponding to the supply price of labor (T), is 21.80%. Finally, the foreign exchange premium $(\frac{E^e}{E^m} - 1)$ for Ghana equals 6.6%.[18] The EOCL for returned domestic labor from equation (8) is then:

$$\begin{aligned}\text{EOCL} &= W_g^s * (1 - T) + H^d * W_g^a * T' + H^f * R * (\frac{E^e}{E^m} - 1) \\ &= 5{,}643 * (1 - 0.2180) + 0.7 * 4{,}514.4 * 0.3296 + 0.3 * 418.88 * 0.066 \\ &= \text{GHS } 5{,}463 \text{ per month}\end{aligned}$$

The corresponding conversion factor for retained labor is $\frac{5{,}463}{7{,}450} = 0.73$. In this case, the labor market externality is distributed between the labor and the government as follows:

$$\begin{aligned}\text{Labor benefits} &= W_p(1 - T'') - W_g^s(1 - T) \\ &= 6{,}593 * (1 - 0.2285) - 5{,}643 * (1 - 0.2180) \\ &= \text{GHS } 673.6\end{aligned}$$

$$\begin{aligned}\text{Government benefits} &= W_p T'' + W_p T_s - H^d W_g^a T' - H^f * R * (\frac{E^e}{E^m} - 1) \\ &= 6{,}593 * 0.2285 + 6{,}593 * 0.13 - 0.7 * 4{,}514.4 * 0.3296 - 0.3 \\ &\quad * 418.88 * 0.066 \\ &= \text{GHS } 673.6\end{aligned}$$

Table 6 Summary Statistics for Urban Skilled Labor in the Formal Sector with Migration Abroad

16 This wage rate represents the average monthly earnings of technicians and associate professionals in high-skilled migrant workers (Ghana Statistical Service (GSS), 2020).

17 Given that the employer social security contribution is 13%.

18 The foreign exchange premium has been estimated to be 6.6% for Ghana.

Case	Monthly project wage (W_p)	Monthly supply price of labor (W_g^s)	Total labor compensation (W_p')	Alternative wage rate (W_g^a)	EOCL	CF	Labor externality (LE)	Labor benefits (LB)	Fiscal benefits (FB)	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{FB}{W_p'}$
Urban, skilled, with migration abroad	6593	5643	7450	4514.4	5463	0.73	1987	673.6	1313.7	0.26	0.09	0.17

4.8. A Foreign Worker is Hired to Work in the Formal Sector

Sometimes the implementation of development and infrastructure projects calls for the engagement of foreign workers. Particularly where there is a significant skills gap, these projects often rely on importing highly skilled foreign workers from other countries. It is therefore necessary to determine the EOCL of foreign workers. The EOCL in this case will be measured by the net-of-tax wage that the worker receives in Ghana plus an adjustment of foreign exchange premium on the proportion of the wage rate remitted by the foreign worker to account for the true cost of the foreign exchange to the economy rather than just its market value. A second adjustment concerns the goods and services that foreign workers consume in Ghana. If, for example, they consume subsidized goods and services, the amount of subsidy should be included in the economic cost of labor. Similarly, if the foreign workers pay any taxes, such as the value-added tax levied on consumption by foreign workers in the host country, these taxes should be accounted as an economic benefit to the country and therefore deducted from the cost of foreign labor.

Algebraically, the economic opportunity cost of foreign labor (EOCFL) can be expressed as:

$$\text{EOCFL} = W^f(1-T_h) - W^f(1-T_h)(1-R)t_{VAT} + W^f(1-T_h)R * \left(\frac{E^e}{E^m} - 1\right) + N \quad (9)$$

where:

- W^f denotes the gross-of-tax wage of foreign labor;
- T_h denotes the personal income tax, including the social security paid by the employee, levied by the host country on foreign labor;
- R denotes the proportion of the net-of-tax income repatriated by foreign labor;
- $Ee/Em-1$ denotes the proportion of repatriated income lost via the foreign exchange premium;
- t_{VAT} denotes the VAT rate levied on consumption; and
- N denotes the value of benefits gained by foreign workers from subsidies.

To estimate the EOCFL in Ghana, we need some additional information. The VAT rate in Ghana is currently 12.5%. Assume that foreign workers will need to be paid GHS 9,572 (W_p) on a monthly basis; hence, the income tax rate, including the social security of paid by employees (T_h), is 24.80%.[19] Also, assume that those working abroad will repatriate about one third of their net-of-tax income to their home country, i.e. R = 0.33. In this case, we also assume that the government pays no subsidies with respect to these workers, i.e. N = 0.

Applying those values to the equation for EOCL, we estimate the cost to be:

$$\text{EOCFL} = W^f(1-T_h) - W^f(1-T_h)(1-R)t_{VAT} + W^f(1-T_h)R * \left(\frac{E^e}{E^m} - 1\right) + N$$
$$= 9{,}572 * (1-0.248) - 9{,}572 * (1-0.248) * (1-0.33) * 0.125 + 9{,}572 * (1-0.248) * 0.33 * 0.066 + 0$$
$$= \text{GHS } 6{,}752 \text{ per month}$$

$$\text{Labor externality} = (W^f(1+T_s)) - \text{EOCL}$$
$$= 9{,}572(1+0.13) - 6{,}752$$
$$= \text{GHS } 4{,}064.4 \text{ per month}$$

Government benefits

$$= W^f(T_h + T_s) + (W^f(1-T_h)(1-R)t_{VAT}) - (W^f(1-T_h)R * (\frac{E^e}{E^m} - 1) - N$$
$$= (9{,}572 * 0.3780) + (9{,}572 * (1-0.248) * (1-0.33) * 0.125) - (9{,}572 * (1-0.248) * 0.33 * 0.066) - 0$$
$$= \text{GHS } 4{,}064.4 \text{ per month}$$

Labor benefits = 0

Table 7 Summary Statistics for Foreign Labor

Case	Monthly project wage (Wp)	Monthly supply price of labor (W_g^s)	Total labor compensation (W_p')	Alternative wage rate (W_g^a)	EOCFL	CF	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{GB}{W_p'}$
Foreign labor	9572	---	10816.4	---	6752	0.62	0.38	0	0.38

In this case, the government accrues the full amount of labor externality caused by using foreign workers. We are not concerned with the rise in the welfare of the foreign workers in this situation; thus, any net benefit they gain by migrating to Ghana is not included in an adjustment

19 The wage rate is obtained from WageIndicator and represents the average gross monthly salary for engineering department managers working in the construction of roads and motorways with hours per week specified at 40, and 10 years' experience.

to the economic welfare accruing to Ghana because of the project. As previously, we can determine the conversion factor for foreign labor employed in Ghana: $\frac{6,752}{10,816.4} = 0.62$. The rate of government benefit is 0.38.

A summary of all cases investigated in this study is provided in Table 8.

Table 8 Summary Statistics for All Cases

Case	Project Location	Level of Skill	Source of Workers	Distortions	W_p'	W_p	W_g^s	W_g^a	EOCL	CF	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{FB}{W_p'}$
1	Rural	Unskilled informal sector	Local	None	417.48	417.48	417.48	--	417.48	1	0	--	--
2	Rural	Unskilled formal sector	Local	Social security	658.79	583	551	--	551	0.84	0.16	0	0.16
2.1	Rural*	Unskilled formal sector	Local	Social security	716	633.65	551	--	551	0.77	0.23	0.07	0.16
3	Rural	Skilled formal sector	Local	Income tax, social security	3987	3528	3528	2822.4	3653	0.92	0.08	0	0.08
3.1	Rural*	Skilled formal sector	Local	Income tax, social security	4585	4057.2	3528	2822.4	3653	0.80	0.20	0.09	0.11
4	Urban	Unskilled informal sector	Local	None	500	500	500	--	530	1.06	-0.06	0	-0.06
5	Urban	Unskilled formal sector	Local	Social security	982	869	809	--	858	0.87	0.13	0	0.13
6	Urban	Skilled formal sector	Local	Income tax, social security	2630.64	2328	2328	1862.4	2414.8	0.92	0.08	0	0.08
6.1	Urban*	Skilled formal sector	Local	Income tax, social security	3157	2794	2328	1862.4	2414.8	0.76	0.23	0.11	0.12
7	Urban	Unskilled formal sector	Retention of out-migrants	Income tax, foreign exchange, social security	7450	6593	5643	4514.4	5463	0.73	0.26	0.09	0.17
8	Urban	Skilled formal sector	Foreign	Income tax, foreign exchange, value-added tax, social security	10816.4	9572	--	--	6752	0.62	0.38	0	0.38

* Shows the scenario where the project wage W_p is greater than the supply price of labor W_g^s.

5. Conclusion

This study has aimed to calculate the EOCL in Ghana using the supply price methodology, as a fundamental instrument for the economic evaluation of public investment projects. This methodology takes the wage offered in the project's labor market area as the starting point to determine the EOCL. It then adjusts it to account for market distortions and externalities in that market as well as in other sourcing points for project labor.

Calculating the economic cost of labor requires a prior perception of the functioning of the labor market and its characteristics. In Ghana, as in other countries in the region, it is evident that there are various labor markets that coexist with each other, some in more competitive terms and others more segmented. To a large extent, the characteristics of the labor supply on the one hand (education, age, years of experience) and of the firms that demand it on the other hand (size of companies, types of economic activity, occupations, etc.) all ultimately determine the level of occupation and earnings of different types of labor. In this study, we have considered it pertinent to distinguish between skilled and unskilled workers. Furthermore, in accordance with the characteristics of the Ghanaian labor markets, we have adopted the analysis to evaluate the labor force according to the areas of residence (urban and rural).

The results reveal that the numerical estimate of the EOCL in Ghana could range from near equality with the project wage for unskilled workers to about 62% of the project wage for foreign labor. These rates depend heavily on location and the highly differentiated skills of the labor employed, and, most importantly, on the wage paid by the project relative to the minimum wage required (the supply price) to attract sufficient workers with the required skills. Similarly, the consideration of foreign workers can further enrich these calculations. The preceding analysis should serve as an operational guide for estimating the EOCL in Ghana.

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Appendix A – Taxation of Earned Income in Ghana

Table A1 shows the cumulative income tax bands and progressive rates that are normally applied to the chargeable income of resident individuals for a tax year. The information provided here is tabulated from Ghana Revenue Authority 2021.

Table A1. Income Tax Brackets and Rates, Ghana (2020/2021)

Cumulative income (GHS)	Tax rate on excess	Cumulative tax amount (GHS)
3828	5.0%	0.00
5028	10.0%	60.00
6468	17.5%	204.00
42468	25.0%	6504.00
240000	30.0%	55887.00

- Resident individuals are subject to tax on their worldwide income.
- Employees, including directors of companies, are subject to tax on gains or profits from any employment, including allowances, gifts, or benefits paid in cash or in-kind to or on behalf of an employee.
- Contributions of individuals to the mandatory pension schemes qualify as tax reliefs under the National Pensions Act, 2008 (Act 766).
- Ghana imposes a mandatory social security tax at a rate of 18.5%. Employers must pay social security tax at a rate of 13% of the employees' salaries, and must withhold an additional 5.5% from each employee's salary.
- These items are deducted from an employee's income before calculating the personal income tax:
  1. GHS 1,200 for an individual with a dependent spouse or at least two dependent children.
  2. GHS 600 per child for Children's Education – up to a maximum of three (3).
  3. GHS 1,000 per aged dependent person (over 60 years) up to a maximum of two (2) aged dependent relatives.
  4. Up to GHS 2,000 for professional, technical, or vocational training costs.
  5. GHS 1,500 for old age (60 years or above).

Using the information above, Table A2 demonstrates the calculation of the total effective tax rates, including both the income tax rate and the social security tax rate corresponding to the project wage used in our analysis.

Table A2. Total Effective Tax Rates

Case	Annual income (W_p) (GHS)	Annual taxable income (GHS)	Annual income taxes paid (GHS)*	Effective average income tax rate	Effective income tax rate plus social security of 5.5% paid by the employee**	Total effective income and social security tax rates (5.5% paid by employee plus 13% paid by employer)**
1	5009.76	1609.80	--	--	--	--
2	6996.00	3211.26	--	--	--	18.50%
2.1	7603.80	3785.63	--	--	--	18.50%
3	42336.00	36607.56	5478	12.94%	18.44%	31.44%
3.1	48686.40	42608.69	6539	13.43%	18.93%	31.93%
4	6000.00	2600.04	--	--	--	--
5	10428.00	6454.50	--	--	--	20.44%
6	27936.00	22999.56	3097	11.09%	16.59%	29.59%
6.1	33528.00	28284.00	4022	12.00%	17.50%	30.50%
7	79116.00	71364.66	13728	17.35%	22.85%	35.85%
8	114864.00	105146.52	22174	19.30%	24.80%	37.80%