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Estimation of the Economic Opportunity Cost of Labour: An Operational Guide for Ghana

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Abstract: The implementation of projects often affects employment through direct job creation, indirectly stimulating employment or augmenting labour supply. These changes in employment have significant benefits and costs to both labour and society. However, the estimation of job creation benefits is complicated because of the large diversities in labour input. We attempt to address this issue by using the supply price approach to develop an analytical framework based on sound microeconomic principles to assist project analysts to arrive at justifiable empirical estimates of the economic opportunity cost (K^{ℓ}) for a wide range of labour types across a set of diverse situations and market conditions in Ghana. The paper adopts the relevant literature regarding the specifics of labour markets and the peculiarities of different labour types. Accordingly, the K^{ℓ} will vary by skill, location, and labour market conditions that need to be incorporated into its estimation. In this analysis, the estimation has been carried out to quantify the K^{ℓ}, the conversion factor, as well as the labour externalities corresponding to the two types of labour: skilled and unskilled. Similarly, these estimates refer to groups of labour according to areas of residence: rural and urban.

Keywords: Ghana; job creation; economic cost; supply price; informal labour; formal labour; labour externality

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1. Introduction

In recent times, there has been a shift in policy debate from the traditional concept of economic growth and poverty reduction to one of income, inequality, and more importantly job creation and decent employment, particularly among developing countries. In line with the International Labour Organization's Global Employment Agenda and the Millennium Development Goals of the UNDP [1] on the significance of jobs and employment and the need for them to be seen as a top development priority for income generation and sustainable growth, the World Bank [2] further emphasised that in developing countries, job creation in decent employment situations has become one of the cornerstones of development with the payoffs far beyond incomes alone. The call for job creation and decent employment has been receiving great attention among scholars, policymakers, and governments, especially in developing countries with governments across the world pursuing pro-employment policies and programmes that create jobs for their citizens. However, in quantifying the benefits of job creation the emphasis has been primarily on the number of jobs created and the wages earned by those employed. To quantify the net benefit of job creation, one needs to understand the determinants and the value of the economic opportunity cost (K^{ℓ}) of the various types of labour employed. This is a significant consideration when estimating the net benefit or labour market externality generated by these employment policies and projects.

When employment policies or programmes are implemented and jobs are created, labour is employed to produce goods and services. The benefits of the employment policies are measured by how much the value of labour exceeds the economic opportunity cost of labour (K^{ℓ}). In the estimation of the benefits associated with employment policies, the supply wage of labour is used as the economic opportunity cost of labour (K^{ℓ}). However, this is not always the case as different situations create a wedge between the supply wage of labour and the economic opportunity cost of labour (K^{ℓ}). The economic opportunity cost of labour, K^{ℓ}, is the value to the economy of the set of activities given up by workers, including non-market costs (or benefits) associated with employment change. It can be seen from the definition that the supply wage of labour does not reflect the correct opportunity cost of labour, especially when distortions of externalities are present or when labour is reallocated from the previous task to new employment. Therefore, the use of the supply wage of labour as the economic opportunity cost of labour when estimating the benefits of employment policies leads to an exaggeration of the benefits associated with employment policies, especially in developing countries where labour markets are characterised by different institutional arrangements, persistent and high unemployment, and underemployment in addition to the widespread labour-induced distortions.

The net benefit to the economy (including the benefits to the labourers themselves and other stakeholders) from the employment of the worker by a project is the labour externality (ε^{ℓ}) generated by employing a specific type of labour in this specific project [3]. The labour externality (ε^{ℓ}) is the difference between the total compensations paid to labour ($\acute{\omega}$) and the economic opportunity cost of labour (K^{ℓ}) generated by the worker [4].

$$\varepsilon^{\ell} = \acute{\omega} - K^{\ell} \quad (1)$$

When ε^{ℓ} is greater than zero (i.e., $\varepsilon^{\ell} > 0$), it implies that the financial cost of labour exceeds its economic cost to the project. The size of this labour externality (ε^{ℓ}) is determined by these two variables, the total compensation paid to this type of labour ($\acute{\omega}$) by the project and the economic opportunity cost of the labour (K^{ℓ}).

The measurement of the total compensation paid, or to be paid, to this type of labour is quite straightforward to estimate, however, it is the estimation of the economic opportunity cost of labour by type in different specific geographic and economic environments that is a great challenge to the project analyst.

This gross-of-tax supply wage is the initial building block for the determination of the economic opportunity cost of labour (K^{ℓ}) in the area and is determined by several factors including labour skill and labour market conditions. It will also vary by the set of institutions and labour market distortions that are present in the place of employment. These will include variables such as income, social security tax, subsidies, unemployment benefits, labour union premiums, and minimum wage legislation [5–8].

While the estimation of the economic opportunity cost of labour (K^{ℓ}) is significant for policy formulation, resource allocation, and hence estimating the actual benefits associated with job creation, relatively few empirical studies on the issue have been undertaken, especially in Africa. In the literature, some studies, including [9–11], estimate the benefits of employment policies using the value of leisure as the economic opportunity cost of labour. However, the challenge is the use of the value of foregone leisure as the marginal product forgone. If the wage rate compensates people for giving up leisure for work and working necessitates the person incurring additional expenditures, then the value of leisure time differs from the wage rate and will usually be less than the wage rate.

Other studies [12] use the reservation wage as the opportunity cost of labour to estimate the employment benefits for disadvantaged workers. However, empirical studies [13,14] found that the average ratios of the unemployed individual's stated reservation wages to previous market wages are approximately one. The ratios are even higher for job losers, the long-term unemployed, or welfare recipients [15]. Similarly, it is very difficult to measure reservation wages because in a market-clearing labour market, the reservation wage for all the workers is the existing market wage but this does not imply that, if the

market wage falls, all workers will desert the market. In fact, given the complex reality of the estimation of the economic opportunity cost of labour and the fact that most of the studies have been undertaken in developed economies, the replication of models from developed economies seldom captures the economic opportunity cost of labour in developing countries where labour markets are largely informal, underdeveloped, and fragmented.

In the literature, to the best of our knowledge, there is no published work on Ghana. Jenkins et al. [8] estimated the economic opportunity cost of labour in South Africa. The estimation of the economic opportunity cost of labour is location-specific, and because the structure of the South African labour market is quite different from that of most developing countries in Sub-Saharan Africa, including Ghana, a different model that will incorporate the features of the Ghana labour market is necessary.

In view of these challenges, the motivation of this paper is to provide an analytical framework based on sound microeconomic principles to assist project analysts to arrive at justifiable empirical estimates of the economic opportunity cost for a wide range of labour types across a set of diverse situations. In most situations, the net labour externality will be substantially less than the gross amount of labour compensation. Hence, for the estimates to be defendable they must be developed from sound economic welfare theory and at the same time be quantifiable using data that are either available in the country and region of the project or can be easily obtained from local surveys.

The paper makes a non-exclusive classification of labour types (skilled and unskilled), geographic environments (rural and urban), and scope of labour sourcing (domestic versus foreign sourced labour). There is extensive literature on the different labour market situations that would affect the value of K^{ℓ} [6–8,11]. The framework for analysis provided in this article is broad enough to accommodate a wide range of labour employment situations.

The paper consists of six sections, including the Introduction. Section 2 gives an overview of the labour market in Ghana and some of its essential aspects. Section 3 presents the methodology used to estimate the economic opportunity cost of labour. Section 4 presents eight case studies in the context of the Ghanaian labour market and the results obtained from applying the methodology. Section 5 presents the results and discussion. Finally, the conclusions are presented.

2. Labour Market in Ghana

Over the past three decades, Ghana has experienced steady and high economic growth which has contributed substantially to the reduction in poverty [16,17]. Yet, the average annual growth rate of over 6% during the past decade has not turned into increased employment in Ghana because the agriculture and manufacturing sectors, which have a higher capacity to create jobs, experienced slower growth compared to the mining and oil extraction sectors, which have seen substantial expansion but generate relatively fewer employment opportunities [18].

The economy of Ghana which has been traditionally agriculture-dominated has undergone scores of changes over the years with employment increasingly drifting away from the agricultural sector to the services sector. The agricultural sector, which over the past decades has employed the largest share of the workforce, declined from 50.1% of total employment in 2010 to an estimated 29.8% in 2019. Over the same period, the service sector, on the other hand, increased from 36.0 percent to 49.2 percent whiles the industry sector increased by 7 percent from 13.9 percent to 21.0 percent points during the same period [19].

As a distinguishing feature of many labour markets in developing economies, particularly in Sub-Saharan Africa, Ghana's labour market is divided between the formal sector and the informal sector. Data show that over 90% of the employed population aged 15 years and older are in the informal sector with males constituting 45.1% and females 54.9% [20]. The failure of the formal sector (both public and private) to create jobs has forced many of the workforce into the informal sector [21,22]. Working conditions in the informal sector are not as attractive as those in the formal sector. The sector is characterised by low wage premiums, the absence of a formal written contract of engagement and conditions of service,

and a lack of social safety nets and recourse to social dialogue [21]. The informal workers operate mainly in a cash economy with low earnings which makes them non-liable for taxes as their earnings fall below the threshold of taxable income [20].

According to the GLSS 7 main report, more than 7 in every 10 (71.30%) of the total workforce employed persons are in the informal sector with only 28.70% in the formal sector [23]. The pervasiveness of the informal labour market which largely consists of small- and medium-scale businesses is quite worrying as studies [24,25] have shown that a significant number of workers in the informal sector are trapped in disguised unemployment and poverty and hence do not earn enough to lift themselves and their families out of poverty as they are unable to earn above the USD 2.00 a day poverty threshold.

A total of 300,000 workers enter the labour market every year, out of which only 2% are absorbed into the formal sector while the remaining 98% seek employment in the informal sector [26]. Unemployment in Ghana is high and concentrated in the unskilled and semi-skilled working brackets but is relatively low for those in skilled jobs. Despite a large and growing supply of labour in general, the supply of labour in Ghana is characterised by a workforce with low levels of educational qualifications and a low proportion of skilled workers with advanced schooling. As such and for many projects, foreign workers are brought in by corporations or the government for projects requiring their skills. For example, Chinese construction firms typically rely on foreign labour (mainly Chinese) to execute projects in Ghana [27].

As in most countries, especially in Sub-Saharan Africa, the labour in Ghana is experiencing changes in the net migration flow: from high in-migration to high out-migration [28]. The data show that Ghana's population is experiencing rapid and continuing urbanisation driven largely by population growth and migration from rural to urban areas. Similarly, the transnational migration of skilled and unskilled workers from poor nations to advanced economies has reached high levels. Ghana, like other countries, has a history of its citizens migrating to other countries to seek better employment opportunities. It is estimated that in 2000, 46.9% of tertiary-educated Ghanaians emigrated, mostly to the United States and Europe [29]. The number of Ghanaians in foreign countries rose from 716,044 in 2010 to 970,625 in 2019—an increase of 26.2% [30]. Personal remittances from abroad have become an indispensable part of Ghana's economy.

In 2003, the Ghana Labour Act 2003 was enacted. A significant aspect of the Labour Act 2003 is the creation of a tripartite committee tasked with the mandate of setting the minimum wage by a collective bargaining agreement and providing advice on employment and labour issues including labour laws, labour standards, industrial relations, etc. Similarly, the National Labour Commission (NLC), which is a state institution, serves as the mediator for the arbitration of labour disputes, particularly unfair labour practices. Enforcement of labour laws by this institution is challenged due to the widespread informal sector workers which most often are not covered by legal mandates.

Consistent with the above-mentioned features of the labour market in Ghana, the focus of this study is on a set of scenarios and how K^{ℓ} should be determined in each of these scenarios.

3. Methodology and Model

3.1. Approaches to the Estimation of the Economic Opportunity Cost of Labour (K^{ℓ})

In the value of the marginal product foregone approach, technology and market structure are held constant and the gross supply wage of labour is adjusted in response to the additional costs (benefits), including taxes incurred in employing the worker. Whereas some of the factors attracting workers to a job could be monetary, others could be non-monetary such as proximity of work to family, regional preferences, cost of living differentials, etc. The challenge with this approach is the complications in monetarising these non-monetary variables, especially in situations where information on prior variables, including cost of living differential, etc., is not readily available. This makes the value of the marginal product foregone approach difficult to use.

The supply price approach is relatively straightforward and easy to use under a wide variety of situations. The supply wage accounts for all the non-monetary factors such as preferences, location-specific factors, cost of living differential, etc. Unlike the marginal product foregone which must measure both components separately, the local supply wage directly measures the wage and non-wage costs of employment by the project as a combined package.

3.2. A Model for Comparing the Value of Marginal Product Foregone and Supply Price Methods

A simple empirical model is formulated to compare the two methodologies of estimating the economic opportunity cost of labour (K^{ℓ}). Suppose unskilled farm workers decided to move from their present work of washing and packaging potatoes (P) in a private farm to a newly created state farm to wash and package bananas for export (B). Given that the wage rate paid on the banana farm is W_b whiles that on the potato farm is W_p, the estimation of the economic opportunity cost of labour (K^{ℓ}) using the marginal product foregone approach starts with W_p, however, the supply price approach begins with the prevailing market wage on the newly created banana (state) farm W_b. It should be noted that the prevailing market wages on these farms are determined by several factors including labour skill, employment level, job location, internal pay structure, collective agreements, labour market conditions, etc. and sometimes political decision variables [5–7,11,31,32].

If it is assumed that the prevailing wage rates on both farms fall below the taxable income and therefore the workers are exempted from taxes and other significant distortions in the labour market, the decision of these workers to take the job in the state farm could be largely due to other factors such as proximity to family, closeness to recreational facilities or urban centres, regional preferences, etc. The proximity of the state farm (new job) to the family of the employees might translate into a reduction in the aggregate household expenditure in terms of rent and utility bills (C) since the workers stay together with their families. Another factor might be the preference (X) of workers to work on state farms (public sector) rather than for private individuals.

Using the marginal product foregone approach, the economic opportunity cost of labour is calculated as:

$$\begin{aligned} K^{\ell} &= \text{Previous wage} - \text{change in the cost of living} - \text{preference of worker} \\ &= W_p - (C_p - C_b) - X_b \end{aligned}$$

For the purpose of comparison, the following values are given:

W_p = GHS 59.00 per day.

C_p = GHS 15.00 per day.

W_b = GHS 50.00 per day.

C_b = GHS 10.00 per day.

$$\begin{aligned} X_b &= \text{GHS 4.00 per day (monetary value of preference for working on state farm).} \\ &= \text{GHS } 59.00 - (15 - 10) - 4. \\ &= \text{GHS 50.00 per day.} \end{aligned}$$

The supply price approach yields the same results straightaway since the prevailing market on the banana (state) farm already accounts for the cost of living differential ($C_p - C_b$) and the workers' preference for state farms rather than the private farm (X_b). In the absence of distortions, the economic opportunity cost of labour is simply equal to the prevailing market wage on the state farm; thus $K^{\ell} = W_b$ = GHS 50.00 per day.

This empirical example demonstrated above indicates that both methods of estimating the K^{ℓ} give similar results. Whereas both approaches give similar outcomes, the challenge in most circumstances is the difficulty in placing monetary values on complex factors such as cost of living differentials, sectoral preferences, etc. The uncertainties in quantifying these values make the marginal product foregone approach cumbersome to use when information is scarce. Hence, the supply price method is straightforward and usually easier to determine K^{ℓ}.

3.3. Empirical Strategy

In this study, the supply wage of labour approach is used. In this approach, the fundamental determinant of the K^{ℓ} is the competitive wage (supply wage) at which labour of a particular type is willing to work [33]. The supply price is the precise measure because it is location-specific and captures the value of a foregone product as well as the value of all other monetary and non-monetary sacrifices that the worker makes before employment.

To determine the K^{ℓ} for a specific occupation, industry, and region, the first thing to do is to identify the supply wage of labour that exists within the area of the project for the type of labour required. The supply price is determined by several factors including labour skill, employment location, unemployment rate, internal pay structures, as well as political and regional variables [5–7]. The wage rate accounts for the workers' preferences regarding location and other working conditions. A number of adjustments are made to the market wage to obtain K^{ℓ}.

If a project hires labour and pays above the prevailing wage for this labour type, we should expect people who are already employed in the existing enterprises to move to the project. These workers will only respond to the vacancies if the project wage is at least as large as their required supply price. This labour market adjustment will decrease the quantity of labour supplied to alternative enterprises. If a labour market is characterised by a high level of unemployment, then the supply price that workers would demand before offering their labour services will be low and vice versa.

Once the gross-of-tax supply price is determined, it is adjusted to account for the various distortions present in the labour market. It is necessary to incorporate all the relevant distortions to accurately estimate the K^{ℓ}. In line with Harberger's three basic postulates of applied welfare economics, the K^{ℓ} has two main components: (1) the cost of attracting a worker to the job in question (the gross-of-tax wage rate) and (2) the welfare effect that results from disturbing related markets due to distortions. These distortions arise from the presence of income taxes, social security contributions, etc. 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 alternative employment, they do not consider these taxes as a loss in economic welfare.

While the loss in tax revenue from the reduction in employment is not in itself an economic welfare loss, workers must be generating a value of a product in the alternative enterprise large enough so that the employer is willing to pay a gross-of-tax wage sufficient for the employee 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 labour that serves to cover the cost of these taxes is an economic loss. 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.

It is important to indicate that when a project hires additional employees, it is natural that some new workers may represent new entrants to the formal labour market in response to the improved labour 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 labour 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 derive the K^{ℓ}. The supply price captures exactly the lost benefits of the worker in the alternative market.

In summary, when labour markets are competitive, the estimation of the K^{ℓ} begins with the gross-of-tax supply price of labour (ɯ_{s}^{ℓ}) for a particular type of labour skill that will be supplied to a specific project at a given location. The ɯ_{s}^{ℓ} reflects the minimum wage that the project would need to offer to satisfy its labour demands. This simple measure captures several important factors.

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

When distortions of externalities are present, the supply price needs to be adjusted since there will be a difference between the K^{ℓ} and the supply price of labour. The difference is the welfare effect generated by any changes in equilibrium quantities in previously distorted markets. Several distortions, including subsidies, unemployment benefits, etc., are present in the labour markets. However, the two most common among them are personal income and social security taxes. Income tax is levied as the proportion of the wage income that the employee is expected to pay to the government. By convention, the task of paying the income tax rests on the employee, however, the employer is required to withhold the estimated income tax and transfer it directly to the government. The tax base for social security tax is also the wage gross of income tax paid by the employer to the employee. 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 is the project wage (ω) plus the social security tax paid by the employer (ψ). Thus,

$$\acute{\omega} = \omega(1 + \psi) \tag{2}$$

When the wages are subject to income taxes, the K^{ℓ} becomes the gross-of-tax supply price to the project less the income tax paid by this worker on the project plus the tax lost because of the movement of labour to the project. With distortions, the K^{ℓ}:

$$K^{\ell} = \text{ɯ}_{s}^{\ell} - \left(\text{ɯ}_{s}^{\ell}\tau - \lambda\gamma_{a}^{\ell}\tau'\right) \tag{3}$$

where:

- ɯ_{s}^{ℓ} denotes the gross-of-tax supply price of labour.
- γ_{a}^{ℓ} denotes the gross-of-tax wage of labour from alternative sources.
- τ denotes the income tax rate plus social security paid by the employee corresponding to the supply price of labour.
- τ' denotes the total effective tax rate, including both the income tax paid by the employee and the social security taxes paid by the employer and the employee corresponding to the alternative wage rate.
- λ denotes the proportion of the project's demand for labour obtained from taxed employment in the alternative market.

The supply price of labour is adjusted by deducting the income tax rate levied on the wage paid to the project's labour force ($\text{ɯ}_{s}^{\ell}\tau$) but adding the income and social security taxes lost from the reduced employment in the alternative formal labour market ($\lambda\gamma_{a}^{\ell}\tau'$). In the case of Ghana, λ is a key parameter. As the informal sector makes up such a large proportion of economic activity, it may be reasonable to assume that a greater proportion of labour is sourced from informal market activities as opposed to alternative formal markets. We expect the parameter λ for Ghana to be relatively lower than that of a country where

the formal labour market dominates. The labour externality (ε^{ℓ}) associated with the project is given by:

$$\begin{aligned} \varepsilon^{\ell} &= \acute{\omega} - \left[\mathrm{w}_{\mathrm{s}}^{\ell} - \left(\mathrm{w}_{\mathrm{s}}^{\ell}\tau - \lambda\gamma_{a}^{\ell}\tau'\right)\right] \\ &= \omega(1+\psi) - \left[\mathrm{w}_{\mathrm{s}}^{\ell} - \left(\mathrm{w}_{\mathrm{s}}^{\ell}\tau - \lambda\gamma_{a}^{\ell}\tau'\right)\right] \\ &= \omega\tau'' + \omega(1-\tau'') + \omega * \psi - \left[\mathrm{w}_{\mathrm{s}}^{\ell}(1-\tau) + \lambda\gamma_{a}^{\ell}\tau'\right] \end{aligned} \tag{4}$$

where:

- τ'' denotes the income tax rate plus social security paid by the employees that corresponds to the project wage, levying on wages in the formal sector.

The nature of the employer and labour productivity in the sector or project is also critical to the determination of the labour externality from the increase in employment. It is the employer that sets the overall level of labour compensation that the labour will receive. This level of compensation will determine the size of the net labour externality given the economic opportunity cost of the type of labour employed.

The labour externality (ε^{ℓ}) is divided between labour and the government as labour benefits (ℓ^{b}) and government benefits (g^{b}). Thus,

$$\ell^{b} = \omega(1-\tau'') - \mathrm{w}_{\mathrm{s}}^{\ell}(1-\tau) \tag{5}$$

$$\mathrm{g}^{b} = \omega\tau'' + \omega * \psi - \lambda\gamma_{a}^{\ell}\tau' \tag{6}$$

4. Economic Opportunity Cost of Labour

Here, the supply price approach is used to estimate the K^{ℓ} for projects in Ghana under different prevailing labour market situations. We estimate the K^{ℓ} for rural and urban projects, hiring skilled and unskilled labour from domestic markets. We also examine the K^{ℓ} for the case of a project in Ghana hiring domestic labour who can alternatively work abroad. We now focus on the case of foreign labour hired in Ghana. It should be noted that each case is examined systematically and from the general perspective while the empirical illustrations are indicated in Tables 1 and 2 using national data from the Ghana Statistical Service.

Table 1. Summary Statistics of the Inputs values for each Labour Type.

Cas	Proj Loc.	Skill Level	Worker Source	$\mathrm{w}_{\mathrm{s}}^{\ell}$	ω	γ_{a}^{ℓ}	τ	τ'	λ	Ψ	ψ_1	$\frac{\chi_e}{\chi_m}-1$	τ''	ßr	μ	θ	τ^{VAT}
1	Rural	Unskill	Local	800	800	-	-	-	-	-	-	-	-	-	-	-	-
2	Rural	Un For	Local	865	915	-	-	-	-	0.13	0.055	-	-	-	-	-	-
2.1	Rural *	Un For	Local	865	995	-	-	-	-	0.13	0.055	-	-	-	-	-	-
3	Rural	Skl For	Local	3024	3200	2720	0.18	0.30	0.9	0.13	0.055	-	0.184	-	-	-	-
3.1	Rural *	Skl For	Local	3024	3840	2720	0.18	0.30	0.9	0.13	0.055	-	0.189	-	-	-	-
5.4	Urban	Un Inf	Local	965	965	-	-	-	-	-	-	-	-	-	-	0.06	-
5.5	Urban	Un Inf	Local	965	1037	-	0.07	-	-	0.13	0.055	-	-	-	-	0.06	-
5.6	Urban	Skl For	Local	2373	2511	1898	0.17	0.28	0.9	0.13	0.055	-	0.17	-	-	-	-
5.6.1	Urban *	Skl For	Local	2373	3085	1898	0.17	0.28	0.9	0.13	0.055	-	0.18	-	-	-	-
5.7	Urban	Ski For	R Mig	5750	7468	4514	0.22	0.33	0.7	0.13	0.055	0.06	0.23	419	0.3	-	-
5.8	Urban	Skl For	Foreign	-	8136	-	0.21	-	-	0.13	0.055	0.06	-	0.33	-	-	0.13

* Indicates the case in which the project wage $\mathrm{W_p}$ is greater than the supply price of labour $\mathrm{W_g^s}$, i.e., ($\mathrm{W_p} > \mathrm{W_g^s}$).

Table 2. Summary Statistics of Outputs/Results.

Case	Skill Level	Distortion	ω	K^{ℓ}	$\hat{\mathbf{f}}$	$\mathcal{E}^{\ell}$	$\ell^{\mathbf{b}}$	$\mathrm{g}^{\mathbf{b}}$	$\frac{\mathcal{E}^{\ell}}{\omega}$	$\frac{\ell^{\mathbf{b}}}{\omega}$	$\frac{\mathrm{g}^{\mathbf{b}}}{\omega}$
1	Un Inf	--	800	800	1	0	--	--	0	--	--
2	Un For	Ψ, ψ_1	1034	865	0.84	169	0	169	0.16	0	0.16
2.1 *	Un For	Ψ, ψ_1	1124	865	0.68	259	75	185	0.23	0.07	0.16
3	Skl For	τ, Ψ, ψ_1	3616	3362	0.93	264	0	264	0.07	0	0.07
3.1 *	Ski For	τ, Ψ, ψ_1	4339	3352	0.77	988	503	484	0.23	0.12	0.11
5.4	Un Inf	------	965	1023	1.06	-56	0	-56	-0.06	0	-0.06
5.5	Un Inf	Ψ, ψ_1	1172	1023	0.87	149	0	149	0.13	0	013
5.6	Skl For	τ, Ψ, ψ_1	2682	2462	0.92	220	0	220	0.08	0	0.08
5.6.1 *	Skl For	τ, Ψ, ψ_1	3486	2462	0.7	1025	566	459	0.29	0.16	0.13
5.7	Un For	τ, Ψ, ψ_1, $\frac{\chi_e}{\chi_m} - 1$	8439	5547	0.66	2892	1254	1638	0.34	0.15	0.19
5.8	Skl For	τ, Ψ, ψ_1, $\frac{\chi_e}{\chi_m} - 1$, τ^{VAT}	9194	6023	0.66	3171	0	3171	0.34	0	0.34

* Indicates the case in which the project wage W_p is greater than the supply price of labour W_g^s, i.e., $(W_p > W_g^s)$.

Ψ, ψ_1 = Social security
τ, Ψ, ψ_1 = Income tax, social security
τ, Ψ, ψ_1, $\frac{\chi_e}{\chi_m} - 1$ = Income tax, social security, foreign exchange
τ, Ψ, ψ_1, $\frac{\chi_e}{\chi_m} - 1$, τ^{VAT} = Income tax, social security, foreign exchange, value-added tax

4.1. A Rural Project Employing Domestically Sourced Unskilled Labour

The estimation of the economic opportunity cost of labour (K^{ℓ}) for unskilled labour is relatively easy because of the absence of distortions. Generally, most low-skilled occupations are predominantly agriculture and other basic jobs that require no formal training. Most low-skilled jobs are primarily in the informal sector and rural settings and hence thrive well in developing countries. In Ghana, 65.2% of rural dwellers are employed in the agricultural sector [23]. To estimate the K^{ℓ} for an unskilled labour market in a rural agricultural project without distortions, three assumptions are required: (1) wages and labour demand do not fluctuate during the project's life, (2) workers will only respond to job vacancies if the wages offered are at least equal to the opportunity costs associated with each labour type, and (3) the supply of labour is inelastic over the project period. Therefore, if an agricultural project in a rural setting hires the services of an unskilled worker within the vicinity at the prevailing market monthly wage rate without distortions, then K^{ℓ} is equal to w_s^{ℓ} which is the gross-of-tax wage. This supply price of labour is the accurate measure of the K^{ℓ} in the absence of distortions and externalities since it captures all the aforementioned factors and thus reflects the true K^{ℓ} for this labour type. Thus:

$$K^{\ell} = w_s^{\ell} \tag{7}$$

The absence of distortions suggests that no labour externality is generated from the reallocation of labour to employment by the project from other activities. However, for the sustainability of the project and to maintain these workers, the project is likely to pay a wage much higher than the supply price of this type of labour and this will generate a positive labour externality. As the project wages rise, the labour externality triggered by public project implementation increases rapidly. The unemployment rate, seasonalities, project location, etc. determine the labour supply price. The conversion factor here is 1, suggesting that the additional value generated from hiring a unit of this labour type is just equal to the opportunity cost incurred in hiring this labour.

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

The recruitment of a worker into the formal economy comes with a mandatory social security tax payment. Employers are required by law (National Pension Act 766) to register their workers for the purpose of making social security contributions on their behalf. This provision is non-negotiable and by law the employer is required to pay 13% of each

employee's monthly base pay into the scheme. Per the same provision, the employer is authorised to withhold 5.5% of the employee's base pay and subsequently forward it into the same fund each month [34]. The social security tax rate paid by the employer is denoted ψ and that of the employee ψ_1.

For the formal sector that pays a competitive wage, $\omega(1-\psi_1) = \mathrm{w}_{\mathrm{ls}}^{\ell}(1-\psi_1)$. When an employee is sourced from the informal sector where social security is not paid, the social security tax rate ψ_1 levied on the supply price of labour in the informal sector is zero (0). The employer is mandated to withhold 5.5% of each worker's base pay. Therefore, $\omega(1-\psi_1) = \mathrm{w}_{\mathrm{ls}}^{\ell}$. This identity could be interpreted as follows: the worker's wage net of social security is equal to the supply price of labour (market wage) in the informal sector. If the project is to pay something less, the employees would be worse off working for the project than working in the informal sector.

The demand price for this labour is the aggregation of the wage rate paid to the worker and the 13% social security contribution paid by the employer. With regard to unskilled labour jobs, it is assumed that the remuneration is not high enough for the individual to be subject to tax. Therefore, the supply price of labour is less than the demand price of labour by 18.5%. Here, $\mathrm{K}^{\ell} = \mathrm{w}_{\mathrm{ls}}^{\ell}$, but the associated labour externality (ε^{ℓ}) will be positive because of the wedge between the demand price and labour supply price. The labour externality generated in this case accrues to the government in the form of social security tax revenue. As the project wage is equal to the labour supply price, the labour benefit is zero.

Monthly Wage in the Formal Sector Is Higher than the Prevailing Market Wage Rate

If the project pays a wage higher than the prevailing labour supply price then we would expect some reactions. K^{ℓ} remains unchanged as it is not affected by the project wage. Secondly, because the demand price is determined by the project wage, the increase in project wage will in effect increase both the total compensation paid to labour and the total labour externality generated. Also, the labour benefits will be positive but the conversion factor ($\frac{\mathrm{K}^{\ell}}{\omega}$) will fall as the project wage exceeds the labour supply price.

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

Here, a project is located in a remote village but labour with the requisite skills is absent in that locality. There is a need to bring labour with the required skills from a different district. It is important to note that skilled labourers are frequently subject to many distortions which must be carefully identified individually and accounted for in the estimation of the K^{ℓ}. Similarly, it is worth mentioning that, globally, labour markets are generally tighter for high-level skill jobs such as professionals, managers, etc. In Ghana, and just like many developing countries, the average annual labour demand and supply at different skill levels yield a deficit for high-, semi-, and specialised-skill labour and an excess supply for low-skill labour [35].

For a project that is expected to hire skilled labour, the majority of the vacant positions are likely to be occupied at the cost of other employers who lose these workers. Taxes paid by these workers in their previous jobs are significant in determining the K^{ℓ}. Also, it is highly possible that the prevailing wage for this type of labour in this region may be higher than that which this skilled labour would have been earning in the alternative urban labour market. Some categories of skilled labour are scarce in some regions and may need to be sourced from other urban localities. These skilled workers place a premium on a number of factors before moving to the project region to come to work on the project. These factors include differences in the cost and quality of living, workers' preferences, etc. Skilled workers weigh these factors to establish the minimum wage they are willing to accept in order to forego their place of work for the new remote locality.

The rural project's net-of-tax wage rate must be at least as high as the net-of-tax supply price of this labour. To entice skilled labour to seriously consider relevant job vacancies in a remote and deprived locality, the project wage may in some instances be much higher

than the market wage for a given skill in the project's area in order to persuade this skilled worker to come to work on the project. Since the new job is in the formal sector, social security contributions must be taken into account. Moreover, when workers are recruited in a labour market where personal income taxes are present, the K^{ℓ} is determined by the price these workers receive by supplying their labour services. This is measured by the wage net of personal income taxes. The K^{ℓ} becomes the supply price less the amount of income taxes paid by the individual working at the supply price, plus the foregone income taxes that would have been generated elsewhere in the economy if the employee had not moved to the project vicinity.

Suppose the share of the project's labour, λ, will be sourced from taxed employed workers earning the alternative wage γ_a^{ℓ}, perhaps even in other localities. However, the remaining share of the project's labour would be sourced from the informal sector or non-market activities, which does not require adjusting for income taxes. In the presence of distortions, K^{ℓ}, ε^{ℓ}, ℓ^{b}, and g^{b} are given as:

$$\begin{aligned} K^{\ell} &= \mathrm{w}_s^{\ell} - \left(\mathrm{w}_s^{\ell}\tau - \lambda\gamma_a^{\ell}\tau'\right) \\ \varepsilon^{\ell} &= \omega\tau'' + \omega(1-\tau'') + \omega * \psi - \left[\mathrm{w}_s^{\ell}(1-\tau) + \lambda\gamma_a^{\ell}\tau'\right] \\ \ell^{b} &= \omega(1-\tau'') - \mathrm{w}_s^{\ell}(1-\tau) \\ g^{b} &= \omega\tau'' + \omega * \psi - \lambda\gamma_a^{\ell}\tau'. \end{aligned}$$

Although the project wage is same as the labour supply price under this category of labour, i.e., $\omega(1-\tau'') = \mathrm{w}_s^{\ell}(1-\tau)$, the presence of tax-induced distortions creates a wedge between K^{ℓ} and w_s^{ℓ}. Also, since the project pays a wage equal to the prevailing labour price, labour has no benefits under this scenario. However, the net benefits that accrue to the government in the form of revenues is equal to the total labour externality generated in employing this worker. The entire labour externality is a net gain in government revenues. The conversion factor ($\hat{f}$) is $\frac{K^{\ell}}{\omega}$.

The Project Wage (ω) Is above the Supply Price of Labour (w_s^{ℓ})

If the project pays a wage slightly above the gross-of-tax supply price of labour, then the total compensation paid to labour will increase since the demand price of labour is a function of the project wage. Therefore, the total labour externality will increase due to the rise in the total compensation paid to labour at constant K^{ℓ}. Here, the labour benefit will be positive and the aggregation of the labour benefits and the government benefits gives the total labour externality generated. The conversion factor ($\hat{f}$) declines in this scenario as compared to the above case due to the increase in the demand price of labour relative to the constant K^{ℓ}.

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

Ghana's urban informal sector is noted for its widespread diversity. The sector serves as a lifeline for the majority of the labour force by providing the bulk of employment and income to many, including poor rural–urban migrants [23]. Most urban projects rely largely on unskilled labour from the informal sector. Hence, we assume that the project pays a wage equal to the market wage. In Ghana, unskilled workers in the informal sector are typically not entitled to any social cover or other incentives. Therefore, they do not pay social security contributions on their gross-of-tax wage. Similarly, the typical project wage falls below the income tax threshold.

Most informal sector workers in the urban centres of Ghana are rural–urban migrants. Internal migration activities occur largely from the northern and savanna regions to the south and from the less developed rural areas to the relatively developed urban areas that serve as growth poles. The push factors include economic gains and better working opportunities, proximity to better public services, etc. Therefore, the most important determinants of migration flows between two locations are the differences in average income levels between the migrants' origin and destination [36].

Although such domestic movement has some advantages for the development of the communities involved, rural–urban migration is usually seen as generating negative externalities, particularly on urban infrastructure, employment etc. These negative externalities include increased congestion and additional investment in public services, increased crime that results in extra security cost, and the larger costs of housing and transportation faced by these migrants. A study by [37] noted that rural–urban migration in recent times has become a threat in Ghanaian society. They observe that the problems that come with rural–urban migration in Ghana include the mass movement of energetic labour from rural areas, congestion, poor housing conditions, and increased unemployment and crime rates, among others.

These negative externalities generated due to rural–urban migration activities are not paid for by these unskilled informal sector workers. This creates extra economic costs on society that should be accounted for in the K^{ℓ}. We account for these external costs simply as a percentage θ of the gross-of-tax supply price of labour. Assuming θ% of the prevailing urban market wage for unskilled labour [38], then, $K^{\ell} = w_s^{\ell}(1+\theta)$ and $\varepsilon^{\ell} = \acute{\omega} - w_s^{\ell}(1+\theta)$. As the cost of living, particularly transportation costs and rents, is relatively higher for urban residents than their rural counterparts, it is expected that the supply price for unskilled labour in these urban areas will be higher than the wage for comparably unskilled workers in rural areas. In absolute terms, the conversion factor ($\hat{f}$) under this scenario is greater than one because of the extra fiscal costs generated by rural–urban migration activities that society has to pay.

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

Assume that there is a project in the formal sector in an urban locality which needs to rely on unskilled labour from the vicinity. It is mandatory to register the employees with social security, which provides them with social security cover, etc. By law, employees contribute 5.5% of their base pay as social security payment, while employers contribute 13%. Let us also assume that the gross-of-tax project wage is large enough to be subject to taxation aside from the 5.5% deduction. Furthermore, activities of rural–urban migration generate negative fiscal externalities which these migrants do not pay for. We assume that this negative externality equals θ% of the prevailing market wage for unskilled labour in the urban sector. It is worth mentioning that to attract and maintain this type of labour for this project, the lowest amount that should be paid must be such that the value net of personal income taxes and social security at least equals the supply price demanded by this worker. Therefore,

$$K^{\ell} = w_s^{\ell}(1+\theta)$$
$$\varepsilon^{\ell} = \omega(1+\psi) - w_s^{\ell}(1+\theta)$$
$$\hat{f} = \frac{w_s^{\ell}(1+\theta)}{\omega(1+\psi)}$$

The entire labour externality goes to the government as government revenues and $\ell^{b} = 0$.

4.6. An Urban Project Employing Locally Sourced Skilled Labour at Its Supply Price

Under this scenario, the K^{ℓ} is estimated for a project in an urban district that hires the services of a local skilled worker and pays the gross-of-tax market wage prevailing in the project locality. This wage rate is subject to income tax. With skilled labour, the locality in which the project is to be executed is an important determinant of the supply price of labour which in turn determines the K^{ℓ} of this skilled labour. Globally, skilled labour markets are tight with supply deficits. Suppose the proportion of the project's labour that will be drawn from existing enterprises is λ, while the alternative wage rate is γ_a^{ℓ}. Then, $K^{\ell} = w_s^{\ell} - \left(w_s^{\ell}\tau - \lambda\gamma_a^{\ell}\tau'\right)$ while the corresponding labour externality (ε^{ℓ}) is: $\varepsilon^{\ell} = \acute{\omega} - K^{\ell}$. The entire externality goes to the government in the form of tax revenue. Thus, $g^{b} = \omega\tau'' + \omega\psi - \lambda\gamma_a^{\ell}\tau'$. The conversion factor ($\hat{f}$) is $\frac{w_s^{\ell} - \left(w_s^{\ell}\tau - \lambda\gamma_a^{\ell}\tau'\right)}{\omega(1+\psi)}$.

The Project Wage Is Greater than the Supply Price of Labour ($\mathfrak{w}_{ls}^{\ell}$)

If the project wage (ω) is above the labour supply price ($\mathfrak{w}_{ls}^{\ell}$), thus, $\omega > \mathfrak{w}_{ls}^{\ell}$, then the total compensation paid to labour will go up and the total labour externality generated will also increase using the same values for λ, γ_a^{ℓ}, and τ' as in the previous scenario but K^{ℓ} remains unchanged. The labour benefits here will be greater than zero, i.e., $\ell^b = \omega(1-\tau'') - \mathfrak{w}_{ls}^{\ell}(1-\tau) > 0$, but the conversion factor will decline as compared to the case when the project wage and the labour supply price are equal.

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

In Ghana, and over the past decades, there has been a change in the migration flow from high internal migration to high external migration [39]. Migrants from Ghana are increasingly emigrating outside West Africa to other popular destinations such as the United States of America, the United Kingdom, Italy, etc. Although these departures includes both skilled and unskilled labour, the phenomenon is more pervasive among medical professionals and has been referred to as the "Exodus of Health Workers" [40–42]. The number of Ghanaians in foreign countries rose from 716,044 in 2010 to 970,625 in 2019—an increase of 26.2% [30]. Demographic and economic migration is related to poor labour standards, high unemployment, and the overall health of a country's economy. The factors influencing the out-migration in Ghana include low levels of wages, inadequate opportunities for career promotion and development, poor living standards, limited educational opportunities, and the absence of employment opportunities (job prospects) [11,43].

Given that the difference in wages between countries is one of the leading factors driving high-skilled workers away from the domestic labour market, often to jobs offshore which pay relatively higher wages, and the fact that personal remittances from these overseas workers are an integral part of the foreign exchange matrix, it is necessary to estimate the impact of international migration on the K^{ℓ}. Specifically, between 2011 and 2021, the volume of remittances received by Ghana increased from approximately USD 2.2 billion to USD 4.3 billion [44]. The 2020 data constitute approximately 6.2% of the country's GDP and place the Ghana as the second-largest recipient of remittances in Sub-Saharan Africa after Nigeria [45].

When a project is created in Ghana and workers are hired to perform certain tasks, part of this labour comes from a reduction in the outflow of international migration [46]. When this occurs, the K^{ℓ} must take into account any distortions associated with the retention or return of Ghanaian workers who would have been employed overseas as well as the adjustment of the labour demand and supply in the domestic markets. One common feature associated with having a country's nationals working overseas is the flow of remittances repatriated home to family members in the country of origin. Applying the supply price approach to the K^{ℓ}, the reduction in remittances itself is not an economic cost, as this will be factored into the worker's supply price to the project. Taking both the domestic and international labour market adjustments into consideration,

$$K^{\ell} = \mathfrak{w}_{ls}^{\ell}(1-\tau) + \lambda\gamma_a^{\ell}\tau' + \mu * ß_r * \left(\frac{\chi_e}{\chi_m} - 1\right) \quad (8)$$

where:

- λ denotes the proportion of the project's demand for a given type of labour obtained from taxed employment activities in the domestic market;
- μ denotes the proportion of the project's domestic demand for a given type of labour sourced from reduced international out-migration;
- $ß_r$ represents the average amount of remittances if this worker were employed overseas;
- χ_e/χ_m represents the foreign exchange premium which accounts for the true cost of the foreign exchange to the economy rather than just its market value.

Now,

$$\begin{aligned}
\varepsilon^{\ell} &= \omega(1+\psi) - \{\mathrm{ш}_{\mathrm{s}}^{\ell}(1-\tau) + \lambda\gamma_a^{\ell}\tau' + \mu * ß_r * (\tfrac{\chi_e}{\chi_m} - 1)\} \\
\ell^b &= \omega(1-\tau'') - \mathrm{ш}_{\mathrm{s}}^{\ell}(1-\tau) \\
\mathrm{g}^b &= \omega(\tau'' + \psi) - \lambda\gamma_a^{\ell}\tau' - \mu * ß_r * (\tfrac{\chi_e}{\chi_m} - 1) \\
\hat{\mathrm{f}} &= \tfrac{\mathrm{ш}_{\mathrm{s}}^{\ell}(1-\tau) + \lambda\gamma_a^{\ell}\tau' + \mu * ß_r * (\frac{\chi_e}{\chi_m} - 1)}{\omega(1+\psi)}
\end{aligned}$$

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

In Ghana and just like other developing countries, when developmental and infrastructure projects are to be implemented, there is the need to engage the services of overseas worker who possess the needed expertise. Complex projects faced with a skills deficit solicit the services of highly skilled foreign workers from other countries. It is therefore necessary to estimate the K^{ℓ} of these foreign workers. The K^{ℓ} here will be measured by the net-of-tax wage that the worker receives in Ghana in addition to 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. Furthermore, there is the need to also consider the adjustments such as taxes, VAT, subsidies, etc. regarding the goods and services that foreign workers consume in Ghana. The VAT and other taxes should be accounted for as an economic benefit to the country. Therefore, the economic opportunity cost of foreign labour (K_f^{ℓ}) is given as:

$$\mathrm{K}_f^{\ell} = \varpi_f\left(1-\tau^f\right) - \varpi_f\left(1-\tau^f\right)\left(1-ß_r^f\right)\tau^{VAT} + \varpi_f\left(1-\tau^f\right) * ß_r^f * \left(\frac{\chi_e}{\chi_m} - 1\right) + I_n^f \quad (9)$$

where:

- ϖ_f represents the gross-of-tax wage of foreign labour;
- τ^f represents the personal income tax, including the social security tax rate paid by the employee, levied by the host country on the foreign worker;
- $ß_r^f$ represents the proportion of the net-of-tax income repatriated by foreign labour;
- $\chi_e/\chi_m - 1$ represents the proportion of repatriated income lost via the foreign exchange premium;
- τ^{VAT} represents the VAT rate levied on consumption, which is 12.5% in Ghana;
- I_n^f represents the value of benefits gained by foreign workers from subsidies.

The ε^{ℓ}, g^b, and $\hat{\mathrm{f}}$ are;

$$\begin{aligned}
\varepsilon^{\ell} &= \varpi_f\left(1+\psi^f\right) - \{\varpi_f\left(1-\tau^f\right)[1 - \left(1-ß_r^f\right)\tau^{VAT} + ß_r^f * \left(\tfrac{\chi_e}{\chi_m} - 1\right)] + I_n^f.\} \\
\mathrm{g}^b &= \varpi_f\left(\tau^f + \psi^f\right) + \varpi_f\left(1-\tau^f\right)\left(1-ß_r^f\right)\tau^{VAT} - \varpi_f\left(1-\tau^f\right) * ß_r^f * \left(\tfrac{\chi_e}{\chi_m} - 1\right) - I_n^f \\
\hat{\mathrm{f}} &= \tfrac{\varpi_f\left(1-\tau^f\right)[1-\left(1-ß_r^f\right)\tau^{VAT} + ß_r^f * \left(\frac{\chi_e}{\chi_m} - 1\right)] + I_n^f.}{\varpi_f\left(\tau^f + \psi^f\right)}
\end{aligned}$$

The labour benefit here is zero (i.e., $\ell^b = 0$) and the government accrues the full amount of labour externality that results from the employment of foreign labour. The welfare gains of the foreign workers are not considered under this situation and therefore any net benefits they gain by migration to Ghana are not included in the adjustment of the economic welfare accruing to Ghana because of the project.

4.9. Data

The input data for the computation of the economic opportunity cost of labour (K^{ℓ}), the conversion factor ($\hat{\mathrm{f}}$), the total labour externality (ε^{ℓ}), as well as other labour market outcomes associated with job creation projects were obtained from Ghana Living Standard Survey 7 (GLSS 7) and other labour market surveys including the 2019 Recruitment

Cost Pilot Survey conducted by the Ghana Statistical Service (GSS). These are nationally representative household surveys conducted by the GSS. They contain detailed data on individual household characteristics and labour market statistics including education, occupation, employment (and type—formal or informal), wage, etc., and other geographical variables. The Ghana Labour Market Survey was conducted in 2015 while the GLSS 7 was conducted in 2017. In terms of labour statistics in Ghana, these datasets are the best to be used to carry out any study in Ghana. The initial data for the computation were extracted from these sources and subsequently adjusted for inflation, exchange rate changes, and other labour market variations to obtain the corresponding 2022 values.

In practice, if a project is to be implemented, the project specialists are required to undertake extensive research and use all information at their disposal of the unemployment rate, cost of living, labour type, project location, seasonality, etc. that exist within the vicinity of the project to detect for each labour type the prevailing labour price required to attract sufficient workers of the required skill level to work on the project. This unique wage rate for each labour category accounts for the workers' preferences regarding location, working conditions, or any other factors that affect the desirability of working for the project.

In Ghana, the Social Security Contribution Scheme is structured into three tiers. The first two require mandatory contributions, however, the third one is voluntary. Under the first two tiers, employers are required by law (National Pension Act 766) to contribute 13% (i.e., ψ = 13%) of each worker's monthly base pay as the employer share of the National Social Security Tax contribution to the scheme. The same provision also mandates the employer to deduct 5.5% (i.e., ψ_1 = 5.5%) of the employee base pay as the share of the employee's contribution and forward it into the scheme. These contributions are deductible for tax purposes and are tax free for both the employer and the employee. These datasets are drawn from the Ghana Social Security and National Insurance Trust (SSNIT).

The standard value-added tax (VAT) rate in Ghana as of 2022 is 12.5% (i.e., τ^{VAT} = 12.5%). The income tax rate in Ghana (τ) depends largely on the labour type, the wage rate earned, and the income bracket or category of the labour type under consideration. According to the statistics from the Ghana Revenue Authority (GRA), the income tax rate (τ) charge in Ghana ranges from 5.5% to 30% and the rate associated with each labour type depends on the cumulative annual income earnings of the worker. These rates and their computations are show in Table A1 of Appendix A.

The International Labour Organization statistics [25] indicate that, in Ghana, around 25.3% of the employed workforce are covered by at least one social protection benefit [25]. This explains the widespread prevalence of the informal sector and the corresponding low-skilled workforce. As the formal sector in Ghana makes up such a small share of the economic activities (less than 20%) and skilled labour markets are tight in Ghana, it is reasonable to suggest that a great deal of skilled workers come from existing formal market activities as opposed to from non-economic activities. Thus, for skilled labour markets $0.7 < \lambda < 1.0$. Similarly, the Recruitment Cost Pilot Survey conducted by the Ghana Statistical Service [47] shows that, in general, migrant workers from Ghana earn, on average, GHS 3798 per month for unskilled workers and GHS 5750 per month for skilled workers but the average mean monthly cash remitted by Ghanaian migrants living abroad is GHS 418.88.

The datasets for the supply price (ϖ_S^{ℓ}) of each labour type and their corresponding project wages (ω) as shown in column 5 and column 6 of Table 1 were extracted from the GLSS 7 conducted in 2016/2017 and the Labour Market Survey conducted by the GSS in 2015. The GSS [48] indicated that the average monthly wage rate for those who work in elementary employment (i.e., weeding, harvesting, packaging, etc.) that requires no skill is GHS 504.99. However, in 2017, it was GHS 597. Similarly, for highly skilled workers such as managers, the average monthly wage was GHS 1533 in 2015 but GHS 1781 in 2017. This suggests that the average annual growth in the monthly wage rate for both skilled and unskilled labour is approximately 9%. This annual increment in the monthly wages is assumed to account for inflation, exchange rate changes, and other labour market

adjustments. Therefore, these initial values are used to estimate the corresponding 2022 wages for each labour category. The analysis is carried out for each labour type when the project pays a wage rate (ω) equal to the prevailing labour market price (ɯ_s^{ℓ}) for each type of labour as in rows 2, 4, 7, and 8 and their corresponding columns 5 and 6. The estimations and empirical analysis are carried out using these datasets.

Using these datasets, the total compensation paid to each labour type based on the specifics of that particular group is denoted by ($\acute{\omega}$) in column 6 of Table 2. For each labour group (case), the total compensation paid to labour is estimated using Equation (2) and the respective project wages paid for each labour type. The total economic cost (welfare costs) generated in hiring a unit of each labour type is given by K^{ℓ} in column 7 of Table 2. For each labour type, the K^{ℓ} is estimated using Equation (3) together with the supply price (ɯ_s^{ℓ}) for each labour type. For each labour category, the size of the K^{ℓ} depends largely on the degree of distortions (in column 5) associated with each labour type and the prevailing market price of the particular labour under consideration. The conversion factor ($\hat{\mathbf{f}}$), which is the share of the total payments to each labour type ($\acute{\omega}$) that accounts for the total cost incurred in employing a unit of a particular labour type, is shown in column 8 of Table 2. This is the ratio of K^{ℓ} and $\acute{\omega}$. The total labour externality (ε^{ℓ})—total benefits of job creation—for each labour type is shown in column 9 of the same table. It is estimated using Equation (4). The labour benefits (ℓ^b) and government benefits (g^b) associated with each labour type are estimated using Equations (5) and (6). They are represented in columns 10 and 11, respectively.

The input data provided in Table 1 are substituted into Equations (2)–(6) to estimate the labour demand price ($\acute{\omega}$), the economic cost of each labour type (K^{ℓ}), total labour externality by each labour type (ε^{ℓ}), the labour benefits (ℓ^b), and their respective government benefits (g^b) as shown in Table 2 (Outputs/Results).

5. Results and Discussion

The results from the estimations are presented in Table 2. In the absence of distortions, if a rural project hires a domestic unskilled worker but pays exactly the prevailing labour market price as in case 1, then the costs generated in hiring this worker are just equal to the total payments to labour. Here, the costs (K^{ℓ}) generated for hiring this particular worker are 800 but the total compensation ($\acute{\omega}$) paid by the project is also 800. The labour externality (ε^{ℓ}) generated from this job creation project is zero. There are no benefits for both labour and government and the conversion factor here will be one because the total compensations paid to this type of labour are equal to the economic welfare costs generated in hiring this worker. Therefore, if a project (e.g., targeting jobs at underutilised labour force resources, disadvantaged workers, etc.) is intended to create employment in a specific area for this labour type while at the same time mitigating poverty among this target group, then it is expected to pay a project wage that is above the prevailing market wage for it to achieve these goals.

Similarly, for a project that is located in a remote area but hires workers from the informal sector to the formal sector and pays the prevailing market wage as in case 2, a benefit (labour externality) in the form of social security tax revenue accrues to the government because of the presence of the tax-induced distortions. Although the project pays a wage rate just equal to the welfare cost generated in employing labour, because of the social security taxes paid by both the employer and the employee, a wedge is created between the project wage and the labour supply price which accrues to the government in the form of tax revenue. The labour benefits here are zero but the government benefit is positive. This is the precise result observed in row 2 of Table 2. Here, the project in the rural vicinity hires unskilled workers and pays the prevailing labour supply price (ɯ_s^{ℓ}) of 865. However, because of the presence of social security tax rates, the project pays a corresponding project wage (ω) of 915. Therefore, the total compensations ($\acute{\omega}$) paid to this labour are estimated using Equation (2) and are equal to 1034. Thus, from Equation (3), the

total labour externality generated is 169. This entire labour benefit goes to the government in the form of social security tax revenue.

Suppose the same project pays a wage rate that is above the prevailing market wage rate, then the labour benefits here will be positive. This is the scenario in row 3 of Table 2. The labour supply price here remains at 865 but the project pays a higher wage rate of 15% above the prevailing labour price (i.e., $\acute{\omega}$ = 995). A higher project wage means that the total compensation paid to labour will also be higher because of the share of the project wage that the employer pays as social security tax. Therefore, the demand price as shown in Equation (2) is $\acute{\omega}$ = 1124 but the associated costs generated in hiring this labour type are just 865, and the total labour externality generated is 259. Out of this total, 75 goes to labour as labour benefit while the remaining 185 goes to the government in the form of tax revenues. Hence, a general pattern of increasing labour externality (labour benefits) as higher wages is offered by the project. Therefore, for a project that seeks to alleviate poverty through job creation, it is expected to pay wages above the prevailing labour market price for it to achieve this intended objective. This is similar to the scenarios in row 5 and row 9 of Table 2.

In terms of the formal urban project that employs locally sourced informal workers in the urban areas and pays the prevailing market wage, the government finances the costs of the negative activities of migrants. This is shown as the negative labour externality generated in the output table. For skilled labour that is employed in a formal urban project that pays a wage rate above the prevailing labour price (case 5.6.1), because the project pays a wage rate of 3085 but the prevailing labour price for this labour type is just 2373, a positive labour externality and labour benefits of 1025 and 566 are generated, respectively. Thus, in general, if a public policy is targeted at creating jobs that is expected to benefit labour, then such projects must pay wages above the price of the particular labour type targeted for labour to benefit from such policies. This is true for all the labour types. It should also be noted that for all domestic labour types, the closer the conversion factor is to 1, the more likely the labour benefit from such a project is to be 0.

In the appraisal of an investment project, it is important to have a defendable estimate of the value of the net labour benefits arising from the employment of labour both in the construction and operation of the project. Each labour type in each project will be different. The project analyst will need to provide the basic data such as the supply wage rate for the type of labour working in the region of the project and the level of compensation that the project sponsor is planning to pay in wages and fringe benefits to those employed. By applying the relevant relationships expressed in Equations (1)–(9), the net labour benefits can be estimated along with the economic conversion factor for each type of labour as is presented in column 6 of Table 2. The distribution of the net labour externalities is presented for this set of illustrative situations in columns 7 to 12 of Table 2. The paper is an operational guide showing that the economic opportunity cost of labour can be estimated using the expressions derived, however, the basic data are specific for the type of labour and the geographical and labour market conditions where the project is situated.

6. Conclusions

The paper analyses the benefits (labour externality—ε^{ℓ}) of jobs created through policies and projects in Ghana. In the analysis, a framework based on the supply price approach was developed and used for the estimation of the economic opportunity cost of labour (K^{ℓ}) and, consequently, the total labour externality (ε^{ℓ}) generated when a policy programme creates jobs in Ghana. To estimate the K^{ℓ} for a given labour type or category, the supply price of labour (market wage) for the type of labour under consideration is adjusted to account for the tax-induced distortions and the externalities generated when labour is reallocated from the initial work to the new job. The most significant variable in the estimation of the labour externality (ε^{ℓ}) generated when a new job is created through any policy is the economic opportunity cost of labour—K^{ℓ}. The K^{ℓ} measures the total cost incurred in getting labour to work for the new project. It includes all the market distortions caused by reallocating

labour from the previous market and non-market activities to the new employment. The value of K^{ℓ} determines the quality of the labour externality (ε^{ℓ}) and other parameters as well.

To estimate the K^{ℓ}, the essential features of the particular labour market and the specific characteristics of the labour type are significant. In Ghana, the labour market is largely dominated by the informal sector and is characterised by a workforce with low levels of educational qualifications and a lack of social safety nets and recourse to social dialogue. The informal workers operate mainly in a cash economy with low earnings which makes them non-liable for taxes as their earnings fall below the threshold of taxable incomes. In general, the characteristics of the labour supply (e.g., qualification, level of experience, etc.) vis-à-vis the features of the firm (organisation) that demands it (i.e., firm size, types of economic activity, occupation, etc.) in aggregate determine the demand and earnings of different types of labour. This study differentiates between skilled and unskilled labour based on the characteristics of labour markets in Ghana and hence uses this categorisation to examine the labour force based on the geographical areas where individuals reside, urban and rural.

The results from the estimation reveal that the numerical estimate of the K^{ℓ} in Ghana could range from near equality with the project wage for unskilled workers to about 68% of the project wage for foreign labour. These rates depend largely on the location and the highly differentiated skills of the labour hired and, most importantly, on the wage paid by the project relative to the minimum wage required to attract sufficient workers with the requisite skills to execute the project.

The labour externality generated ranges from 7% of the gross-of-tax wages of skilled workers to approximately 30% of the gross wages while, for unskilled labour categories, the range is below 24% of the project wage. This indicates that, on average, policies that target job creation are more likely to benefit skilled than unskilled labour. Similarly, for both skilled and unskilled workers, the benefits accruing to the government are positive and less than 34% of the project wages except for unskilled informal sector workers employed by urban programmes that recorded a deficit of 6% due to the negative externalities arising from the inflow of migrants into urban areas.

In terms of the share of the project wage accruing to labour as benefits, the range is from 0 to 9% for unskilled labour. However, for skilled labour, it is from 0 to 17% of the gross-of-tax wage. A general pattern of increasing labour externality (labour benefits) as higher wages are offered by the project is observed in the results.

If the desire is to create employment for a specific group (e.g., targeting jobs at underutilised labour force resources, disadvantaged workers, etc.) to mitigate poverty, then such projects must pay wages above the prevailing market wage to achieve this intended objective. This is true for all labour types. Furthermore, the inclusion of overseas employees goes a long way to enrich these estimations. The preceding analysis will serve as an operational guide for estimating the economic opportunity cost of labour and the degree that labour benefits from projects that create jobs in Ghana.

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Appendix A. Taxation of Earned Income in Ghana

Table A1 shows the respective cumulative annual and monthly income tax bands and the progressive rates that are applied to the chargeable income of resident individuals for the tax year 2017/2018. These statistics provided here is tabulated from the Ghana Revenue Authority 2017.

Table A1. Income Tax Brackets and Rates, Ghana (2017/2018).

Annual Income Tax Bands in Ghana for 2017/2018			
Year (2017)	**Annual Chargeable Income (GHS)**	**Cumulative Ann. Chargeable Income (GHS)**	**Tax Rate %**
First	0–2592	2592	0
Next	1296	3888	5
Next	1812	5700	10
Next	33,180	38,880	17.50
Exceeding	33,180		25

- Resident individuals are subject to income tax on their entire income earnings.
- 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 18.50 per cent. Employers must pay social security tax rate of 13 per cent of the basic pay of the employee, and must withhold 5.5 per cent from the worker's salary and transfer both funds directly to the central government.
- These items are deducted from the worker's income before calculating the personal income tax:
    1. GH₵ 1200 for an individual with a dependent spouse or at least two dependent children.
    2. GH₵ 600 per child for Children's Education—up to a maximum of three (3).
    3. GH₵ 1000 per aged dependent person (over 60 years) up to a maximum of two (2) aged dependent relatives.
    4. Up to GH₵ 2000 for professional, technical, or vocational training costs.
    5. GH₵ 1500 for old age (60 years or above).

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