Role of Shadow Prices in Economic Analysis: Estimating True Economic Value beyond Market Prices

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Abstract

Shadow prices or accounting prices are crucial for accurately valuing factors and products beyond their market prices. They adjust for market distortions, externalities, and other factors to reflect the true social value of goods and services. In cost-benefit analysis, shadow prices are used to evaluate the social profitability of public sector projects by translating market prices into more accurate measures of economic value through conversion factors. Shadow prices, such as shadow wages and shadow exchange rates, fluctuate based on local conditions like unemployment and balance of payments issues. They provide a more realistic view of resource value, particularly important for developing countries. Incorporating shadow prices helps address market failures, improve the accuracy of cost-benefit analyses, and inform policy decisions on subsidies, taxes, and resource management. Despite challenges like data limitations and static assumptions, shadow pricing is vital for optimizing resource allocation and supporting sustainable development by considering broader societal impacts, especially in economies where market distortions are significant.

Keywords: Shadow prices, accounting prices, cost-benefit analysis, conversion factor, foreign exchange rate

Introduction

A shadow price, also known as an accounting price, represents the true economic value of a factor or product, distinct from its market price. It is used in cost-benefit analysis to reflect the social value of goods and services, considering market distortions, externalities, and other factors that are not captured by market prices. Shadow prices are essential for accurately estimating the social profitability of public sector projects and policies (Little & Mirrlees, 1974). Shadow prices serve as a means to capture the true economic value of factors and products, essential for accurate estimations in social cost-benefit analysis. J. Tinbergen (1982) describes shadow prices as indicators of the intrinsic or true value of a factor or product, similar to equilibrium prices. These values can vary across different periods, geographic locations, and labour occupations, often diverging from market prices. The goal of cost-benefit analysis is to assess the "production activities" of the public sector, evaluating the "social profitability" of public sector projects similarly to how a business enterprise assesses its profitability. However, the resources utilized and the outputs generated are valued differently. In this appraisal, "shadow prices," reflecting the social value of goods, replace the market prices used in private calculations. In a perfectly competitive economy, market prices and shadow prices align. However, in an imperfect economy, market distortions cause discrepancies between market and shadow prices, complicating cost-benefit analysis since shadow prices or social values are not directly observable.

Squire & Van der Tak (1975) emphasize the importance of shadow prices in project evaluation. They define shadow prices as prices that reflect the opportunity cost of resources, which is the value of the best alternative use. They explain that shadow prices are used to correct market distortions and to ensure that the benefits and costs of a project are measured in terms of their true economic value. This approach helps in identifying projects that contribute the most to economic development and social welfare.

Shadow prices include shadow wages, shadow interest rates, shadow foreign exchange rates, and shadow product prices. These prices are theoretical constructs that do not exist in reality; actual market prices, which apply to traded goods and services, may differ from these calculated values. Shadow prices fluctuate over time and across

professions, differing from market prices. The concept of shadow prices is often explained through the opportunity cost of factors, representing the potential economic loss from reducing one unit of a factor. For scarce factors in a country, the shadow price will exceed the market price, while for abundant factors, the shadow price will be lower than the market price.

This study aims to investigate shadow prices through a descriptive research approach, focusing on converting market prices into shadow prices for labour and foreign exchange. It involves a literature review and the application of conversion factors to establish principles for computing shadow wage rates. The research seeks to address market distortions and provide insights for informed policy-making.

Literature Review

Zolkover and Georgiev (2020) explored the balance between shadow activities and macroeconomic stability, focusing on fictitious investment transactions. They highlighted how shadow investments distort markets and impede financial resource mobilization. Analyzing Ukraine's economy from 2010 to 2019, the study used regression analysis and the Brown-Robinson method to identify a nonlinear relationship between fictitious investments, shadowing, and stability. Their findings suggest that maintaining fictitious investment at 14.76% of GDP could enhance stability and reduce shadowing, offering valuable insights for policymakers to improve the business environment and attract foreign investment.

Vijayalakshmi and Sangeetha (2023) investigated the application of shadow pricing in project analysis, especially in developing countries where the assumptions of neoclassical economics frequently do not apply. They found that shadow prices can occasionally replace distorted market prices, though not universally. The paper concentrated on assessing critical economic resources in sectors with imperfect markets, such as wage rates, exchange rates, capital costs, and inflation. Shadow pricing was found to be crucial for shaping public policies, evaluating projects, and programming, with cost-benefit analysis (CBA) being a key method for project evaluation.

Fedajev et al. (2022) studied the shadow economy (SE) and its varying impact on different countries, particularly market and transition economies, highlighting that socio-economic characteristics influence the SE's forms and mechanisms. The study emphasized the importance of understanding SE factors during the post-crisis period due to their effect on tax revenue, which is crucial for implementing anti-crisis measures. By analyzing data from 17 markets and 19 transition economies in Europe between 2009-and 2014 using the PLS-SEM method, the research identified key factors affecting the SE, such as a country's wealth and development, market openness, tax system, and political environment. The findings indicated that a favourable political environment, greater wealth and development, and a lower tax burden in transition economies contribute to a smaller SE, while greater market openness and a higher tax burden increase it. Conversely, in market economies, a high tax burden and greater market openness reduce the SE, with the political environment and wealth and development also playing positive roles. The study used the Multi-Group Analysis (MGA) method to compare path coefficients and found that differences in the relationship between market openness and SE are not statistically significant. The paper concluded with recommendations for policymakers in both market and transition economies based on these findings.

Mishchuk et al. (2020) evaluated the connections between the formal economy, the shadow economy, and social safety in Ukraine, revealing that the shadow economy significantly exceeds critical levels, ranging from 18% to 46% in 2018. This extensive shadow economy negatively impacts GDP, with a correlation coefficient of -0.729, and contributes to the country's low global competitiveness. It also deteriorates social safety by increasing poverty, maintaining an inefficient cost structure with high food expenditures, and limiting housing opportunities. The analysis showed strong negative relationships between the shadow economy and both economic and social safety, with correlation coefficients of -0.865 and -0.560, respectively. The paper estimated the economic losses due to reduced tax revenues and highlighted the urgent need for public administration to prioritize reducing the shadow economy in Ukraine.

Meneghello et al. (2024) presented a new technique for estimating shadow wages and evaluating the shadow contribution of child labour to household income, offering a direct method to test recursively by comparing shadow wages with market

wages. This innovative strategy for testing non-separability complements traditional indirect methods and can also identify gender-specific shadow wages. The study's estimated shadow wages are relevant to Nepal's rural economy, showing that the separable representation of farm households is inconsistent with the Nepalese data. Additionally, the research measured the contribution of child labour to household and national income, with simulations demonstrating its impact on household livelihoods and income distribution, providing valuable insights for policymakers and researchers.

Research Methodology

This paper employs descriptive research methodologies to investigate the concept of shadow prices in economic analysis. The research commences with a thorough literature review aimed at exposing existing theories and methodologies for calculating shadow prices, with a particular emphasis on influential works by Little and Mirrlees (1974), Squire and Van der Tak (1975), and other influential scholars. This review serves to situate shadow prices within the broader context of economic theory and practice, underscoring their critical role in cost-benefit analysis. This analysis utilizes conversion factors to translate market prices into shadow prices, applying formulas such as the shadow wage rate for labor and conversion factors for foreign exchange rates. This study seeks to establish general principles for computing shadow wage rates, thereby furnishing a robust framework for accurately estimating the genuine economic worth of labor and foreign exchange in cost-benefit analysis. This methodology aims to address market distortions and offer valuable insights for policy-making, contributing to more informed decision-making processes.

Analysis and Discussion

Conversion factors

The conversion factors method is the most straightforward and commonly employed technique for translating market values into shadow prices (Little & Mirrlees, 1974). This approach involves using a conversion factor, which can be defined as:

$$\text{Conversion factor} = \frac{\text{Shadow price}}{\text{Market price}}$$

By applying the relevant conversion factor, one can easily estimate shadow prices. The initial step is to ascertain these conversion factors. For instance, if the market wage is Rs. 400 per day and the conversion factor is 0.8, the shadow wage rate would be calculated as follows:

$$\text{Shadow Wage Rate} = Wage\ Rate\ X\ Conversion\ factor = 400X0.8 = 320$$

This method simplifies the process of estimating shadow prices by providing a direct relationship between market prices and shadow prices through the conversion factor.

Determination of the Accounting Price of the Labour

Determining the accounting price of labor, or the shadow wage rate, is a crucial aspect of cost-benefit analysis in developing economies. Shadow wage rates reflect the true economic value of labor, accounting for market imperfections, unemployment, and underemployment. Unlike market wages, shadow wage rates consider the opportunity cost of labor, social costs, and benefits, providing a more accurate measure for project evaluation and policy-making. Determining the shadow wage rate is crucial yet challenging due to the varying efficiencies among laborers, including both skilled and unskilled workers. In rural areas of developing countries, there is often a surplus of labor with nearly zero marginal product, but its opportunity cost should not be considered zero. The market wage rate does not necessarily reflect the opportunity cost of labor forgone, especially when no output is lost due to labor being employed in a project amid mass unemployment. Hence, there appears to be no direct relationship between the output forgone and the market wage paid to workers (Little & Mirrlees, 1974).

In a perfectly functioning labor market, the market wage rate and the opportunity cost of labor would align. However, in an imperfect market, the output forgone does not correspond to the market wage rate, leading to market wages being higher than the supply price of labor. In developing economies with high unemployment and underemployment, calculating wage costs based on prevailing market wages is inappropriate. The market wage represents the financial cost but not the economic cost, indicating that the market wage would be higher than the wage

determined by the equilibrium of demand and supply. Therefore, the market price exceeds the shadow price in developing countries.

Little & Mirrlees (1974) have suggested the following formula for calculating the shadow wage rate.

$$\text{SWR} = c' - \frac{I}{s}(\text{c} - \text{m})$$

Where,

SWR = Shadow wage rate

c' = Additional resources devoted to consumption

I= Value of a unit of resources uncommitted

I/s = Value of unit of committed resource

c = Consumption of wage earner

m = Marginal productivity of the wage earner

Above formula can be written in extended form as follow:

$$\text{SWR} = m + (\text{c}' - \text{c}) + \left(1 - \frac{1}{\text{s}}\right)(\text{c} - \text{m})$$

m= Marginal product of labour

$(\text{c}' - \text{c}) = \text{The cost of urbanization}$

$\left(1 - \frac{1}{\text{s}}\right)(\text{c} - \text{m}) = \text{The cost of having an extra amount}$

A special case occurs when a developing country does not have sufficient workers with skills demanded by the project, then the required workers must be brought from abroad. The shadow wage for foreign labour (SW_f) would be computed as follows:

$$SW_f = [\ h + (1-h)\ (cc_f)\ ]\ (p_w)$$

Where,

SW_f = Shadow wage for foreign labour

h= The fraction of the project wage spent or taken home

(1-h) = The fraction spent domestically

cc_f = Consumption conversion factor

p_w= Project wage

Determination of the Rate of Foreign Exchange

Developing countries often struggle with balance of payment problems, making it important to use shadow pricing for foreign exchange. These countries can achieve a more balanced financial state by setting a shadow exchange rate that differs from the official rate. The official exchange rate might not show the true availability of foreign currency. Usually, due to the limited supply of foreign exchange, the market rate is higher than the official rate. This shortage is a major challenge for many developing countries (Little & Mirrlees, 1974).

To address these imbalances and make better economic decisions, it's crucial to use a shadow exchange rate in project analysis. This rate offers a more accurate value of foreign currency compared to the official rate, helping with better planning and resource management. The formula for calculating the shadow exchange rate considers the actual economic conditions, unlike the often misleading official rates. Using this method, policymakers and analysts can make more informed decisions that reflect the true economic costs and benefits of foreign exchange.

$$\mathrm{CFf} = \frac{M + Tm + X - Tx + Sx}{M + X} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where,

CF_f = Conversion factor of shadow exchange rate

M = Total amount of import

T_m = Total value of import duties

X = Total value of export

T_x= Total value of export taxes

S_x= Total value of export subsidies

Equation (1) assumes that additional foreign exchange expenditure affects the level of imports as well as exports in proportion to their value in total trade. But the following formula assumes that additional foreign exchange expenditure only affects the level of imports.

$$\mathrm{CFf} = \frac{M + Tm}{M} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Equation (2) usually gives a higher value for Shadow Exchange Rate (SER) than equation (1) because in most countries the average rate of import duty is much higher than the rate of net export subsidy. This thing can be clarifying with the help of one numerical example.

Let us assume

M = 200,

X= 120

Tm = 50 (average 25% rate of duty)

T_x = 12 (average 10% rate of duty)

S_x = 6 (Average 5% rate of subsidy)

In equation (1), $\mathrm{CFf} = \frac{200 + 50 + 120 - 12 + 6}{200 + 120} = 1.14$

In equation (2), $\mathrm{CFf} = \frac{200 + 50}{200} = 1.25$

Determination of the Shadow Price

An Import

The cost, insurance, and freight (CIF) price represents the total cost of an import, including insurance and freight charges to the destination port. It's often referred to as a border price because it reflects the foreign currency required to pay for the import at the border. When assessing an import's value, additional expenses like transportation costs are incorporated into the CIF price using their respective shadow prices. Notably, tariffs are not included in this calculation.

An Export

The free on board (FOB) price is the selling price of an export at the port of departure before adding insurance and freight charges. It encompasses the production cost of the item, export taxes, and the expense of transporting it to the departure point. Export taxes are included because foreign buyers generally do not bear them. The shadow price of an export is determined based on how much each unit contributes to the country's foreign exchange earnings.

General Principles for Calculating the Shadow Wage Rate

When estimating the Shadow Wage Rate (SWR), it is crucial to consider the extent and nature of unemployment and underemployment in the project area and its surroundings. Independent surveys conducted in these areas are preferred to validate estimates obtained from official sources, ensuring more accurate and context-specific calculations. This approach is recommended because it allows for a detailed and

localized understanding of labor market conditions, which can vary significantly from one region to another. By conducting independent surveys, project planners can obtain more precise data on the actual labor supply and demand, as well as the local economic factors affecting employment (Asian Development Bank, 1999).

- The economic value of labor is determined by its supply price, which considers factors such as the preference for leisure over work at low wages, family income, migration costs, and the benefits associated with different types of employment. The reservation wage, the minimum wage at which individuals are willing to work, varies across different types of work and geographical locations.
- There is significant diversity in labour types based on skills, regional differences within countries, and specific job roles. Therefore, it is often necessary to establish multiple shadow wage rates tailored to different skills, locations, economic sectors, and even seasonal variations, rather than applying a uniform rate nationwide. Workers are typically categorized into skilled, semi-skilled, and unskilled categories, each reflecting varying levels of scarcity in the labour market.
- Skilled workers are generally in short supply in developing nations, making prevailing market wages in specific project areas reflective of their supply price. This assessment should also include additional benefits like housing and contributions to provident funds in estimating the supply price.
- For semi-skilled labourers, wages in the informal or unregulated sectors, adjusted for local unemployment levels, provide a basis for estimating the Shadow Wage Rate (SWR). This estimation involves calculating a weighted average of wages from both formal and informal sectors, considering the proportion of labour sourced from each sector.
- Unskilled workers' SWR is determined based on their wages in the unregulated sector over a year of employment, accounting for the high rates of unemployment and underemployment prevalent in both rural and urban areas of developing countries.
- When estimating SWR, careful consideration is given to the extent and nature of unemployment and underemployment in the project area and its

surroundings. Independent surveys conducted in these areas are preferred to validate estimates obtained from official sources.

Difficulties in Calculating the Shadow Prices

1. **Data Availability**: Accurate shadow price calculations require comprehensive and reliable data. In many developing countries, such data is often insufficient, leading to challenges in determining precise shadow prices (Squire & Van der Tak,1975).
2. **Intrinsic Value**: Determining the intrinsic or true value of factors or products requires a state of full market equilibrium, which is rarely achieved in developing economies. This lack of equilibrium makes shadow prices somewhat arbitrary (Dreze & Stern, 1987).
3. **Assumption of Full Employment**: Shadow prices assume full employment, needing comprehensive data on supply and demand dynamics, which is often unavailable (Dasgupta et al., 1972).
4. **Time Dynamics**: Shadow prices are static and do not reflect real-time changes in factor prices, making them unrealistic for dynamic economies (Pearce & Nash, 1981).
5. **Marginal Productivity Calculation**: Estimating shadow prices requires calculating marginal productivity across various factors, a challenging task due to data limitations and complexities (Harberger, 1971).
6. **Practical Implementation**: Governments use shadow prices for project evaluations, but must procure inputs and sell outputs at market prices. This creates practical difficulties in aligning theoretical shadow prices with real-world transactions (Baumol & Oates, 1988).

Prospective of Shadow Pricing

1. **Optimal Resource Allocation**: Shadow pricing facilitates efficient resource allocation by accurately reflecting the true economic costs and benefits, including externalities often overlooked by market prices alone (Loehman et al., 1998).
2. **Enhanced Cost-Benefit Analysis**: By incorporating social costs and benefits beyond market prices, shadow pricing improves the accuracy of cost-benefit

analyses. This enables policymakers to make well-informed decisions about projects and policies (Boardman et al., 2018).

3. **Addressing Market Failures**: It helps mitigate market failures such as externalities and imperfect competition by valuing goods and services at their social opportunity costs rather than just their market prices (Sen, 1972).
4. **Support for Long-Term Planning**: Shadow pricing provides a framework for evaluating the long-term economic impacts of policies and projects, considering fluctuations in market conditions and evolving social values (Dasgupta et al., 1972).
5. **Promoting Environmental and Social Sustainability**: Including environmental and social factors in pricing promotes sustainability goals. It encourages investments and policies that account for broader societal impacts beyond immediate financial returns (Baumol & Oates, 1988).
6. **Effective Policy Design and Evaluation**: Governments use shadow prices to design and evaluate policies related to pricing, subsidies, taxes, and resource management, thereby achieving policy objectives more efficiently and equitably (Dreze, & Stern, 1987).
7. **Facilitating International Trade and Development**: In the realm of international trade and development, shadow pricing assists developing countries in managing foreign exchange constraints, optimizing trade policies, and attracting investments based on realistic economic values (Squire & Van der Tak, 1975).
8. **Enhanced Risk Management**: By assessing economic risks associated with different decisions, shadow pricing provides a comprehensive view of potential outcomes and their probabilities, aiding in effective risk management strategies (Loehman et al., 1998).

Conclusion and Implications

In summary, shadow prices are crucial in economic analysis and policy formulation, acting as theoretical tools to ascertain the genuine economic worth of factors and goods beyond their market values. Inspired by J. Tinbergen's notion of equilibrium prices, shadow prices reveal disparities across time, regions, and types of labour due to market imperfections. While ideal in competitive markets, their divergence from actual market prices in imperfect economies complicates cost-benefit

assessments, where societal impacts supersede private profitability. Encompassing dimensions like labour wages, interest rates, and foreign exchange, shadow prices leverage conversion factors and opportunity costs to refine economic assessments. Despite challenges like data scarcity and static pricing in dynamic economies, their integration promises to optimize resource allocation, bolster policy efficacy, and promote sustainable development goals through informed decision-making globally.

The application of shadow prices in economic analysis significantly enhances project evaluation and policy-making by providing a true economic value of resources, which is crucial in developing economies where market imperfections distort actual values. This approach helps in accurately identifying projects and policies that contribute to economic development and social welfare, addressing market failures, and ensuring optimal resource allocation. Furthermore, shadow pricing aids in designing more effective subsidies, taxes, and resource management policies, while also supporting developing countries in managing foreign exchange constraints and optimizing trade policies for better economic stability and growth.

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