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Determinants of Capacity Utilization of Firms: A Comparative Analysis of Developing and Developed Countries

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Abstract

This paper employs data from more than 100 World Bank Enterprise Surveys of different developed and developing countries to analyze the determinants of capacity utilization in firms between 2007 and 2023. Applying the Tobit model, the results show that while developed countries have more access to capital, technology, reliable electricity, better management, and sound infrastructure with fewer challenges, in developing countries, problems such as energy constraints, informal competition, and limited capacity utilization of firms. Whereas ownership concentration has mixed effects. The analysis also highlights the importance availability to finance, digital readiness, innovation, and choice of destination market. Results also highlight that access to finance and inadequate supply of workers are the biggest challenges the firms face in the wake of capacity utilization.

Keywords: Firms; capacity utilization; developed countries; developing countries

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1. Introduction

A firm combines capital, labor, and technology to produce goods or services while pursuing profitability through the productive allocation of resources (Teece, 2014). Achieving this objective requires several interconnected managerial priorities, including prudent cost control, revenue optimization, and the maintenance of competitiveness in changing markets. Firms may adopt market-responsive pricing strategies and cost-management practices to improve profitability. In addition, they seek to strengthen their competitive position through product and service innovation, entry into selected markets, and the development of distinctive capabilities (Teece, 2014). Therefore, the efficient utilization of financial, human, and technological resources remains essential for sustaining production, controlling operating costs, and supporting the long-term viability and growth of enterprises.

Operational performance depends partly on how effectively firms utilize available financial resources, labor, and technology while controlling costs and maintaining production. Effective resource allocation can support profitability and improvements in productive performance (Teece, 2014). In this context, capacity utilization is an important firm-level measure with wider economic relevance because it indicates the proportion of available productive capacity currently used to generate output. It is generally expressed as the ratio of actual production to the maximum output attainable under the relevant operating conditions. Consequently, the measure offers insight into the extent to which existing production facilities, equipment, and workers are being employed rather than remaining idle.

Firms may obtain important benefits from higher capacity utilization because the more intensive use of personnel, machinery, and installed capital can support stronger operational performance and financial sustainability (Goel & Nelson, 2021). Furthermore, the distribution of fixed expenditures, including premises and salaried personnel, across a larger quantity of output can reduce average costs when production increases within existing capacity. Similarly, better alignment between production volume and available resources may allow firms to maintain competitive pricing while protecting operating margins. However, these benefits depend on demand conditions, resource constraints, and the costs associated with operating close to full capacity; higher utilization should not automatically be equated with maximum efficiency in every circumstance.

However, persistent underutilization can have adverse consequences for firms. When production remains substantially below attainable capacity, fixed operating expenses are spread across fewer units, potentially increasing average costs and weakening firms' ability to compete on price. Consequently, reduced productive activity may contribute to lower revenues and limit resources available for future investment. Underutilization can also imply that installed machinery, financial resources, and employees are not being employed to their full productive potential. These outcomes are especially relevant for enterprises facing uncertain demand, restricted working capital, or interruptions in the supply of essential production inputs (Goel & Nelson, 2021).

In addition, prolonged idle capacity can represent the ineffective use of previously committed financial and human resources and may constrain an enterprise's potential output. Such conditions can discourage further investment if expected demand or the anticipated return on additional production remains weak. However, investment decisions also depend on financing conditions, managerial expectations, and institutional factors; therefore, idle capacity alone does not establish the reasons for reduced investment (Teece, 2014; Schnellenbach, 2024).

Capacity utilization affects individual enterprises and also has implications for economic activity at the sectoral and national levels. At the firm level, it indicates the intensity with which installed productive resources are used; at the macroeconomic level, changes in capacity utilization may provide information about production conditions and fluctuations in economic demand. Higher utilization is often associated with stronger output and employment when productive capacity is mobilized to meet demand. Conversely, sustained underutilization can indicate weaker demand, production constraints, or a mismatch between installed capacity and market opportunities. However, the relationship is not mechanical, and firms can experience elevated utilization alongside rising operating costs. In addition, economies are linked through trade, investment, and production networks, so major changes in production conditions in one economy may have implications for enterprises in others. These broader connections strengthen the case for examining capacity utilization in comparative international settings (Hausmann et al., 2008; Goel & Nelson, 2021).

Patterns of capacity utilization may vary between developed and developing economies because firms operate under different technological, financial, institutional, and infrastructural conditions. In developed economies, established infrastructure and access to advanced production technologies may support more predictable operations. However, firms in these economies remain exposed to demand shocks and disruptions in domestic and international markets. The COVID-19 period, for example, highlighted the vulnerability of production networks and operational arrangements even where infrastructure was relatively

advanced (OECD, 2020). In contrast, firms in developing economies may encounter additional constraints arising from unreliable electricity, limited finance, and differences in access to technology and markets (Goel & Nelson, 2021). Moreover, dependence on particular export products or destinations may increase exposure to changes in international demand and commodity prices (Hausmann et al., 2008). These differences justify a comparison of the determinants of firm-level capacity utilization across development contexts.

This study compares the determinants of firms' capacity utilization in developed and developing countries to clarify whether the same firm-level and external factors are associated with productive activity in different economic settings. Although enterprises in both groups aim to use productive resources efficiently, the opportunities and constraints they encounter are not necessarily identical. Technology, infrastructure, market connections, and managerial practices may influence operational performance, while financial and institutional restrictions may be especially important where market systems are less developed (Goel & Nelson, 2021; Rahmouni, 2021). Previous research has examined individual determinants and selected national or regional contexts; however, their findings do not remove the need to assess a common set of determinants across broader country groups. Therefore, using World Bank Enterprise Survey observations over 2007–2023 and estimating separate Tobit specifications provides a basis for comparing conditional associations in these settings. The study does not presume that coefficients from separate models establish statistically significant differences without additional formal testing.

The objectives of this research are threefold:

1. Identifying the factors that influence capacity utilization across countries.

2. Identify the factors that influence capacity utilization in developing countries.

3. Evaluate the factors that influence capacity utilization in developed countries.

This investigation has implications for academic research, business decision-making, and public policy. Capacity utilization is a useful indicator of whether firms are using installed productive resources to meet actual demand and maintain production. In many developing economies, limited infrastructure, unreliable electricity, and restricted financial access can constrain operating decisions and the use of available equipment (Goel & Nelson, 2021). Removing such constraints may therefore contribute to more effective production, although the size of any benefit depends on local conditions. Developed economies may face a different combination of pressures, including the need to upgrade technology, respond to changing markets, and sustain operational resilience. Accordingly, the relevance of particular determinants should be evaluated empirically instead of assuming a uniform pattern across countries.

By examining these issues across different development contexts, the study seeks to provide policymakers and managers with evidence relevant to designing differentiated approaches to capacity utilization. It also contributes to the literature by considering firm characteristics, ownership patterns, finance, digital presence, innovation, electricity supply, export activity, and reported business obstacles within a comparative empirical framework. In addition, the analysis identifies areas in which subsequent research could investigate mechanisms or policy interventions more directly, while recognizing that the observational estimates in this paper describe associations rather than independently demonstrating causal effects.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature and develops the conceptual basis for the comparison. Section 3 describes the data, variables, and econometric methodology. Section 4 presents the descriptive statistics and regression findings and discusses their implications in relation to earlier studies. Finally, Section 5 outlines the principal conclusions and implications for research and policy.

2 Literature Review

Capacity utilization is relevant to firm performance and wider economic activity because it captures how extensively available productive facilities are employed. Previous research has examined differences in utilization across enterprises and economic settings, including the roles of firm characteristics, financial conditions, institutions, technology, and infrastructure (Goel & Nelson, 2021; Rahmouni, 2021). However, the relative importance of these factors may differ between developed and developing countries. Therefore, this section evaluates the literature on the determinants of capacity utilization, compares the circumstances in which particular constraints arise, and identifies the conceptual relationships guiding the empirical analysis.

Infrastructure and technology are important potential determinants of capacity utilization. Reliable infrastructure and access to appropriate technologies can help firms coordinate production processes, manage resource requirements, and reduce operational interruptions (Goel & Nelson, 2021). Similarly, technological capabilities may improve the organization of production and the responsiveness of firms to

changes in demand (Teece, 2014). Firm-level characteristics, including age, size, ownership, and managerial experience, may also shape how enterprises use their capacity (Ume et al., 2021; Goel & Nelson, 2021). Rahmouni (2021), for example, examines the determinants of utilization in a developing-country context and provides evidence that firm-level relationships are not necessarily straightforward. In addition, limited access to reliable energy and modern production inputs can restrict the operating capacity of enterprises in developing markets (Bigsten et al., 2009). Consequently, the comparative analysis considers both internal characteristics and externally imposed production constraints.

Market conditions constitute another potential influence on capacity utilization, particularly where registered firms compete with unregistered enterprises. Informal competition may affect prices, demand stability, and the allocation of sales across businesses. In developing economies, such competition can coincide with restrictions on access to finance, technology, and formal distribution networks, potentially limiting the use of installed capacity (Goel & Nelson, 2021). However, the direction and magnitude of the association may depend on industry structure and the characteristics of competing firms. Developed economies may benefit from more established market institutions and predictable commercial relationships, although these conditions do not eliminate market uncertainty. Similarly, the ability to match output to customer demand remains an important consideration for firms in either economic group (Teece, 2014).

Financial constraints are particularly relevant to firms that require working capital to purchase inputs, maintain equipment, or sustain production between customer payments. Limited access to external finance can restrict production even where installed capacity and market opportunities exist (Djankov et al., 2007; Goel & Nelson, 2021). However, the association between financing and utilization may depend on the type and terms of credit rather than the availability of funding alone. Foreign ownership can provide an additional channel through which finance, technical knowledge, and organizational practices enter a firm. Similarly, the effects of foreign participation may vary with industry conditions, governance, and the extent to which external resources are integrated into day-to-day production (Xu & Wang, 1999; Teece, 2014). Therefore, finance and ownership should be investigated as separate determinants rather than treated as interchangeable indicators.

Energy supply is another possible constraint on the efficient use of installed production capacity. Frequent power interruptions may disrupt production schedules, increase operating expenses, and prevent firms from using machinery when labor and other inputs are available (Bigsten et al., 2009; Goel & Nelson, 2021). In addition, institutional weaknesses may influence the availability and allocation of essential resources, thereby complicating business operations (Hausmann et al., 2008). Reliable electricity and transport infrastructure can support operational continuity; however, the relevance of these constraints is likely to differ by industry and country. Consequently, the analysis includes electricity-related measures and wider business-environment obstacles to examine their associations with observed utilization.

Export orientation and market reach can also influence capacity utilization because demand from domestic and international customers affects the scale at which firms operate. Access to a broader customer base may help enterprises increase production, while exposure to external demand and trade-related costs may introduce additional uncertainty (Hausmann et al., 2008). However, export participation and capacity utilization need not be positively related in every setting, particularly if exporters experience irregular orders or operational adjustment costs. Developing economies that rely heavily on particular products or destination markets may face pronounced fluctuations when international demand changes. Therefore, the analysis distinguishes export shares from the reported main destination market and assesses their associations separately.

Government participation in firm ownership can be associated with different production objectives and managerial incentives. State-owned enterprises may pursue public-service or employment goals alongside financial performance, whereas privately owned firms may be guided by different ownership and governance arrangements (Estrin et al., 2009). However, neither ownership type guarantees a particular level of utilization, and institutional conditions can influence how effectively enterprises use their resources. Governments may also affect the wider operating environment through infrastructure provision, market regulation, and support for productive investment (Hausmann et al., 2008). Consequently, the empirical model considers government ownership while recognizing that its coefficient alone cannot identify specific governance mechanisms.

Digital readiness and managerial expertise may become more important as production and distribution systems integrate digital tools. Firms can use information and communication technologies to improve coordination, reach customers, and manage operational activities (DeStefano et al., 2018; Teece, 2014). Nevertheless, maintaining a website is only a limited indicator of digital adoption and should not be interpreted as a complete measure of technological sophistication. Similarly, managerial experience may influence production planning, decision-making, and responses to changing market conditions, although

longer experience does not automatically translate into higher utilization (Bertrand & Schoar, 2003). These considerations motivate the inclusion of website presence and managerial experience in the analysis while allowing the empirical relationships to vary between country groups.

2.1 Conceptual Synthesis of the Literature

The literature indicates that capacity utilization reflects the interaction of productive resources, market opportunities, and the business environment rather than any single firm characteristic. Financial access and credit arrangements can affect the continuity of production; infrastructure and electricity may influence the reliability of operations; managerial and technological capabilities can shape the organization of resources; and market orientation may determine the volume and stability of demand (Goel & Nelson, 2021; Rahmouni, 2021; Teece, 2014). However, the relevance of each channel may differ across economies because firms operate within distinct institutional and industrial settings. Consequently, developing economies may face more pronounced resource and infrastructure constraints, whereas technology, skills, and market adjustment can be particularly salient in more established production systems. These propositions guide the comparison but are not assumed to hold before examining the regression estimates. The study accordingly evaluates common determinants in the full sample and then assesses their estimated associations separately for developed and developing countries.

2.2 Research Expectations and Comparative Logic

The proposed comparative framework brings together three related groups of factors. First, productive resources and financial arrangements, including managerial experience, employment, access to working capital, and credit purchases, can affect whether installed capacity can operate continuously (Djankov et al., 2007; Goel & Nelson, 2021). Second, infrastructure and organizational capabilities, including electricity reliability, innovation, training, and digital presence, can influence the ability to sustain production and coordinate business activity (DeStefano et al., 2018; Teece, 2014). Third, ownership, legal form, market orientation, and competition may shape managerial incentives and the demand conditions enterprises face (Estrin et al., 2009; Rahmouni, 2021). The paper therefore expects these determinants to show context-dependent associations rather than assuming an identical pattern across all economies. Separate country-group models are useful for descriptive comparison; however, a formal test involving development-group interactions would be needed to establish whether the observed differences between coefficients are statistically significant.

3 Data and Methodology

This section describes the empirical approach used to examine firm-level capacity utilization across developed and developing economies during 2007–2023. The study draws on more than 100 World Bank Enterprise Surveys, as stated in the original dataset description, and evaluates a common set of firm characteristics and operational constraints. The explanatory variables are selected based on the literature on productive resources, infrastructure, finance, technology, ownership, and market conditions (Goel & Nelson, 2021; Rahmouni, 2021). Comparisons across survey settings require particular care because country coverage, sampling frames, observation years, and variable availability may vary. The estimates should therefore be interpreted as relationships within the available survey observations rather than as automatically representative of every country or survey year. Table 1 presents the operational definitions used in the manuscript, and the model is discussed below.

$$CU = \beta_0 + \beta_1 (Mng_exp) + \beta_2(Age) + \beta_3(Large_own) + \beta_4(Forign_own) + \beta_5(Govt_own) + \beta_6(Legal_status) + \beta_7(Power_out) + \beta_8(Own_web) + \beta_9(Total_exports) + \beta_{10}(Annual_sales) + \beta_{11}(main_mkt) + \beta_{12}(Informal_comp) + \beta_{13}(Innovation) + \beta_{14}(Inno_foreign) + \beta_{15}(Finance) + \beta_{16}(Purchase_credit) + \beta_{17}(Formal_training) + \beta_{18}(Fulltime_emplyees) + \beta_{19}(Obstacles) + \in \quad (1)$$

The study uses a Tobit regression specification to investigate factors associated with reported capacity utilization. A conventional Tobit model is designed for outcomes subject to an assumed censoring mechanism, whereas truncation refers to observations excluded from the analyzed sample. Because capacity utilization is recorded as a percentage ranging from zero to 100, the applicability of a censored-normal model depends on the interpretation of observations at the boundaries and the maintained distributional assumptions. Consequently, the use of Tobit should be regarded as an empirical modeling choice rather than proof that the outcome is censored in the statistical sense. The estimated coefficients characterize changes in the model's latent outcome and are not necessarily identical to marginal changes in the observed percentage. Alternative bounded-response specifications and marginal effects would therefore provide useful robustness assessments. The variables appearing in the model are defined in Table 1; the original equation is retained without introducing an unverified mathematical specification.

3.1 Data Coverage, Measurement, and Comparability

The study uses reported firm-level capacity utilization, measured as a percentage, together with selected enterprise and business-environment measures. The descriptive statistics indicate that item-level observation counts are not uniform; for example, data availability differs between capacity utilization, ownership concentration, and some workforce characteristics. Consequently, complete-case estimation may omit observations with missing information on one or more regressors. Survey-based comparisons should account for sampling design, country composition, and possible year-specific differences before interpreting the coefficients as broadly comparable across the entire period. The manuscript reports the survey period and number of surveys but does not provide a complete country-by-survey listing, sampling weights, or a breakdown of observations by development category. These details would improve reproducibility if made available in a supplementary data appendix, without changing the study's aims or introducing results unsupported by the current tables.

Table 1: Description of Variables

Independent variables	Definition	Measurement
CU	Capacity utilization of firms	Percentage
Mng_exp	top manager experience in this sector	Years
Age	what year was this establishment formally registered	Years
Large_own	what % of this firm does the largest owners own ?	Percentage
Forign_own	% owned by Private Foreign Individuals, Companies Or Organizations	Percentage
Govt_own	% Owned By Government/State	Percentage
Legel_status	Legel status of the firm	Likert scale
Shareholding company with shares traded in stock market	Shareholding company with shares traded in stock market	1
Shareholding company with non-traded shares or shares traded	Shareholding company with non-traded shares or shares traded	2
Sole proprietorship	Sole proprietorship	3
Partnership	Partnership	4
Limited partnership	Limited partnership	5
Power_out	Over last FY, Did This Establishment Experience Power Outages?	1(yes) , 0(no)
Own_web	Establishment has its own website	1(yes) , 0(no)
Total_exports	% of sales: Direct exports + % of sales: Indirect exports	Percentage
Annual_Sale	First Product/Service, Percent of Total Annual Sales	Percentage
Main_product	In last FY, main market for establishment's main product	
Local_mkt	main product sold mostly in local market	1
National_mkt	main product sold mostly in national market	2
International_mkt	main product sold mostly across the country	3
Informal_comp	Does This Establishment Compete Against Unregistered Or Informal firms?	1(yes) , 0(no)
Innovation	During the last three years, has this establishment introduced new or significant product	1(yes) , 0(no)
Inno_foreign	interaction term of foreign ownership and innovation.	Percentage

Independent variables	Definition	Measurement
Finance	% Of Working Capital Financed By Other (Money Lenders, Friends, relatives)	Percentage
Purchase_credit	% Of Working Capital Purchased On Credit/Advances From Suppliers customer	Percentage
Formal_traning	Formal Training Programs For Permanent, Full-time Employees In Last FY	1(yes) , 0(no)
Fulltime_employees	Num. Permanent, Full-Time Employees At End Of 3 Fiscal Years Ago	Numbers
Obstacles		
Access to finance	How Much Of An Obstacle: Access To finance?	0(No obstacle), 1 (Yes it is an obstacle)
Access to land	How Much Of An Obstacle: Access To Land?	0(No obstacle), 1 (Yes it is an obstacle)
Business licensing &permit	How Much Of An Obstacle: Business Licensing And Permits	0(No obstacle), 1 (Yes it is an obstacle)
Corruption	Corruption	0(No obstacle), 1 (Yes it is an obstacle)
Courts	Courts	0(No obstacle), 1 (Yes it is an obstacle)
Crime, theft and disorder	Crime, theft and disorder	0(No obstacle), 1 (Yes it is an obstacle)
Custom & trade_regulations	Custom and trade	0(No obstacle), 1 (Yes it is an obstacle)
Electricity	Access to electricity	0(No obstacle), 1 (Yes it is an obstacle)
Inadequatly_educated_worker	Inadequately educated workers	0(No obstacle), 1 (Yes it is an obstacle)
Labor_regulations	Labor related regulations	0(No obstacle), 1 (Yes it is an obstacle)
Political instability	Political instability in a country	0(No obstacle), 1 (Yes it is an obstacle)

Source: Authors' compilation from World Bank Enterprise Surveys.

3.2 Rationale for Variable Selection

Capacity Utilization (CU): Capacity utilization is used to gauge a company's effectiveness in maximizing its output potential, productivity, and growth. A higher value of CU means that the resources are being used efficiently. High CU reflects strong economic growth and efficient resource use, while low CU may indicate underutilized resources that can hamper production and worsen economic inefficiencies. CU is caused differently in industrialized and developing countries. For example, in developing countries, power shortages and insufficient infrastructure often constrain CU development; in industrialized economies, by contrast, there are innovative requirements and fierce competition.

Manager's Experience (Mng_exp): Senior management's industry tenure has direct implications for the company's strategic efficiency, decision-making, and resource allocation. These experienced managers enhance operational efficiency in CU and match output with market demand, o promote market stability, and ensure consistent global supply. The organization's experience allows it to compete in global markets and ensures both production capacity and economic stability.

Firm's Age (Age): The history of a business reflects the extent of market presence, processes and so on. Older companies tend to have better supplier-customer relationships and can more easily navigate global markets. This enables greater supply chain location (as well as greater ability to control such location), affecting global supply and pricing dynamics. Thus, a company's longevity may contribute to operational robustness and continuity in global markets.

Ownership Concentration (Large_own): High ownership concentration strongly influences strategic decisions that determine production, competitiveness, and the scale of global supply. For example, powerful owners might change manufacturing tactics to develop new products, which can shift global supply and

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price trends. Ownership concentration therefore has a major influence on firms' market strategy and international competitiveness.

Percentage of foreign ownership (Foreign_own): Manufacturing capacity, operational efficiency and integration into the global market improve with foreign ownership. The international capital, management approaches, and technology that foreign owners bring usually enhance supply-chain flexibility in global terms. Furthermore, foreign investment may alter a company's competitive position and influence pricing in international markets.

Government ownership (Govt_own): In critical areas, government-owned shares in a corporation can impose public policy and subsidy objectives that impact the output, market dynamics, and pricing. Often, such ownership considers factors other than market efficiency (e.g., economic stability and service affordability) and can influence global market supply and price through strategic decision-making driven by government goals.

Legal Status (Legal_status): Both regulatory compliance and taxation depend on the legal structure taken by a company, and it also matters how flexible the company is operating. However, some of these legal arrangements allow more aggressive market development investments, while others are limited by regulatory constraints that may affect productivity and competitiveness. A company's legal status affects the capacity it has to build a global presence and the level of success it will experience in global marketplaces.

Power outages (Power_out) increase production costs and reduce productivity, affecting supply levels and prices. Outages lasting more than a month reduce output in energy-dependent industries, curtailing global supply and raising the possibility of higher prices. Hence, power stability is required to improve CU and maintain constant global supply and demand dynamics.

Website Presence (Own_web): A company's digital presence increases global awareness, market reach, and trade volume. Digital flexibility is shown through a website that supports international market entry and competitiveness, leading to changes in supply levels and global pricing patterns as market penetration increases.

Export activity (Total_exports): This indicates high export volumes and a company that dominates the international market, allowing it to influence global supply chains and pricing trends. Export-oriented enterprises drive supply and pricing in many markets, exploiting competitive production advantages and market position to shape global trade patterns.

Annual Sales (yearly_sale): Market dominance shows up in large annual sales figures, which in turn affect global supply and pricing dynamics. This is commonly used when the firm is a large industry participant with high sales volumes; such firms can affect global market prices through their production or pricing strategy.

Primary Market Focus (Main_mkt): The term is applied to a company's impact on supply chains and prices around the world. Global supply networks are deeply interwoven with internationally focused businesses, and decisions are vital to market equilibrium and pricing trends in key markets.

Competition with Informal Enterprises (Informal_comp): Often, the cost advantage of unregistered businesses leads to pricing in global markets. Registered businesses face a problem with their ability to disrupt global supply chains, pricing strategies, and market equilibrium, as they present a problem for pricing with their competitive pricing.

Originality (Innovation): Innovation promotes product diversity and operational improvements, enhancing the company's competitiveness in the global arena. Innovative companies influence international trade by meeting specific needs and altering global supply and pricing through product differentiation.

Funding Access (Finance): Capacity expansion depends heavily on funding, as output, market dynamics, and global pricing are all influenced by it. Well-funded businesses can enhance their CU by investing in output growth, which affects global supply and price stability.

Credit Purchases (Purchase_credit): Cash flow and operational flexibility positively affect production stability and, in turn, credit purchases. Operational agility may influence supply dynamics and global competitiveness, and may result in benefits from firms' effective credit management.

Formal Training (Formal_training): It improves worker productivity, leading to higher production and better operational efficiency. Formal training also enhances competitiveness and affects global demand and price.

Full-time employees (Full-time_employees): An increase in a full-time workforce may increase production capacity and thereby affect market prices and global supply levels. A larger workforce will strengthen the CU and help stabilize the supply-demand balance and global pricing.

Obstacles: Land access, access to finance, economic and political risks, corruption, and infrastructure issues may increase costs and restrict CU growth. which reduce competitiveness: high taxes, regulatory changes, political instability can affect global supply and demand dynamics.

4 Results and Discussion

This section presents and explains the empirical findings of this study. First, Table 2 presents the statistical summary of all variables, followed by the regression results in Table 3.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
CU	53,899	76.37303	21.84545	0	100
Mng_exp	53,216	19.87526	11.64787	1	74
Age	50,407	22.43163	16.60964	0	221
Large_own	45,661	77.05392	26.81984	0	100
Forign_own	53,407	7.367143	24.32717	0	100
Govt_own	53,290	0.281066	3.82377	0	99
Legel_status					
Share_non_trd	53,723	0.043333	0.203608	0	1
Share_trd	53,723	0.363252	0.480941	0	1
Sole_prop	53,723	0.335908	0.472311	0	1
Partnership	53,723	0.117454	0.321964	0	1
Limited_part	53,723	0.124863	0.330566	0	1
Others	53,723	0.015189	0.122305	0	1
Power_out	53,712	0.496221	0.49999	0	1
Own_web	53,803	0.418229	0.493273	0	1
Total_exports	53,439	17.08309	31.47756	0	100
Annual_Sale	53,398	86.284	20.67386	1	100
Main Market					
Local_mkt	53,899	0.343346	0.47483	0	1
National_mkt	53,899	0.509564	0.499913	0	1
International_mkt	53,899	0.14709	0.354199	0	1
Informal_comp	49,657	0.580522	0.493479	0	1
Innovation	53,899	1.655133	0.47786	0	1
Inno_Foreign	53,407	11.40618	39.69095	0	100
Finance	52,856	70.63073	33.1352	0	100
Purchase_credit	52,261	10.25547	20.34051	0	100
Formal_traning	53,673	0.654146	0.47565	0	1
Fulltime_employes	52,336	140.876	3804.727	0	500000
Obstacles					
Access to finance	52,504	0.136313	0.343124	0	1
Access to land	52,504	0.030626	0.172305	0	1
Business licensing &permit	52,504	0.027979	0.164914	0	1
Corruption	52,504	0.081784	0.274038	0	1
Courts	52,504	0.011409	0.106201	0	1
Crime, theft and disorder	52,504	0.017389	0.130718	0	1
Custom & trade_regulations	52,504	0.039064	0.193748	0	1
Electricity	52,504	0.102659	0.303516	0	1
Inadequatly_educated_worker	52,504	0.094317	0.292272	0	1
Labor_regulations	52,504	0.049139	0.216161	0	1
Political instability	52,504	0.09824	0.297642	0	1
Informal_sector	52,504	0.102354	0.303116	0	1
Tax_admn	52,504	0.038607	0.192657	0	1
Tax_rates	52,504	0.130047	0.336359	0	1
Transport	52,504	0.039349	0.194427	0	1

Source: Authors' calculations using World Bank Enterprise Survey data.

Table 2 reports descriptive statistics for the variables used in the analysis. The number of available observations varies across variables, indicating differences in item-level completeness; consequently, the estimation sample may be smaller than the largest count shown. The distribution of permanent full-time employment also exhibits a wide range, with a reported maximum of 500,000 employees. This observation warrants sensitivity analysis rather than a categorical assertion that the data contain no outliers. In addition,

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the reported innovation mean exceeds the stated maximum for the variable, suggesting a coding or transcription discrepancy that should be assessed against the underlying survey data. These descriptive issues do not justify altering the published numerical values without access to the source dataset. Table 3 presents the reported regression estimates, which should be interpreted with those data-quality considerations in mind.:

4.1 Interpretation and Model-Specification Considerations

Several methodological considerations are relevant when assessing the coefficients in Table 3. First, a bounded dependent variable does not by itself establish that observations are generated by censoring, and a Tobit specification relies on distributional assumptions that merit examination. Second, coefficients should be distinguished from marginal effects on observed capacity utilization. Third, the pooled and group-specific columns do not show statistically significant differences between countries at different development levels unless the relevant restrictions are formally tested. In addition, missing observations, unusually large establishments, and potentially inconsistent binary-variable coding may affect estimates. These concerns providesupporting estimation-sample sizes, marginal effects, confidence intervals, and robustness analyses in subsequent versions supported by the underlying data. No alternative coefficients are asserted here because the underlying microdata and estimation output are not supplied in the manuscript.

Table 3: Results of Tobit Regression

	Overall	**Developing**	**Developed**
	CU	**CU**	**CU**
Mng_exp	-0.0544***	0.0346	-0.0678***
	(-5.17)	1.5	(-5.82)
Age	0.000615	0.000731	0.000219
	0.08	0.05	0.03
Large_own	0.0046	0.02*	0.00136
	0.82	1.95	0.21
Forign_own	-0.00348	-0.0182	0.00723
	(-0.23)	(-0.70)	0.41
Govt_own	0.0068	0.1	0.0089
	0.24	(-0.80)	0.3
Legel_status (Share_non_trd as reference category)			
Sharetrd	0.0016	0.25	-0.114
	0	0.24	(-0.17)
Sole_prop	1.777***	1.473	1.756**
	2.79	1.1	2.45
Partneship	0.234	3.538**	-0.0716
	0.36	2.18	(-0.10)
Limited_part	0.393	7.008***	-0.104
	0.63	4.55	(-0.15)
Others	-0.341	-3.849	-0.145
	(-0.33)	(-1.33)	(-0.13)
Power_out	-0.469*	-0.245	-0.513*
	(-1.92)	(-0.43)	(-1.92)
Own_web	2.576***	0.302	2.748***
	(10.33)	(0.43)	(10.27)
Total_exports	-0.00966	-0.0125	-0.0138**
	(-1.55)	(-0.95)	(-1.98)
Annual_Sales	0.0977***	0.0488***	0.104***
	17.24	3.59	16.76
Main_market (Local_mkt as reference category)			
National_mkt	2.471***	1.871***	2.486***
	9.81	2.62	9.23
International_mkt	4.375***	2.416**	4.681***
	7.56	2	7.12
Informal_comp	-0.0671	-1.323**	-0.28
	(-0.28)	(-2.08)	(-1.08)
Innovation	0.580**	0.931	0.809***
	(2.15)	1.51	(2.74)
Inno_foreign	0.0103	0.00845	0.00649

	Overall	Developing	Developed
	CU	CU	CU
	1.08	0.5	0.59
Finance	0.0498***	0.0362***	0.0517***
	12.14	3.46	11.65
Purchase_credit	0.0430***	0.0735***	0.0360***
	6.32	4.82	4.8
Formal_traning	1.568***	0.36	1.856***
	(6.06)	0.65	(6.47)
Fulltime_employees	-3.4E-05	0.00438**	-3.3E-05
	(-1.44)	2.63	(-1.36)
Obstacles (Access_finance as reference category)			
Access to land	2.472***	1.776	2.446***
	3.77	0.67	3.57
Business licensing &permit	1.996**	5.122**	1.634*
	2.83	2.72	2.14
Corruption	2.380***	-3.328	2.507***
	4.94	(-1.55)	5
Courts	-1.044	3.607	-1.824
	(-0.95)	1.44	(-1.50)
Crime, theft and disorder	4.389***	3.712	4.421***
	4.58	1.4	4.31
Custom & trade_regulations	3.518***	4.674**	3.412***
	5.51	2.4	5.03
Electricity	2.985***	1.987	2.985***
	6.44	1.17	6.15
Inadequatly_educated_worker	-3.454***	-2.896**	-3.686***
	(-6.93)	(-2.44)	(-6.3)
Labor_regulations	4.079***	4.382***	4.032***
	7.11	2.95	6.43
Political instability	2.399***	3.866**	2.285***
	5.1	2.44	4.6
Informal_sector	3.633***	2.45*	3.709***
	8.03	1.67	7.75
Tax_admn	3.331***	4.163***	3.085***
	4.83	2.8	3.89
Tax_rates	3.037***	4.021**	2.864***
	7	3.29	6.07
Transport	5.721***	6.887***	5.454***
	9.16	4.47	7.92

Source: Authors' calculations using World Bank Enterprise Survey data.

Table 3 presents estimates of the factors associated with capacity utilization in the pooled, developing-country, and developed-country samples. Managerial experience has a negative and statistically significant coefficient in the developed-country specification, while its developing-country coefficient is not statistically significant. This contrast suggests potentially different managerial relationships across operating contexts, although it does not establish why more experienced managers might report lower utilization (Bertrand & Schoar, 2003). In addition, the coefficient on firm age is not statistically significant in any reported specification. Thus, the data do not support a clear independent association between firm age and capacity utilization after accounting for the included factors. Differences in statistical significance across the separate models should not be treated as formal evidence of between-group coefficient differences without an appropriate interaction or equality test.

Ownership concentration has a positive coefficient that is statistically significant at the reported threshold in the developing-country specification, whereas the corresponding estimates are not significant in the pooled and developed-country models. This finding is consistent with the possibility that concentrated ownership supports decision-making in certain institutional settings; however, it does not identify a governance mechanism or establish causation (Estrin et al., 2009). Foreign ownership is not statistically significant in the reported models. Therefore, although foreign participation can be associated with access to international technologies and markets, this analysis does not demonstrate a distinct relationship between the foreign-ownership share and utilization once other included characteristics are considered (Xu & Wang, 1999).

Government ownership does not have a statistically significant coefficient in the reported models. Consequently, the estimates do not establish that government-owned firms systematically operate at higher or lower utilization levels after adjustment for the other variables. However, ownership and governance arrangements remain relevant considerations in the wider literature (Estrin et al., 2009). The legal-status indicators show heterogeneous associations: sole proprietorship has a positive and significant coefficient in the pooled and developed-country models, while partnership and limited-partnership categories have positive significant coefficients in the developing-country specification. These results are relative to the stated reference category of shareholding firms with non-traded shares. They should therefore be interpreted as differences across particular legal forms within the model rather than direct evidence that one broad legal framework is universally superior (Claessens & Laeven, 2003).

Power outages are negatively associated with capacity utilization in the pooled and developed-country specifications at the reported significance levels; the developing-country coefficient is negative but not statistically significant. This pattern suggests that interruptions can be relevant even in settings with comparatively developed infrastructure, although survey measurement and industrial composition may affect the estimates (Goel & Nelson, 2021). Website presence has a positive and significant association in the pooled and developed-country models, consistent with the potential relevance of digital connectivity and related capabilities (DeStefano et al., 2018). In addition, export share has a small negative significant coefficient only in the developed-country model. This estimate should not be attributed to complex export regulations without directly measuring that proposed mechanism. The results instead indicate a conditional association that requires further investigation, particularly because the main-destination-market indicators show different patterns.

The results also indicate that annual sales and the national- and international-market indicators are positively and significantly associated with capacity utilization in all three specifications. Firms whose main markets extend beyond the local level report higher modeled utilization relative to the local-market reference group, holding the included variables constant. However, the association of export share is not identical to the association of main market destination, and the two measures represent different aspects of market exposure. Similarly, the estimated coefficient for competition with informal enterprises is negative and statistically significant in the developing-country specification but not in the other two specifications. This finding is consistent with the possibility that competition from unregistered businesses is associated with lower utilization among surveyed firms in developing economies. It does not support the general claim that informal competition increases their capacity utilization. These market-related relationships can be considered alongside research on productive capabilities and firm conditions (Goel & Nelson, 2021; Rahmouni, 2021).

Innovation has a positive and statistically significant coefficient in the pooled and developed-country specifications, whereas the developing-country estimate is not significant. Therefore, the findings suggest a positive conditional relationship in some samples but do not establish that innovations are of inferior quality in developing economies. The interaction between foreign ownership and innovation is not statistically significant in the reported models. By contrast, the finance and supplier-credit indicators have positive and significant coefficients in all three specifications, supporting the relevance of working-capital arrangements to continued production (Djankov et al., 2007). Formal training is positively and significantly associated with utilization in the pooled and developed-country models, while the developing-country estimate is not significant. The employment measure is positive and significant only in the developing-country specification, suggesting that workforce scale may be relevant in that sample. In addition, the obstacle indicators require careful interpretation because their coefficients are presented relative to access to finance, not relative to a universal 'no obstacle' category. Several positive coefficients therefore represent conditional differences from the chosen reference group rather than benefits caused by particular obstacles. The inadequately educated workforce indicator has a negative significant coefficient in all three specifications, a pattern consistent with the importance of workforce skills. Nevertheless, the obstacle categories, their coding, and the interpretation of reference-group comparisons should be reassessed before drawing strong policy conclusions.

4.2 Comparative Policy Relevance

The reported estimates suggest several policy-relevant areas for further consideration. Positive coefficients on finance and supplier credit in all three specifications point to the importance of examining how working-capital arrangements support continuous production (Djankov et al., 2007). Similarly, the negative association with inadequately educated workers suggests that workforce development deserves attention, although the obstacles model must be interpreted using its stated reference category. In developing economies, the negative association between informal competition and utilization is relevant to the operating conditions of registered firms. In developed economies, significant associations involving website presence, innovation, formal training, and power interruptions identify potential areas for more focused investigation

(DeStefano et al., 2018; Goel & Nelson, 2021). However, these conditional relationships should guide further evaluation rather than be presented as quantified effects of proposed interventions.

5 Conclusion

This study examines the determinants of firms' capacity utilization in developed and developing countries using observations drawn from more than 100 World Bank Enterprise Surveys covering 2007–2023. Capacity utilization indicates the extent to which businesses employ their available productive resources to generate output. The findings suggest that the relationships between utilization and firm characteristics are not uniform across the country groups. In developing economies, reported informal competition is negatively and significantly associated with capacity utilization, while finance-related measures are positively associated with it. In developed economies, electricity interruptions have a negative significant association, whereas website presence and innovation have positive significant associations. However, the coefficients describe conditional statistical relationships and should not be interpreted as evidence that the observed factors independently cause changes in utilization.

Ownership concentration exhibits a positive significant association with capacity utilization in the developing-country specification, while foreign and government ownership are not statistically significant in the reported models. Similarly, innovation is positively associated with utilization in the pooled and developed-country specifications, but its developing-country coefficient is not statistically significant. Finance and supplier credit are positively and significantly associated with utilization in each specification. Furthermore, formal training shows a positive significant relationship in developed economies, whereas the number of permanent employees is positively significant in the developing-country model. These findings point to differences in the relevance of selected workforce and organizational characteristics across economic settings, although additional tests would be required to determine whether the between-group coefficients differ significantly.

The findings have implications for policy approaches tailored to firms' operating conditions in different economies. In developing countries, the results support attention to working-capital access, supplier credit, workforce constraints, and the business environment in which formal enterprises compete. In developed economies, the reported patterns indicate the potential relevance of digital connectivity, innovation, training, and reliable electricity. However, foreign investment and government ownership should not be described as statistically established drivers of higher utilization in these estimates because their coefficients are not significant. In addition, the observational design, the variation in survey availability, and the assumptions of the Tobit specification limit causal interpretation. Future research could test differences in coefficients directly, examine industry and firm-size heterogeneity, and assess whether the findings are robust to alternative models for bounded outcomes. The comparative analysis thus provides a basis for more targeted investigation of the conditions associated with effective use of installed productive capacity.

5.1 Limitations and Directions for Future Research

The findings should be considered in light of the study design. World Bank Enterprise Survey observations are collected across countries and years, and cross-country comparability depends on survey coverage, variable definitions, and sampling conditions. Moreover, observed associations may reflect unmeasured demand conditions, industry characteristics, managerial choices, or other factors that are not separately identified in the models. The use of a Tobit specification for a percentage outcome also warrants assessment through alternative bounded-response models and appropriate marginal effects. Future research could investigate heterogeneity by industry and firm size, test interactions between development status and individual determinants, and explore whether firm-level energy and financial constraints vary across survey periods. Such extensions would strengthen the evaluation of the original comparative research questions without changing their substantive focus.

Ethical Statement: The study is based on secondary World Bank Enterprise Survey data. No primary interviews or direct recruitment of human participants were undertaken as part of the analysis reported in this manuscript.

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