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The Effects of Market Power and Managerial Efficiency on the Performance of Industrial Firms in Burkina Faso

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Abstract

This study examines the determinants of industrial firms' performance in Burkina Faso. The endogeneity of market concentration is addressed using the instrumental variables method (2SLS), applied to cross-sectional data from 1,296 formal industrial firms in Burkina Faso for the year 2022. The results show that market concentration has no significant impact on performance. By contrast, market share has a positive and significant effect: firms with large market shares can achieve exceptional profits even when the market is not concentrated. Operational efficiency also contributes positively to profits. The findings align primarily with structure-efficiency theory and partially with the structure-conduct-performance framework. They call for caution regarding policies to promote competition, which may prove ineffective, and suggest instead that support for the operational efficiency of industrial firms should be strengthened. It is essential to prioritize strategies that facilitate market share growth and implement targeted training and support programs to optimize internal processes and enhance firms' productivity.

Keywords Market structure · Efficiency · Firms' performance · Industry · Cross-Sectional Models

JEL Classification L11 · L25 · L50 · C21

1 Introduction

The industrial sector, which includes manufacturing, mining, energy production, and construction, has the capacity to produce important social and economic effects within an economy. Yet in sub-Saharan Africa, the sector is experiencing difficulty, with a decline in its value added (Enongene 2024; Zidouemba 2021; Siry 2016). According to both structuralist and dependency theories, industrial specialization in developing countries is usually confined to low-value-added activities, which leaves them in a state of dependence (Hout 2023). Both structuralist and neoliberal theories advocate that countries should concentrate on their comparative advantages, especially in those sectors in which they are most competitive, rather than being forced to carry out expensive industrialization. As a result, many countries have undergone deindustrialization and have specialized in sectors other than industry (Zidouemba 2021; Önis 1995). On the other hand, the institutionalist approach states that successful industrialization needs a combination of competition and cooperation and that the state should play a role by helping to bring about the required long-term economic changes through the removal of political obstacles (Önis 1995). In order to improve productivity and reduce poverty, sub-Saharan African economies should follow a development strategy that gives priority to heavy industry and the industrial sectors, thus enabling a shift from agriculture to the secondary and tertiary sectors (Enongene 2024). For this kind of priority to be given, it is necessary to ensure that these sectors, especially the industrial one, perform well.

The industrial policy measures introduced in recent years in Burkina Faso, a developing country, seem to be in line with the institutionalist approach, since the performance of industrial firms has continued to be weak (Zidouemba 2021; Somda 2017). Specifically, between 2020 and 2024, the proportion of the secondary sector in GDP fell from 29.0 percent to 26.5 percent, even though reforms and investments had been made in order to boost it, according to the data from the National Development Plan for 2026. This drop is due to the poor performance of almost all the manufacturing subsectors, as their contribution to GDP decreased from 10.2 percent in 2020 to 9.6 percent in 2024. Furthermore, the sector is still mainly based on extractive activities, especially gold. Gold has a price-cost margin of 71 percent, compared with margins under 50 percent for the other industrial subsectors, indicating the low profitability and weak performance of those sectors (INSD, 2023a).

The persistent weakness of industrial subsectors and the deterioration of the competitive performance index of Burkina Faso's industrial sector raise questions about the factors that explain the performance of industrial firms. This situation also calls into question the effectiveness of the industrial policies implemented, thereby justifying the need for an in-depth analysis of the determinants of industrial performance in the country. There is no single path to successful industrialization, whether in terms of specific policies or institutions. There are many possible paths, which depend on a country's initial characteristics, its ideological and cultural heritage, as well as other factors (Önis 1995). Therefore, it is certainly not justified to propose a single formula for success, as structuralists or neoliberals do.

There are two main theories which account for the way industrial firms perform. According to the Structure-Conduct-Performance theory, market structure, especially the level of concentration and market share, affects the behavior of firms and determines their performance (Bain 1951; Mason 1939). Empirical studies, including those by Liu et al. (2013), Bhandari (2010), Sung (2014) and Siry (2021) stress the important role of market structure in firm performance. On the contrary, the Efficient Structure theory questions this view of structural determinism by maintaining that firms' performance is mainly due to their technical and allocative efficiency (Peltzman 1977; Demsetz 1973). Various empirical studies point out that technical efficiency is a major factor in determining performance (Fambeu and Messomo 2020; Bucevska and Hadzi Misheva 2017; Alhassan et al. 2016; Outreville 2015).

Beyond this opposition, several authors highlight the complementarity between these two approaches. Shepher (1986) and Lambson (1987) show that market structure and efficiency can be self-sustaining. Thus, the performance of industrial firms results from the interaction between the structural characteristics of the market and the level of efficiency of firms (Demirgüç-Kunt and Huizinga 1999; Evanoff and Fortier 1988).

The importance of investments, the age or seniority of firms, the debt ratio, employee wages, and geographic location for the economic performance of industrial firms in Burkina Faso is demonstrated by Ramdé (2020) and

Somda (2017). In addition, the gender and nationality of executives play a decisive role in the industrial sector. Furthermore, management practices boost firm performance in Burkina Faso, and the link between management score and performance is notably stronger for large firms (Ouédraogo and Gansonré 2023). Despite these empirical studies, the debate remains ongoing as to the primacy of the "structure-conduct-performance" and "efficiency-structure" theories.

The analysis of the determinants of industrial firms' performance in Burkina Faso is of great importance in several respects. On the one hand, it will provide a better understanding of the factors explaining the performance of industrial firms in Burkina Faso. On the other hand, examining these determinants, placed within the specific context of Burkina Faso, contributes to enriching the existing literature. Indeed, although the issue of firm performance has been widely studied globally and in Africa, research devoted to Burkina Faso remains essentially focused on the banking sector, leaving industry on the margins. Building on this observation, this study aims to fill this gap by paying particular attention to industrial firms.

In this regard, the present research examines the explanatory factors behind the performance of industrial firms in Burkina Faso. What are the determinants of the performance of industrial firms in Burkina Faso? Specifically, what is the effect of market concentration on the performance of industrial firms in Burkina Faso? What is the effect of technical efficiency on the performance of industrial firms in Burkina Faso?

The general objective of this study is to analyze the determinants of the performance of industrial firms in Burkina Faso. More specifically, the first step is to determine the effect of market concentration on the performance of industrial firms in Burkina Faso. Then, it is necessary to identify the effect of technical efficiency on the performance of industrial firms in Burkina Faso.

As a general hypothesis, market concentration and/or technical efficiency amplify the performance of industrial firms in Burkina Faso. Specifically, market concentration improves the performance of industrial firms in Burkina Faso. Technical efficiency has a positive effect on the performance of industrial firms in Burkina Faso.

The following section will be devoted to the literature review. The third section will present the methodology. The results of the analysis of the determinants of industrial firm performance will be presented in the fourth section. The conclusion and economic policy implications are presented in the fifth section.

2 Literature review

This section provides theoretical and empirical foundations on the determinants of industrial firms' performance.

2.1 Theoretical literature review on the determinants of industrial firm performance

The literature examines the determinants of industrial firm performance in two ways. The first is in terms of the relationship between market structure and performance. This suggests that market structure itself determines the performance of industrial firms. The second is based on the Efficient Structure theory, which would suggest that firm performance is the result of management (in particular, the strategic choices of the executives).

Industrial economics has two approaches to the explanation of the relationship between market structure and the performance of industrial firms. The first is the traditional Structure-Conduct-Performance (SCP) approach, which is the basis for the relationship between market concentration and firm performance. The second is the approach which relates to the effect of market share on performance. The SCP approach (Bain 1951; Mason 1939) is an analytical framework which posits that market structure determines firm performance. High concentration is said to lead to tacit cooperation among the firms and so to a reduction in competition and hence to superior profits for the dominant firms (Demirgüç-Kunt et al. 2003; Kurtz and Rhoades 1992; Clark 1986). Market shares is the proportion of the market held by a particular firm (Kurtz and Rhoades 1992; Rhoades 1985; Smirlock 1985). Firms with large market shares have the ability to influence the market and so can use their market power to generate higher profits. It is therefore possible that concentration and market shares are related.

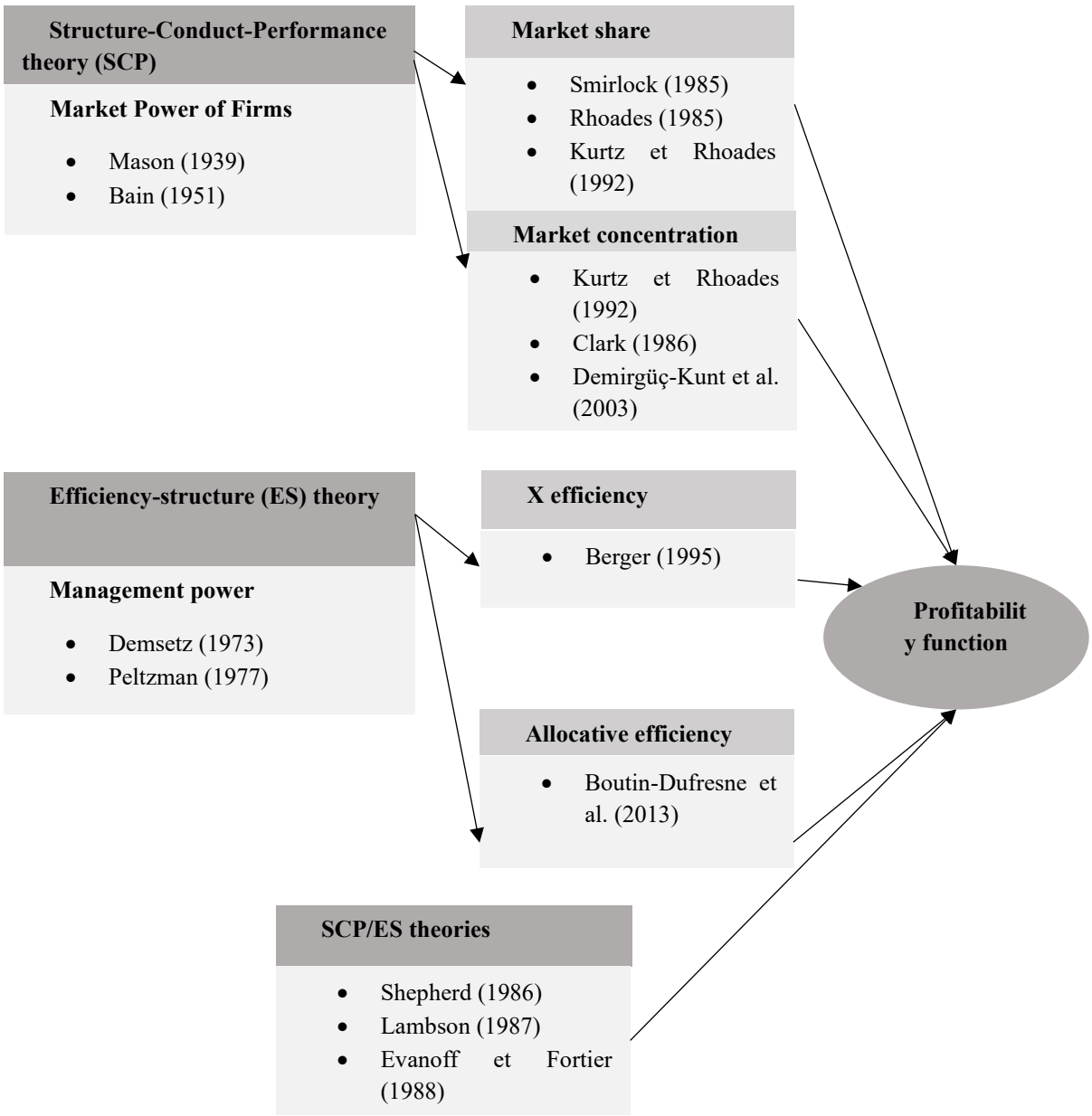


Fig. 1 Explanatory theories of industrial firm profitability

Source: Author

However, this structural determinism has been challenged by the Efficient Structure theory (Peltzman 1977; Demsetz 1973). Indeed, this theory indicates that firms' profitability can be attributed only to their efficiency. The most efficient firms are naturally those that dominate the market. This is based on the idea that firms' profitability is primarily the result of their X-efficiency (Berger 1995) and/or their allocative efficiency (Boutin-Dufresne et al. 2013). These theories are themselves influenced by managerial power. This ability to use resources optimally in the production process and to respond more agilely to market fluctuations allows them to achieve higher profits.

In addition to these attempts at distinction, SCP and ES theories can be self-sustaining (Shepherd 1986; Lambson 1987). In this context, market power—determined by concentration and market shares and conducive to profitability—can result from firms' efficiency, just as firms' efficiency can result from market structure. At the conclusion of this theoretical grounding, the empirical literature on the determinants of industrial firms' performance should be presented.

2.2 Review of the empirical literature on the determinants of industrial firms' performance

The empirical literature shows that market structure is a key determinant of the performance of industrial firms. It is well established that high levels of market concentration lead to higher profit margins as a result of reduced competition. Concentration ratios are positively related to the profit rate in both developed and developing countries (Ait Bari and Asllam 2016; Sung 2014; Bhandari 2010). Concentration is explained by the presence of barriers to entry and the level of technological sophistication. In the case of the Maghreb mobile industry, concentration has a positive effect on performance (Ait Bari and Asllam 2016).

However, a number of studies have found negative or non-significant effects of concentration on performance, indicating that the impact of market structure is very much context and firm- specific (Ekonomi et al. 2012; Demirgüç-Kunt et al. 2003). Technical efficiency is a major driver of performance in other studies. The most efficient firms in the Canadian wine industry perform better irrespective of the level of market concentration (Outreville 2015). Technical efficiency has a significant and positive impact on profitability, whereas market concentration is often not significant (Fambeu and Messomo 2020; Bucevska and Hadzi Misheva 2017; Alhassan et al. 2016). In the case of Cameroon, the performance of industrial enterprises is driven by efficiency rather than concentration (Fambeu and Messomo 2020). The implication of this is that a strategy to improve the technical efficiency of enterprises is likely to be more important for profitability than a policy aimed at altering the market structure.

Some of the studies point to SCP and ES theories being complementary. Firm profitability is thus a function of both market structure and technical efficiency (Demirgüç-Kunt and Huizinga 1999; Evanoff and Fortier 1988). Some of the authors (e.g., Berger 1995) have found a positive impact of market share and X-efficiency on profitability, with allocative efficiency having little impact. In the West African Economic and Monetary Union (WAEMU), the HHI and market shares have a direct and positive impact on the profitability of banking firms, whereas non-performing loans (a measure of poor management) have a negative impact (Siry 2021). The SCP and Efficiency Structure theories are thus confirmed. The findings clearly show that firm performance is the result of an interaction between market structure and efficiency and that an integrated approach is required.

This diversity of results underscores the complexity of identifying the explanatory factors behind firm performance. It highlights the need for a nuanced approach that takes into account sectoral and geographic specificities, as well as the importance of the choice of methodologies and variables in analyzing the determinants of firm performance. In light of the empirical literature, few studies in Burkina Faso have focused on the determinants of industrial firm performance. To this end, it is necessary to specify an appropriate method for analyzing the determinants of industrial firm performance.

3 Methodology

This section presents the variables, the econometric model, and the data sources. It also details the methodological framework adopted, including the modeling techniques used.

3.1 Overview of variables

Market structure and Market share

Market structure refers to the way a market is organized, taking into account several key elements: the number of producers or suppliers, the degree of competition, the level of product differentiation, and the ease of entry into or exit from the market. Industrial economics primarily offers two (2) indices as traditional instruments for measuring market structure: market share (MS) and the Herfindahl-Hirschman Index (HHI).

Market share (MS) is also one of the indices of market structure. According to the relative market share (RMS) theory, large firms do not need to engage in collusive behavior to influence prices. This hypothesis implies that firms with a high market share can always earn supranormal profits even if the market structure is not concentrated (Shepherd et al. 2014; Gale 1972). Market share emphasizes the individual ability of firms to leverage their competitive position (Gale 1972). A firm's market share is measured by the ratio of its sales revenue to that of the industry.

$$\boldsymbol{PM_{ij} = CA_{ij}/CA_j} \quad (1)$$

where CA_i represents the revenue of firm i, CA_j the revenue of firm j.

Herfindahl-Hirschman Index (HHI)

The Herfindahl-Hirschman Index is the most widely used measure in the literature to assess the level of concentration of an industry (Fambeu and Messomo 2020; Sung 2014; Mirzaei et al. 2013). For industry j, the HHI index is calculated as follows:

$$\boldsymbol{HHI_j = \sum_{i=1}^{N} PM_{ij}^2.} \quad (2)$$

Where N is the total number of firms in industry j, and PM_{ij} the market share of firm i in industry j.

The HHI ranges from 0 to 1: HHI = 0 indicates pure and perfect competition, HHI = 1 indicates an absolute monopoly, HHI < 0.1 indicates low concentration. This suggests a highly competitive market with many small firms. 0.1 ≤ HHI < 0.18 denotes moderate concentration. The market has a moderately oligopolistic structure. HHI ≥ 0.18 denotes high concentration. This level indicates domination by a few large firms, that is, a structure close to a monopoly. These different thresholds make it possible to categorize the level of competition and concentration in a market, providing essential information for economic analyses and competition policies. The SCP paradigm predicts that firms operating in concentrated markets earn higher profits because of monopolistic rents.

Efficiency

Efficiency is commonly measured by technical efficiency. The latter reflects a firm's ability to avoid waste by maximizing the volume of production (outputs) from a set of production factors (inputs). A firm is said to be technically efficient when it is impossible to produce the same level of output with fewer inputs or to produce a higher volume of output with the same quantity of inputs (Chaffai et al. 2001).

The literature primarily proposes two approaches for measuring technical efficiency: the parametric approach and the non-parametric approach. The parametric approach requires the prior selection of a functional form for the production frontier. The deterministic parametric frontier method postulates that the gaps between observed production and that described by the functional form correspond exclusively to inefficiencies. Koesler and Schymura (2015) demonstrate that this approach must be rejected for the majority of sectors. The stochastic parametric frontier method assumes that the gap results from both inefficiencies and random disturbances. In this case, a poor specification of the functional form of the production frontier can lead to biases in the estimation of efficiency; also, the random error term in the stochastic model is assumed to follow a centered normal distribution, which is not always true.

The main distinction between this approach and the parametric approach is that the former relaxes the assumption regarding functional form, hence the name non-parametric. This approach includes two sets of methods: the Free Disposal Hull (FDH) method and the Data Envelopment Analysis (DEA) method. In the context of this study, we focus on the second method, which is considered the most widely used in practice. The DEA method is built around two basic models, each generating a distinct efficiency frontier (Chaffai et al. 2001).

The first model is based on the assumption of constant returns to scale, called CRS (Constant Returns to Scale), and assumes that all firms operate at their optimal size. It makes it possible to calculate a technical efficiency score denoted CRSTE (Constant Returns to Scale Technical Efficiency). However, this assumption, although theoretically sound, often diverges from economic realities because it assumes a perfectly competitive environment that is rarely encountered in practice.

The second model introduces flexibility by allowing for variable returns to scale, called VRS (Variable Returns to Scale). It assumes that firms do not necessarily reach their optimal size, a more realistic assumption in contexts of imperfect competition or regulated markets. This model calculates an efficiency score called VRSTE (Variable Returns to Scale Technical Efficiency).

The DEA method offers two possible orientations: input orientation and output orientation. Input orientation aims to minimize the resources used (inputs) for a given level of production (output). Conversely, output orientation seeks to maximize production for a given level of resources.

The Constant Returns Model

We adopt the DEA model specification as formulated by (Kamgna and Dimou 2008). The constant returns to scale model, with an output orientation for a given firm, corresponding to the weighted sum of its outputs over the weighted sum of its inputs, is considered to be a measure of its technical efficiency (Kamgna and Dimou 2008). Thus, for a sample of $\boldsymbol{N}$ firms, $\boldsymbol{K}$ inputs (capital, labor, and raw materials), and m outputs (production), for each of these firms, the efficiency measure of firm $\boldsymbol{i}$ in the sample is given by the following maximization program:

$$\boldsymbol{Max}_{(u,v)}\boldsymbol{E_i} = \frac{\sum_{m=1}^{M} u_m Y_{mi}}{\sum_{k=1}^{K} v_k X_{ki}}, \boldsymbol{i = 1, \dots, N}$$

$$\boldsymbol{SC}: \begin{cases} \frac{\sum_{m=1}^{M} u_m Y_{mj}}{\sum_{k=1}^{K} v_k X_{kj}} \leq \boldsymbol{1, j = 1, \dots, N} \\ \boldsymbol{u_m\ v_k \geq 0\ \forall\ m = 1, \dots, M\ ; k = 1, \dots, K} \end{cases} \quad (3)$$

Where

$\boldsymbol{E_i}$ represents the efficiency index of firm i, between 0 and 1.

$\boldsymbol{Y_{mi}\ et\ X_{ki}}$ represent, respectively, the mth output and the kth input of firm $\boldsymbol{i}$.

$\boldsymbol{Y_{mj}\ et\ X_{kj}}$ represent, respectively, the mth output and the kth input of firm $\boldsymbol{j}$.

$\boldsymbol{u_m\ et\ v_k}$ are parameters to be estimated and represent, respectively, the weighting coefficients of outputs and inputs.

The objective of this program is to determine the weighting coefficients $\boldsymbol{u_m\ et\ v_k}$ that maximize the efficiency index of unit $\boldsymbol{i}$. This maximization is carried out under the constraint that the efficiency index calculated for all the other units in the sample, using the same weights, be less than or equal to 1. This means that all units lie on or below the estimated efficiency frontier (Kamgna and Dimou 2008). Solving the above program as it was formulated is not an easy task. However, this program can be transformed into a linear program by setting that for all $\boldsymbol{i}$ $\sum_{k=1}^{K} \boldsymbol{v_k X_{k,i} = 1}$ the program is written as follows:

$$\boldsymbol{Max}_{(u,v)}\boldsymbol{E_i} = \sum_{m=1}^{M} \boldsymbol{u_m Y_{m,i}}$$

$$sc: \begin{cases} \sum_{k=1}^{K} \boldsymbol{v_k X_{k,i} = 1} \\ \sum_{m=1}^{M} \boldsymbol{u_m Y_{m,i}} - \sum_{k=1}^{K} \boldsymbol{v_k X_{k,i} \leq 0} \\ \boldsymbol{u_m, v_k \geq 0\ \forall\ m = 1, 2, \dots, M;\ k = 1, \dots, K} \end{cases} \quad (4)$$

With $\boldsymbol{u_m}$ being the weight of output $\boldsymbol{m}$ and $\boldsymbol{v_k}$ being the weight of input $\boldsymbol{k}$.

The linear program that makes it possible to obtain the technical efficiency index in the case of an output orientation is as follows:

$$\boldsymbol{Max} \emptyset_i\ \boldsymbol{(1 \leq i \leq N)}$$

$$\boldsymbol{Sc}: \begin{cases} \boldsymbol{X_{k,i}} - \sum_{j=1}^{N} \boldsymbol{\gamma_j X_{k,j} \geq 0}\ \boldsymbol{(Inputs\ must\ not\ increase)} \\ -\emptyset_i \boldsymbol{Y_{m,i}} + \sum_{j=1}^{N} \boldsymbol{\gamma_j Y_{m,j} \geq 0}\ \boldsymbol{(The\ goal\ is\ to\ increase\ outputs)} \\ \boldsymbol{\gamma_j \geq 0} \end{cases} \quad (5)$$

Where $1 < \emptyset_i < \infty$ is a scalar, and $1/\emptyset_i$ between 0 and 1, determines the efficiency score of firm $\boldsymbol{i}$.

The CRS model makes it possible to obtain a measure of total technical efficiency without distinguishing pure technical efficiency from scale efficiency (Kamgna and Dimou 2008).

The Variable Returns to Scale Model

According to Coelli et al. (1998), "The assumption of constant returns to scale is appropriate only if all production units operate at an optimal scale. Imperfect competition and various financial constraints could cause a production unit not to operate at an optimal scale." The variable returns assumption thus appears more plausible than that of

constant returns. According to Banker et al. (1984), to incorporate variable returns to scale into the measurement of technical efficiency, a convexity constraint, $\sum_{j=1}^{N} \gamma_i = 1$ is added to the dual program of the CRS model with output orientation, and the program below is then obtained:

$$\boldsymbol{Max}\emptyset_i \ (\mathbf{1} \leq \boldsymbol{i} \leq \boldsymbol{N}$$

$$\boldsymbol{Sc}: \begin{cases} \boldsymbol{X_{k,i}} - \sum_{j=1}^{N} \boldsymbol{\gamma_j X_{k,j}} \geq \mathbf{0} \\ -\emptyset_i \boldsymbol{Y_{m,i}} + \sum_{j=1}^{N} \boldsymbol{\gamma_j Y_{m,j}} \geq \mathbf{0} \\ \sum_{j=1}^{N} \gamma_i = 1 \ , \ \boldsymbol{\gamma_j} \geq \mathbf{0} \end{cases} \qquad (6)$$

The efficiency score of firm $\boldsymbol{i}$ is determined by the quantity $\mathbf{1}/\emptyset_i$ which lies between 0 and 1. Solving the above program yields the pure technical efficiency of firm $\boldsymbol{i}$. The efficiency score obtained from the DEA model with variable returns to scale (VRS) constitutes a measure of the pure technical efficiency of the firm studied. The scale efficiency of the firm studied is obtained by comparing this index with that obtained from the CRS model (Kamgna and Dimou 2008).

Performance

The concept of performance is commonly used in the literature and in organizational settings to indicate a certain level of excellence. However, there is no consensus on a precise definition and measurement; it varies depending on the objective, the analytical perspective, and the context. In the strict sense, performance is the quantified result from a ranking perspective relative to oneself or relative to others.

Price-Cost Margin (PCM)

The PCM, or profit rate, is an indicator commonly used by many researchers to evaluate performance. Its importance in economic and financial analysis is emphasized by several authors such as Fambeu and Messomo (2020); Domowitz et al. (1986). The PCM is used in econometric models aimed at analyzing the relationship between market structure and firm performance as a dependent variable. This indicator is particularly important insofar as it reflects the market power held by a firm. Indeed, the Price-Cost Margin (PCM) allows, on the one hand, to assess competitive intensity. A high PCM may indicate a lack of competition in the market. On the other hand, it serves to measure productive efficiency, insofar as it provides information on a firm's ability to generate value from its resources. Finally, it helps guide economic policy decisions. Regulatory authorities can rely on this indicator to identify sectors where intervention is necessary to strengthen competition or regulate pricing practices.

PCM is captured by the following formula:

$$\boldsymbol{PCM} = \frac{\boldsymbol{value\ added - labor\ cost}}{\boldsymbol{Sales}} \qquad (7)$$

Where,

Value added is the difference between the firm's total sales (revenue) and intermediate inputs; labor cost represents total wage-related expenses; sales represent the value of goods sold by the firm.

3.2 Model specification and presentation of variables

This subsection will first present the model specification and then the variables selected.

3.2.1 Model specification

The use of the Price-Cost Margin (PCM) as an indicator of industrial firm performance is widely recognized and validated in the literature. Indeed, Domowitz et al. (1986) and Hersch et al. (1994) demonstrated its relevance for assessing profitability in various industrial sectors. In addition, Prince and Thurik (1995) used it to analyze firms' competitiveness and pricing strategies. Setiawan and Effendi (2016) used it to examine the impact of market policies and public interventions on firm performance. Fambeu and Messomo (2020) used the PCM in analyzing the relationship between market structure and industrial firm performance.

The empirical analysis relies on a reduced-form profit equation, making it possible to assess the influence of market structure on firm performance. This model is widely used in the literature (Fambeu and Messomo 2020; González et al. 2019; Seelanatha 2010; Berger 1995). The empirical model is written as follows:

$$\mathbf{PCM_{ij} = \gamma_0 + \gamma_1 HHI_{ij} + \gamma_2 PM_i + \gamma_3 EFF_j + \sum_{i=1}^{n} \gamma_i X_i + \varepsilon_{ij}} \quad (8)$$

Where

$\boldsymbol{\gamma_i}$ represent the parameters

$\boldsymbol{PCM_{ij}}$: represents the profit rate (price-cost margin) of firm i in industry j,

$\boldsymbol{PM_{ij}}$ **:** the market share of firm i in industry j ;

$\boldsymbol{EFF_i}$: the technical efficiency of firm i ;

$\boldsymbol{HHI_j}$: the concentration index of industry j ;

$\boldsymbol{X_i}$ **:** vector of variables that can explain profit ;

$\boldsymbol{\varepsilon_{ij}}$: the error term.

3.2.2 Data

The data come from the National Institute of Statistics and Demography (INSD) of Burkina Faso, specifically from the Economic Accounts and Macroeconomic Analyses Department (SCEAM). These are cross-sectional data from 2022. The database includes 1,296 industrial enterprises of all sizes—Very Small Enterprises (VSEs), Small Enterprises (SEs), Medium Enterprises (MEs), and Large Enterprises (LEs)—across all regions of the country. The data contain information on production, revenue, employee compensation, value added, number of employees, official date of establishment of the enterprise, investment, raw materials, staff training, and advertising. The activity classifications used are those of the AFRISTAT member states (NAEMA rev1), dividing industrial enterprises into five (05) sub-sectors: extractive industries (5 branches), manufacturing of food products, beverages, and tobacco (28 branches), electricity and gas production and distribution (1 branch), water production and distribution, sanitation, waste management, and remediation (1 branch), and construction (4 branches).

Table 1 Model variables and expected signs

Variables	Expected Signs	Reference/Source
Price-Cost Margin (PCM)		Domowitz et al. (1986), Fambeu and Messomo (2020), INSD (2023b)
Concentration Index (HHI)	Positive (+)	Rhoades (1993), INSD (2023b)
Market Share (MS)	Positive (+)	Berger (1995), Martin (1979), INSD (2023b)
Technical Efficiency (EFF)	Positive (+)	Kamgna and Dimou (2008), INSD (2023b)
Number of Employees	Ambiguous (+/-)	INSD (2023b)
Very Small Enterprises	Ambiguous (+/-)	INSD (2023b)
Labor Intensity	Negative (-)	Kalecki (1941), Piketty and Saez (2013), INSD (2023b)
Age	Positive (+)	INSD (2023b)
Investment	Positive (+)	INSD (2023b)
Minimum Efficiency Scale (MES)	Positive (+)	Fambeu and Messomo (2020), INSD (2023b) Strickland and Weiss (1976)
Pure Technical Efficiency	Positive (+)	Kamgna and Dimou (2008), INSD (2023b)
Staff Training	Positive (+)	INSD (2023b)

Source: Author

3.3 Technical Estimation and Descriptive Statistics

3.3.1 Technical Estimation

The relationship between industrial concentration and the Price-Cost Margin requires very in-depth analysis, because the industrial concentration variable poses an endogeneity problem. Indeed, in econometrics, endogeneity is said to occur when one of the explanatory variables is correlated with the error term. In the analysis of the

relationship between industrial concentration and performance, there is a form of feedback, as Peltzman (1977) and Demsetz (1973) pointed out. These authors argue that certain firms, endowed with specific advantages such as the ability to produce at lower cost or to offer a higher-quality product, may earn higher profits than their competitors. Jovanovic (1982) joined this argument by modeling the selection process of the most efficient firms, contributing to an increase in market concentration. This endogeneity generates a correlation between the independent variable (concentration) and the error term, which leads to biased estimates when using the ordinary least squares (OLS) method.

To overcome this problem, two econometric methods are commonly used depending on the structure of the data, such as the generalized method of moments (GMM) and the simultaneous equations model (SEM). Indeed, the generalized method of moments (GMM), developed by Arellano and Bond (1991) and Blundell and Bond (1998), is suited to dynamic panel data and uses lags of endogenous explanatory variables as instruments to correct for endogeneity while accounting for individual and time effects. The GMM method based on lags as instruments has several limitations. It may suffer from the overidentification problem, that is, an excessive number of instruments, which weakens the power of statistical tests and makes the results less reliable (Roodman 2009); the validity of the instruments relies on the assumption that the lags of the variables are not correlated with the model errors, which may not always hold in practice, leading to estimation bias (Judson and Owen 1999).

Simultaneous equation models (SEMs) are systems of interdependent equations in which some variables are endogenous. The estimation methods suitable for SEMs are two-stage least squares (2SLS), three-stage least squares (3SLS), and limited-information maximum likelihood (LIML). 2SLS consists of replacing endogenous variables with their predicted values from exogenous instruments, and is suitable when the errors across equations are uncorrelated (Theil 1971). 3SLS combines 2SLS with the SUR method (Seemingly Unrelated Regression) to account for the correlation of errors across equations, thereby providing more efficient estimators (Zellner 1962) and limited-information maximum likelihood estimation is useful when the instruments are weak or the sample is small (Amemiya 1974; Anderson and Rubin 1949).

An instrumental variable must necessarily satisfy two fundamental conditions to be considered valid in an econometric model: (i) be exogenous, that is, uncorrelated with the error term; (ii) be partially correlated with the endogenous explanatory variable.

However, in practice, identifying a variable that simultaneously satisfies these two conditions often proves difficult. According to Murray (2006), the quality of an instrument depends largely on the strength of the theoretical and empirical arguments justifying its validity. He also notes that even technically valid instruments may turn out to be weakly correlated with the endogenous variable, which reduces their ability to produce reliable and informative econometric estimates. From a theoretical standpoint, industrial economics offers some avenues regarding the identification of potential instruments for market concentration. In particular, entry conditions appear to be key determinants of market structure. Indeed, barriers to entry limit access by new competitors, thereby allowing some firms to maintain a monopolistic or dominant position. In this sense, Martin (1979) argues that barriers to entry do not have a direct effect on profitability, but that they indirectly influence firm performance by affecting the level of industry concentration. They can therefore serve as relevant instrumental variables for explaining industrial concentration, insofar as they influence it without directly affecting the price-cost margin. In the context of this study, the instrumental variables used to estimate industrial concentration are the following: the minimum efficient scale of the industry and investment. The choice of these variables is based on a well-established body of literature (Fambeu and Messomo 2020; Setiawan and Effendi 2016; Prince and Thurik 1993; Gupta 1983; Strickland and Weiss 1976).

Investment, grounded in Romer's (1986) endogenous growth theory, shapes the firm's long-term productive and competitive capacity. Indeed, Tobin (1969) and Jorgenson (1963) note that its immediate effect on performance is often indirect and delayed. Moreover, Cohen and Levin (1989) emphasize investment's influence on market structure through productive and innovative capacities, while Geroski (1990) demonstrates its mainly indirect impact on performance through market structure.

The relevance of minimum efficient scale as an instrumental variable is supported by Strickland and Weiss (1976), who show that minimum efficient scale constitutes a structural barrier to entry. Indeed, a high minimum

efficient scale limits the ability of small firms to enter the market, which tends to increase the level of concentration.

These two variables meet the conditions to be good instruments in the instrumental variable's method. They are correlated with market structure (satisfying the relevance condition), but do not have a direct effect on firm performance (satisfying the exclusion condition).

In this case, the market concentration variable (HHI) is considered endogenous and is determined by a series of variables, including investment and minimum efficient scale. Hence the following equation:

$$\boldsymbol{HHI_j = \beta_1 ln(EME_j) + \beta_2 ln(Invest_j) + \sum_{i=1}^{M} \beta_i Z_i + \mu_{ij}} \quad (9)$$

Where

$\boldsymbol{HHI_j}$ represents the Herfindahl-Hirschman concentration index for industry *j*, $\boldsymbol{ln(EME_j)}$ the logarithm of the average minimum efficient scale for industry *j*, $\boldsymbol{ln(Invest_j)}$ the logarithm of average investment for industry *j*, $\boldsymbol{Z_i}$ the other explanatory variables for HHI, and $\boldsymbol{\mu_{ij}}$ the error term.

The analysis of the determinants of firm performance is conducted using a system of equations written as follows :

$$\begin{cases} \boldsymbol{HHI_j = \beta_1 ln(EME_j) + \beta_2 ln(Invest_j) + \sum_{i=1}^{M} \beta_i Z_i + \mu_{ij}} \\ \boldsymbol{MPC_{ij} = \gamma_0 + \gamma_1 PM_{ij} + \gamma_2 EFF_i + \gamma_3 HHI_j + \sum_{i=1}^{n} \gamma_i X_i + \varepsilon_{ij}} \end{cases} \quad (10)$$

3.3.2 Descriptive statistics

Table 2 presents the descriptive statistics of the variables retained in our study. The average price-cost margin of firms is 0.0698, indicating moderate profitability. This indicator varies considerably, ranging from -0.884 to 0.599, with a very high standard deviation (0.377), revealing a strong disparity among firms. The average Herfindahl-Hirschman Index (HHI) is 0.135, reflecting a moderately oligopolistic market structure.

Table 2 Descriptive summary of the dependent and explanatory variables of the analysis

Variable	mean	S. D	Min	Max
Price-Cost Margin	0.0698	0.377	-0.884	0.599
Concentration index (HHI)	0.135	0.186	0.026	1.000
Economies of scale	0.254	0.270	0.000	1.000
Market Share	0.030	0.105	0.000	1.000
Overall technical efficiency	0.061	0.125	0.000	1.000
Pure technical efficiency	0.333	0.337	0.001	1.000
Number of employees	55.811	229.209	1	2 654
Labor intensity	0.041	0.348	0.000	9.431
Investment	650 515 000	4 880.26	0.000	1 130 083 200
Minimum scale of efficiency	7.028	1.341	2.706	11.725

Source: Author's calculations from INSD (2023b)

However, the variation ranging from 0.026 to 1 reveals that some sectors are characterized by strong competition, while others tend toward quasi-monopolistic structures. Average investment is 650,515,000 FCFA, ranging from 0.000 FCFA to 1,130,083,200 FCFA. This distribution indicates a strong disparity in firms' investment capacity. The average market share of firms is low, as is technical efficiency, reflecting a general lack of efficiency. These data highlight an industrial landscape marked by strong disparities in performance and investment. They suggest that firms face efficiency challenges and that market structure varies considerably across subsectors.

A comparative analysis of market concentration (HHI), and the price-cost margin (PCM) indicator reveals that there is no consistent relationship between these two indicators in Burkina Faso's industrial sectors.

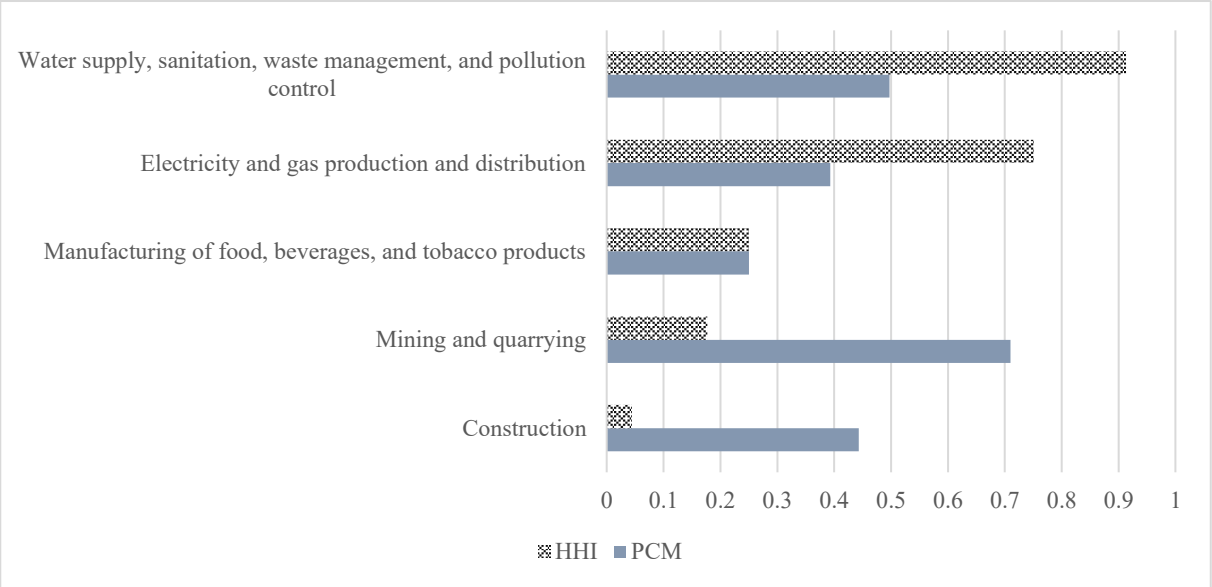


Fig. 2 Performance and market concentration index
Source: Author from INSD (2023b)

Indeed, although the water (HHI = 0.91) and electricity (HHI = 0.75) sectors are highly concentrated, their price-cost margins remain moderate (PCM = 0.50 and 0.39), which reflects the constraining effect of tariff regulation that limits profitability despite a quasi-monopolistic structure. Conversely, the extractive industries sector shows relatively low concentration (HHI = 0.18) but displays the highest performance (PCM = 0.71), illustrating profitability that is more closely linked to mining rents and international prices than to competitive structure. The food (HHI = 0.25; PCM = 0.25) and construction (HHI = 0.04; PCM = 0.44) sectors confirm that profitability depends more on costs, demand, and sector-specific characteristics than on the degree of concentration. Thus, the structure-conduct-performance (SCP) approach is only partially verified in the Burkinabè context: concentration does not necessarily explain performance, which is strongly influenced by regulation, internal productivity determinants, and the firm's managerial system.

4 Analysis of the performance of industrial firms

In this section, we will first present the model validation tests and then the analysis of the results.

4.1 Model validation tests

Multicollinearity Test

The multicollinearity analysis aims to ensure the stability of the model. The Pearson correlation matrix reveals no coefficient greater than 0.60 in absolute value, and most relationships are weak, well below the critical threshold of 0.80 recommended by Gujarati (2003), which indicates the absence of excessive correlations likely to bias the estimates.

This observation is corroborated by the analysis of variance inflation factors (VIF). All calculated VIFs are below 5, largely meeting the alert threshold of 10 proposed by Mason (1939). These results attest to the absence of problematic multicollinearity among our independent variables. This favorable situation strengthens the reliability of our estimates and the validity of the interpretations. Thus, we can affirm that the model does not suffer from bias related to multicollinearity, which consolidates the relevance of the analyses and conclusions.

Table 3 Variance inflation factor (VIF)

Variable	VIF	1/VIF
Workforce	3.48	0.2870
Minimum Efficient Scale (MES)	2.89	0.3455
Pure technical efficiency	2.81	0.3555
Investment (I)	2.68	0.3732
Technical efficiency	2.60	0.3853
Scale efficiency score	2.31	0.4327
Market share	1.53	0.6553
HHI concentration index	1.38	0.7231
Size (Very small enterprise)	1.22	0.8191
Staff training	1.06	0.9476
Labor intensity	1.04	0.9571
Age (AGE)	1.03	0.9736
Mean VIF	2.00	

Source : Author's calculation from INSD (2023b)

Endogeneity test

The endogeneity tests (Durbin, Wu-Hausman, and their robust versions) all indicate that the market concentration indicator (HHI) is endogenous (p-values < 0.05). The Durbin test (chi2 = 23.4881, p = 0.0000) and the Wu-Hausman test (F = 23.7002, p = 0.0000) strongly reject the null hypothesis of exogeneity. The robust versions of these tests confirm these results, although with 1% significance. This endogeneity of the HHI underscores the importance of using instrumental variables to obtain unbiased and reliable estimates of its effect on the dependent variable. 2SLS is therefore appropriate and necessary for this analysis.

Table 4 Endogeneity test results

Test	Statistic	p-value
Durbin (score) $\chi^2(1)$	23,4881	0,0000
Wu-Hausman F(1,1284)	23,7002	0,0000
Robust score $\chi^2(1)$	15,9363	0,0001
Robust regression F(1,1284)	17,3597	0,0000

Source: Author from INSD (2023b)

Instrument validity test

The Bhargava and Sargan (1983) tests were used to verify the validity of the instruments in the model. These tests assess whether the instrumental variables are appropriately correlated with the endogenous variables without being related to the error term. The p-values obtained for both tests are all greater than 0.05, which means that we cannot reject the null hypothesis at the 5% threshold.

In other words, we do not have sufficient evidence to question the validity of the instruments used. The Bhargava and Sargan (1983) test, in particular, confirms that the instruments are not correlated with the error term and that the excluded instruments are correctly omitted from the structural equation. These results strengthen confidence in the specification of the model and the robustness of the estimates by validating the choice and appropriate use of the instruments in the econometric analysis.

Table 5 Instrument validity test results

Test	Statistic	p-value
Sargan (score) $\chi^2(1)$	0,15957	0,6895
Basmann $\chi^2(1)$	0,158138	0,6909

Source: Author from INSD (2023b)

Minimum eigenvalue statistic test

The Minimum Eigenvalue Statistic test is used to assess the strength of the instruments in a 2SLS regression. The test statistic, compared with the critical values of Stock and Yogo (2005), makes it possible to test the null hypothesis of weak instruments. In our case, the value obtained, 75.9501, is clearly higher than the critical values and the highest critical value (19.93 for a relative bias of 10%), indicating that our instruments are not weak. This result makes it possible to rule out the limited-information maximum likelihood estimator, which is useful when instruments are weak. This result also strengthens confidence in the specification of the model by validating the choice and appropriate use of the instruments in the econometric analysis.

Table 6 Minimum eigenvalue statistic test results

	Threshold					
Test / Statistic	**10 %**	**15%**	**20%**	**25%**	**F (2,1285)**	**Prob>F**
2SLS size of nominal 5 % Wald test	19,93	11,59	8,75	7,25	75,9501	0,000
LIML size of nominal 5 % Wald test	8,68	5,33	4,42	3,92		

Source: Author from INSD (2023b)

These various tests show that the selected instruments are relevant. The instrumental variables approach adopted in this study yields unbiased results. Consequently, the use of the two-stage least squares (2SLS) method is sufficient, and resorting to a three-stage least squares (3SLS) estimation is not required.

4.2 Model results

4.2.1 Analysis of the first-stage estimation results (HHI)

The results of the first-stage model show that investment influences market concentration (HHI) at the 5% level and the minimum efficient scale at the 1% level. These results corroborate the findings of Aitken and Harrison (1999) on the impact of investment on industrial concentration. These results also fall within the theoretical framework of classical and neoclassical economics, particularly as developed by Irving Fisher in the early 20th century. According to this theory, capital investment and firms' market shares lead to increased market concentration.

The Structure-Conduct-Performance (SCP) theory, developed by Bain (1951), provides additional insight by explaining how investments enable firms to influence market structure, thereby reinforcing concentration. Porter (1980) enriched this perspective by emphasizing that these investments create barriers to entry, further accentuating market concentration.

The coefficient of the minimum efficient scale (MES) is positive and statistically significant at the 1% threshold. This shows that MES is correlated with market concentration. This result is similar to the work of Peltzman (1977), which showed that sectors characterized by a high MES tend to be more concentrated.

The coefficient of market share (MS) is positive and statistically significant at the 1% level. This means that market share is strongly positively correlated with HHI. This result is consistent with the work of Anderson and Dexter (2005), who showed that industrial concentration (HHI) is often related to performance variables such as firm size.

4.2.2 Results of the PCM estimation and discussion

Table 7 presents the results of the estimation of the main determinants of industrial firm performance. For the reference model, Model 2, technical efficiency is calculated under constant returns to scale. For Model 3, the first robustness test, efficiency is calculated under variable returns to scale. For the last model, the second robustness test, efficiency is measured by scale efficiency scores — the ratio between efficiency under constant returns to scale and efficiency under variable returns to scale.

Table 7 Determinants of industrial firm performance in Burkina Faso

			Robustness tests	
Estimation method	Model 1: 1st step (HHI)	Model 2 : 2nd step (PCM)	Model 3: PCM. *Efficiency under variable returns to scale*	Model 4: PCM *Efficiency under scale efficiency score*
HHI Index	—	-0.0673 (0.1659)	0.0185 (0.1605)	-0.0929 (0.1685)
Market Share	0.7844*** (0.0470)	0.4256*** (0.1409)	0.3415** (0.1415)	0.4406*** (0.1408)
AGE	-0.0039 (0.0090)	0.0023 (0.0173)	0.0073 (0.0174)	-0.0050 (0.0168)
Firm Size	0.0223 (0.0160)	-0.6087*** (0.0308)	-0.6531*** (0.0309)	-0.5923*** (0.0298)
Employees	-0.0215*** (0.0044)	-0.0744*** (0.0060)	-0.0584*** (0.0077)	-0.1110*** (0.0067)
Technical Efficiency, CR	-0.1405*** (0.0200)	0.3721*** (0.0703)	—	—
Technical Efficiency, VR	—	—	0.1565*** (0.0370)	—
Scale Efficiency Score	—	—	—	0.3876*** (0.0386)
Staff Training	0.0458*** (0.0162)	-0.0723** (0.0328)	-0.0644** (0.0327)	-0.0848*** (0.0321)
Labor Intensity	0.0065 (0.0130)	-0.1818*** (0.0248)	-0.1817*** (0.0250)	-0.1652*** (0.0242)
Investment	0.0113** (0.0055)	—	—	—
Minimum Efficient Scale (MES)	0.0349*** (0.0055)	—	—	—
Constant	-0.1068*** (0.0247)	0.9003*** (0.0241)	0.8297*** (0.0347)	0.9060*** (0.0232)
Observations	1 296	1 296	1 296	1 296
R^2	0.2672	0.3473	0.3387	0.3846
Overall statistic	F = 52.11***	Wald χ^2 = 684.46***	Wald χ^2 = 665.61***	Wald χ^2 = 806.02***
HHI Instruments	—	Invest, MES	Invest, MES	Invest, MES

Notes Robust standard errors are shown in parentheses. *** p<0.01; ** p<0.05; * p<0.1.
CR Constant returns, VR Variable returns

In the results of the second-stage Price-Cost Margin model, the coefficient associated with market concentration is not significant. Thus, contrary to the Structure-Conduct-Performance (SCP) theory, the results show that high profit cannot be the result of high market concentration. Indeed, even in highly concentrated markets, firms still adopt competitive behaviors by making high investments and therefore fail to achieve high profits, at least in the short term, which is why firms in concentrated sectors could be less profitable. Also, maintaining market power entails enormous costs, such as excess capacity or low-price strategies to discourage the entry of new firms. All these costs, related to defending market power, lead to lower profitability (Demirgüç-Kunt et al. 2003). This result

contradicts the Structure-Conduct-Performance (SCP) theory, according to which increased market concentration makes it possible to generate higher profit margins.

Consequently, it reinforces the conclusions of previous work, particularly that of the Chicago School, which supports the efficient structure hypothesis. It contradicts the main hypothesis that market concentration positively influences the performance of industrial firms in Burkina Faso. It underscores that the profit of industrial firms in Burkina Faso is not the result of high market concentration and suggests that policies aimed at combating concentration could be ineffective.

However, the results of the econometric estimates indicate that technical efficiency positively and significantly influences the performance of industrial firms in Burkina Faso at the 1% threshold, whether returns to scale are constant or variable. Indeed, a 10-percentage-point increase in technical efficiency at constant returns to scale leads to a 3.72-percentage-point increase in the price-cost margin (PCM), all else being equal. The effect of technical efficiency with variable returns also remains positive, although it is small at the 1% threshold (1.56- percentage-point increase).

Overall, the robustness estimates reveal a positive and significant effect at the 1% level of the scale efficiency score on the Price-Cost Margin (PCM). A 10-point increase in the scale efficiency score leads to a 3.87-point increase in PCM. This result supports the efficient structure theory developed by Chicago School economists such as Peltzman (1977) and Demsetz (1973), according to which the most efficient firms enjoy a competitive advantage over their competitors, reflected in higher profit margins. Indeed, firms with an efficiency score equal to 100% display an optimal capacity to maximize their output while minimizing their costs. This positive relationship between technical efficiency and firm performance aligns with a body of empirical work. In particular, Fambeu and Messomo (2020) and Bucevska and Misheva (2017) emphasized that the most efficient firms can adopt competitive strategies such as price setting or offering higher-quality products, leading to an increase in their profits. This result confirms the second hypothesis that technical efficiency has a positive effect on the performance of industrial firms in Burkina Faso.

The econometric estimation results also show that market share has a positive and statistically significant effect at the 1% threshold on the performance of industrial firms in Burkina Faso. More precisely, a 10-percentage-point increase in market share leads to a 4.25-point increase in firm performance, all else being equal. This result suggests that firms with a large market share exercise individually significant market power, which allows them to set their prices and earn higher profit margins, thereby improving their financial performance. Shepherd (1983) points out that firms with a high market share can always obtain supra-normal profits even if the market structure is not concentrated. This result corroborates those of Bhandari (2010), who emphasizes that only large firms in the market are able to exercise market power by setting the price of well-differentiated products through advertising and location.

The results reveal a negative and statistically significant coefficient at the 1% significance level for very small firms on the price-cost ratio. All other things being equal, very small firms have a price-cost ratio that is, on average, 6.08 points lower than that of large firms. This result could be explained by the structural disadvantages faced by these firms: often higher average costs (meaning they benefit little or not at all from economies of scale), price-taker status (they have no influence over market prices), and difficulty in adapting to new technologies (Porter 1985; Bain 1951).

The results also show that the price-cost margin is negatively correlated with workforce size (employees and labor intensity) at the 1% threshold. More specifically, a 1% increase in the number of employees leads to a decrease of 0.0744 percentage points in the price-cost margin, all else being equal. This result could be explained by the fact that an increase in the number of employees may be accompanied by higher wage costs. Lazear and Shaw (2007) emphasize that an increase in the number of employees, when it is not accompanied by a productivity gain, increases payroll costs and reduces profitability. Our results corroborate those of Demsetz and Lehn (2009), who indicate that an expansion of the workforce puts downward pressure on firm profitability.

Besides, the coefficient associated with the binary variable for staff training is negative and statistically significant at the 5% threshold. This finding shows that companies that trained their employees had, all else being

equal, a lower average price-cost margin than companies that did not. This negative training–performance coefficient is usually explained by one or several factors: costs preceding benefits, negative selection into training, poaching/turnover, or misaligned content. The findings of Kim and Ployhart (2014) may help explain this counterintuitive result. In fact, they find that environmental variability influences the strength and direction of staffing and training on productivity and firm pre- and post-recession profit. Becker's (1964) findings clearly show that training increases employees' technical and organizational skills, which improves work quality and individual productivity. However, a company can be highly productive without necessarily turning a profit, due to intense market competition, a decline in consumer demand, or the influence of powerful stakeholders who profit from the company's resources (Kim and Ployhart 2014).

5 Conclusion

This study aimed to analyze the determinants of industrial firm performance in Burkina Faso. Utilizing secondary data from 1,296 formal industrial firms provided by the National Institute of Statistics and Demography (INSD)—specifically the Service for Economic Accounts and Macroeconomic Analysis (SCEAM)—the research employed the two-stage least squares (2SLS) instrumental variables method. The analysis rejected the first hypothesis, revealing that market concentration (HHI) has no statistically significant impact on the Price-Cost Margin (PCM). Conversely, the second hypothesis was confirmed, as technical efficiency emerged as a key driver of performance. Furthermore, staff training and market share were identified as critical factors influencing the performance of these firms.

These findings align primarily with structure-efficiency theory and partially with the structure-conduct-performance framework. Consequently, public authorities should be cautious in promoting competition policies, as they may be ineffective. Instead, it is essential to prioritize strategies that facilitate market share growth and implement targeted training and support programs to optimize internal processes and enhance productivity. This approach helps firms build a sustainable competitive advantage based on operational excellence.

While this research offers valuable insights into the performance determinants of Burkinabe industrial firms, it is subject to certain limitations. The database contained a significant number of missing values for specific variables, necessitating the use of proxies to prevent bias. This constraint restricted the range of explanatory variables that could be incorporated into the analytical model.

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APPENDIX

Appendix 1 Correlation matrix

	PCM	HHI	ES	MS	AGE	Size	WF	TE	PTE	ST	LaInt	I	MES
Price-Cost Margin (PCM)	1												
Concentration Index (HHI)	-0.07	1											
Economies of Scale (ES)	0.17	0.08	1										
Market Share	0.04	0.40	0.23	1									
Lifespan (AGE)	0.01	-0.01	0.06	0.01	1								
Size (Very Small Business)	-0.43	-0.05	-0.28	-0.09	-0.06	1							
Employees Workforce (WF)	-0.18	0.22	0.55	0.35	0.06	-0.29	1						
Technical Efficiency (TE)	0.23	-0.02	0.48	0.04	-0.01	-0.13	-0.11	1					
Pure Technical Efficiency (PTE)	0.16	-0.15	-0.26	-0.12	-0.10	0.29	-0.69	0.40	1				
Staff Training (ST)	-0.05	0.12	0.15	0.04	-0.09	-0.07	0.14	0.06	-0.11	1			
Labor Intensity (LaInt)	-0.25	0.01	-0.09	-0.03	0.03	0.17	-0.01	-0.05	-0.01	-0.02	1		
Investment (I)	-0.01	0.19	0.23	-0.08	-0.05	-0.05	0.16	0.29	0.11	0.08	0.00	1	
Minimum Efficiency Scale (MES)	-0.02	0.27	0.31	0.02	-0.02	-0.08	0.26	0.31	0.04	0.12	0.01	0.78	1

Appendix 2 Score definitions

Term	**What does it measure?**	**Economies of scale?**	**Possible cause of inefficiency**
Technical efficiency (CRS)	Optimal use of resources. regardless of size	Constants (CRS)	Poor organization or the wrong ladder
Pure technical efficiency (VRS)	Optimal use of resources irrespective of size	Variables (VRS)	Poor organization
Scale efficiency	Difference due to company size	CRS / VRS	Suboptimal size

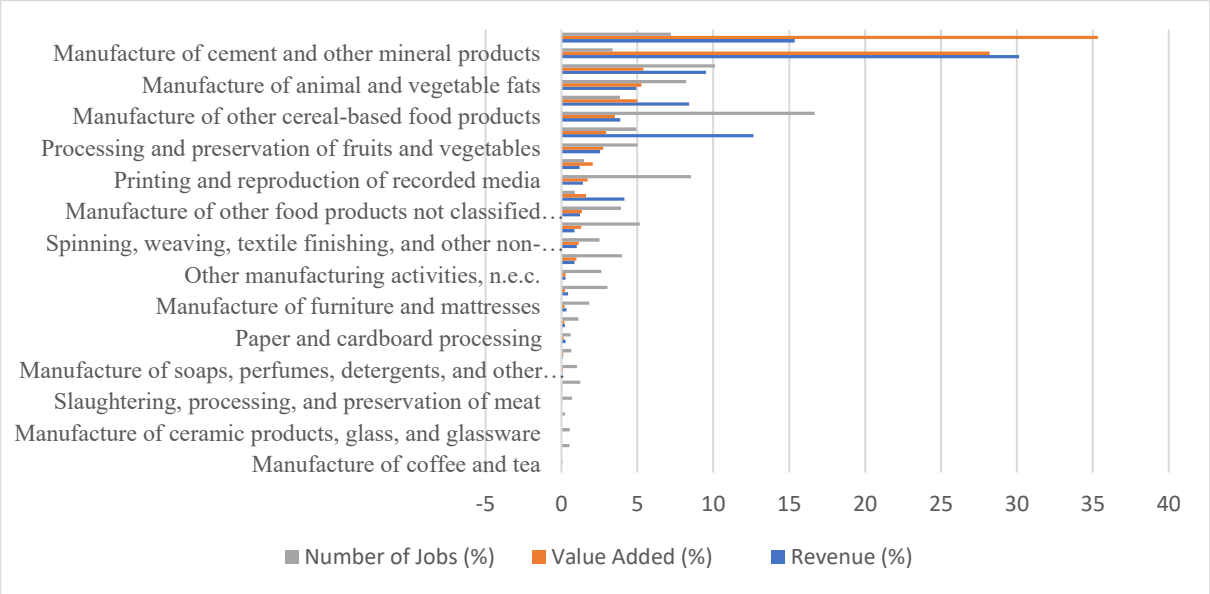


Fig. 3 Revenue, Value Added, and number of jobs in the manufacturing sector

Appendix 3 Breakdown of revenue, Value Added, and number of jobs in the manufacturing sector (%)

Industry (Description)	Revenue	Value Added	Number of jobs
Beverage industry	15.36	35.34	7.2
Manufacture of cement and other mineral products	30.15	28.21	3.36
Manufacture of fabricated metal products and metallurgical equipment	9.53	5.39	10.11
Manufacture of animal and vegetable fats	4.94	5.27	8.22
Manufacture of other chemical products	8.41	4.99	3.86
Manufacture of other cereal-based food products	3.87	3.52	16.68
Grain processing and manufacture of starch products	12.64	2.94	4.92
Processing and preservation of fruits and vegetables	2.55	2.75	5.01
Manufacture of sugar, confectionery, and cocoa-based products	1.2	2.07	1.49
Printing and reproduction of recorded media	1.4	1.72	8.54
Manufacture of tobacco products	4.14	1.62	0.88
Manufacture of other food products not classified elsewhere	1.22	1.34	3.91
Repair and installation of machinery and equipment	0.86	1.3	5.16
Spinning, weaving, textile finishing, and other non-apparel textile products	1.01	1.14	2.5
Manufacture of rubber and plastic products	0.87	0.98	3.99
Other manufacturing activities, n.e.c.	0.28	0.27	2.64
Manufacture of animal feed	0.43	0.22	3.03
Manufacture of furniture and mattresses	0.34	0.21	1.84
Manufacture of machinery and equipment	0.23	0.19	1.11
Paper and cardboard processing	0.26	0.14	0.6
Manufacture of dairy products and ice cream	0.09	0.13	0.64
Manufacture of soaps, perfumes, detergents, and other cleaning products	0.06	0.1	1.02
Slaughtering, processing, and preservation of meat	0.03	0.06	0.7
Manufacture of apparel	0.06	0.06	1.24
Manufacture of pharmaceutical products	0.02	0.03	0.23
Manufacture of ceramic products, glass, and glassware	0.02	0.02	0.54
Woodworking (excluding furniture)	0.02	0.01	0.52
Manufacture of coffee and tea	0	-0.03	0.07
Total	100	100	100

Source Author calculation's from INSD (2023b)

Appendix 4 Concentration Ratios of the k largest companies

Industry	**CR2**	**CR3**	**CR4**
Slaughtering, processing, and preservation of meat	1	1	1
Mining of other metal ores	1	1	1
Manufacture of coffee and tea	1	1	1
Manufacture of furniture and mattresses	0.79	0.92	1
Manufacture of tobacco products	1	1	1
Manufacture of ceramics, glass, and glassware	0.96	1	1
Manufacture of dairy products and ice cream	1	1	1
Manufacture of pharmaceutical products	1	1	1
Manufacture of soaps, perfumes, detergents, and other cleaning products	0.78	0.94	1
Manufacture of sugar, confectionery, and cocoa products	0.99	1	1
Wood processing (excluding furniture)	0.99	1	1
Paper and cardboard processing	0.95	1	1
Water collection, treatment, and distribution; sanitation; waste management; and pollution control	0.98	0.99	0.99
Beverage industry	0.94	0.97	0.98
Electricity and gas production and distribution	0.92	0.95	0.97
Grain processing and manufacture of starch products	0.75	0.91	0.95
Textile spinning, weaving, and finishing	0.8	0.89	0.94
Manufacture of machinery and equipment	0.57	0.77	0.92
Other mining and quarrying activities	0.56	0.72	0.85
Other support activities for the mining and quarrying industries	0.67	0.82	0.85
Manufacture of rubber and plastic products	0.49	0.72	0.84
Manufacture of other chemical products	0.65	0.74	0.83
Manufacture of cement and other mineral products	0.52	0.72	0.83
Manufacture of metal products and metallurgical equipment	0.54	0.73	0.8
Manufacture of other food products not classified elsewhere	0.65	0.72	0.79
Processing and preservation of fruits and vegetables	0.53	0.71	0.78
Manufacture of apparel	0.53	0.64	0.73
Real estate development	0.55	0.68	0.73
Other manufacturing activities not elsewhere classified	0.45	0.58	0.66
Manufacture of animal feed	0.36	0.54	0.66
Manufacture of other cereal-based food products	0.52	0.61	0.65
Manufacture of animal and vegetable fats	0.44	0.55	0.65
Gold mining	0.38	0.5	0.6
Mining exploration and prospecting	0.32	0.43	0.54
Printing and reproduction of recorded media	0.33	0.42	0.5
Repair and installation of machinery and equipment	0.34	0.41	0.47
Building construction	0.31	0.34	0.36
Specialized construction activities	0.17	0.23	0.3
Civil engineering	0.13	0.19	0.24

Source Author calculation's from INSD (2023b)

Note CR_k= Concentration ratio of the k largest companies; $CR_K = \sum_{i=1}^{k} MS_i$