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Effects of collective bargaining on firm performance in Senegal

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Abstract: This article examines the effects of collective bargaining on business performance in Senegal. To do so, we use dynamic panel data from 17 sectors of activity over the period 2016-2020. The database is compiled from the Economic and Financial Data Bank (BDEF) of the National Agency for Statistics and Demography (ANSD), reports from the Directorate of Labor Statistics and Studies (DSTE), and data from the Ministry of Labor. The labor productivity model developed by Brown and Medoff (1978) was used and estimated using the generalized method of moments (GMM). The results of the labor productivity model estimation indicate that collective bargaining has a negative impact on the labor productivity of Senegalese companies. The same model results also show the positive effect of wages on business productivity.

Keywords: Collective bargaining, Firm performance, Labor productivity model, GMM method, Senegal.
JEL Classification: J50, J31, J24, L25

I. Introduction

Collective bargaining has become an essential topic in economic studies since the 1980s and 1990s, notably with the work of Cahuc (1990), Calmfors and Driffill (1988), and Freeman and Medoff (1984), which profoundly renewed the representation of labor market functioning through an understanding of the strategic interactions between employees (generally grouped into unions) and employers.

Collective bargaining is a fundamental tool of industrial democracy. It gives employees a collective voice vis-à-vis employers, who always represent collective entities, i.e., companies (Brandl and Traxler, 2009). According to them, the quantitative importance of collective bargaining as a means of regulating employment conditions generally increases with its coverage, i.e., the number of employees covered by it. Since employees represent the vast majority of the population, employment conditions are of macroeconomic relevance and relate to broader developments in the economy and society. Consequently, collective bargaining is not only a matter of industrial democracy, but also of socio-economic governance.

In the literature, collective bargaining generally takes place at three levels: the company level, the industry or sector level, and the national level. Sectoral or national bargaining is often equated with and considered to constitute a higher level. It should be emphasized that bargaining at the company level does not preclude bargaining at a higher level, and that these two processes can take place in parallel. In the case of "multi-level" bargaining, the talks may cover the same subject or different subjects. This is why a single employee may be covered by several collective agreements (Braakmann and Brandl, 2021).

In theory, the debate on the relationship between collective bargaining and company performance pits two schools of thought against each other: on the one hand, the proponents of neoclassical theory and, on the other, those of institutional theory. First, there is neoclassical theory (Calvo, 1978; De Menil, 1971, and Rosen, 1969), which dismisses not only the relevance of collective bargaining, but also the importance of market institutions. According to this theory, institutions are irrelevant because perfect markets ensure that effective solutions can be achieved through their feedback loops.

However, the perfect market hypothesis, which allows theoretical reasoning and reasonable mathematical models, certainly does not correspond to reality. Indeed, perfect markets do not exist insofar as all actors are forced to adapt their strategies to market movements, i.e., to accept market prices without any possibility of exerting influence.

This runs counter to the real situation in markets, where power relations are always present. In the labor market, power asymmetries between companies and workers, who are generally organized in unions, are endemic (Offe and Wiesenthal, 1980). As a result, their structure is always skewed toward a certain configuration of power, interests, and sociocultural norms.

It is in this sense that institutionalist analysis (Inversi et al., 2017; Tomassetti et al., 2018; Elmeskov et al., 1998; Layard et al., 1991; Calmfors and Driffil, 1988; Cameron, 1984), which draws on institutional economics, sociology, and political science, defends the hypothesis that market institutions in specific configurations of power, interests, and norms are important. Consequently, differences in institutional structure translate into different socioeconomic outcomes.

In light of the two theories outlined above, research on the economic effects of collective bargaining is based on a variety of theoretical perspectives. Some economists have attempted to study the causal link between collective bargaining and economic performance by focusing on the various factors involved in collective bargaining. Studies by Morikawa (2010) and Hirsch (2011) show that, while most analyses find a positive impact on productivity, some find an insignificant or even negative impact. The study by Brown and Medoff (1978) finds that collective bargaining has a positive impact on the performance of individual American companies. In contrast, Clark (1984) finds a negative impact in his study. Black, and Lynch (2001) explain this contrast using the same type of data. They find that collective bargaining has a positive impact on productivity only in companies where the employer adopts human resource management practices that promote joint decision-making. Since then, several studies have been conducted along these lines, and the results remain ambivalent.

In Senegal, since 2000, particularly with the first change of government, collective bargaining has been a real issue that deserves to be explored in order to quantify its effects on business performance. Despite the relatively high number of trade union organizations (18 in total), the unionization rate across all sectors of the formal economy remains low, at around 40% of the official workforce, demonstrating the true fragmentation of the trade union movement (Wintour, 2013). As a result, this proliferation of trade union groups has greatly weakened trade union action and undermined their bargaining power. Added to this is their weakness in terms of their negotiating and proposal-making abilities and their technical mastery of the issues. In other words, the lack of training for union leaders, both in the areas of social legislation, economic and social issues, and in negotiation techniques, does not promote a strong and respected trade union movement. For many trade unionists, trade unionism is only effective when it comes to power relations.

However, unions have very strong bargaining power in Senegal despite this low rate. In 2009, just after the 2008 economic crisis, the union federations succeeded in negotiating a general increase in category-specific wages of 4% to 8% with employers' organizations and the government. Furthermore, given the high economic growth rates announced by the government (6.4% in 2015 and 6.7% in 2016), all the trade union federations are demanding a general wage increase, which they will obtain in 2018.

Despite the strong union presence and their relations with companies, it is clear that there is very little economic research devoted to the economic impact of collective bargaining in Senegal. In other words, quantitative analyses of the impact of collective bargaining on company performance (wages, employment, or labor productivity) are virtually non-existent, hence the importance of this research. We will attempt to answer the following question: *what are the effects of collective bargaining on firm performance?*

The overall objective of this research is to analyze the effects of collective bargaining on the performance of Senegalese companies. More specifically, the aim is first to measure the effect of the wage bill on company productivity and finally to assess the impact of collective bargaining coverage on company productivity.

This article aims to contribute scientifically to a better understanding of the effects of collective bargaining on business performance in Senegal. It consists of three (3) sections. The first revisits the theoretical and empirical review of the relationship between collective bargaining and economic performance. The second establishes the research methodology used. Finally, the third and last section presents the various results obtained from econometric estimates.

II.   Literature review

2.1. Theoretical review

There is a wealth of literature on the effects of institutional mechanisms of collective bargaining on economic performance, and most contributions agree that the characteristics (or institutions) of collective bargaining differ in their ability to internalize their bargaining costs (OECD, 2004; Calmfors, 1993; Calmfors and Driffill, 1988).

The centralization or decentralization of collective bargaining has always been a major concern for industrial relations specialists (Tomassetti et al., 2018; Treu, 1985), particularly in multi-employer bargaining systems. Calmfors and Driffill (1988) define the degree of centralization as "the extent of cooperation between unions and employers in negotiating wages and working conditions for employees." The extent of cooperation, in Calmfors and Driffill's analysis, is obtained by adding two measures: the first is the level at which negotiations take place (national, sectoral, company)

and the second is the degree of coordination between unions (i.e., the number of unions and the extent of their cooperation) and employer confederations (i.e., the number of employer federations and the extent of their cooperation).

The thesis of Calmfors and Driffill (1988) is based on the idea that extremes, i.e., highly centralized (national level) or highly decentralized (company level) bargaining, perform well. More specifically, centralized collective bargaining facilitates the responsiveness of aggregate wage demands to macroeconomic conditions, especially when compared to wage bargaining at the industry or sector level, because unions participating in collective bargaining are more aware of the macroeconomic effects of the wages set. Following a more conventional line of reasoning, they argue that decentralized bargaining can also lead to good productivity performance, since unions would exercise relatively limited monopoly power. Going further, they point out that the good results of decentralized bargaining are attributed to perfect competition in the markets for goods and services, which prevents companies from passing on their wage increases to the prices of their products.

In contrast to these two extremes, intermediate bargaining (i.e., at the sectoral level) is mediocre, according Calmfors, and Driffill . They assume that sectoral- bargaining can externalize the costs of wage increases to the public, as it functions as a branch-specific cartel. Consequently, intermediate bargaining is assumed to be able to ignore macroeconomic requirements, so that its efficiency is lower than centralized and decentralized bargaining.

Confirming Calmfors and Driffill's thesis, Addison (2015) emphasizes that the effects of internalization stem from unions' awareness that the more centralized negotiations are, the more their wage increases will affect the price levels their members face, as well as unfavorable employment trends and loss of competitiveness. As a result, they will be less aggressive in their wage demands and will take into account the macroeconomic implications of wage negotiations. The more decentralized the negotiation, the less wage externalities will be internalized.

However, some researchers have questioned the Calmfors and Driffill (1988) thesis, as it simplifies the important factors involved in collective bargaining. Soskice (1990) was the first to challenge the priority given by Calmfors and Driffill to the centralization of collective bargaining at the expense of coordination mechanisms. He argued that a coordinated system of sectoral bargaining can be as effective as a system of centralized bargaining in adapting to overall economic conditions. In his view, this oversimplification ignores the fact that coordinating bargaining at the sectoral level across the economy can function as a functional equivalent of centralized bargaining. Similar to centralized bargaining, Soskice (1990) points out that none of the bargaining units at the industry level can externalize the costs of wage increases if their wage policies are coordinated across the economy. Furthermore, the assumption of perfect competition does not correspond to the reality of markets.

The Soskice (1990) thesis has been confirmed and defended by several researchers (Traxler and Brandl, 2008; Ruesga, et al., 2007; Boeri and Van Ours, 2008; Tomassetti et al., 2018). Traxler and Brandl (2008) argue that Calmfors and Driffills' hump thesis is derived from a closed economy model, where parties to sectoral bargaining face a relatively inelastic demand curve. In open economies, sectoral bargaining in exposed sectors is unable to organize itself into a cartel in the labor market. This is because bargaining at the sectoral level is still limited to a certain territory (e.g., regions of a country or a country as a whole), so that any attempt to organize a cartel is ineffective if an industry is exposed to international competition. In open economies, Calmfors and Driffils' hump theory is therefore only valid for protected sectors.

Overall, bargaining at the sector or industry level in open economies depends largely on how bargaining for exposed sectors is linked to that of protected sectors. If exposed sectors define the model for the overall bargaining process, sectoral bargaining tends to outperform other bargaining structures (Traxler and Brandl, 2008).

Ruesga et al. (2007), meanwhile, argue that it is coordination, not the degree of centralization, that leads to better macroeconomic performance. Thanks to a high level of coordination, unions and employers are able to adjust wages and, as a result, achieve very good economic performance in terms of employment and inflation. According to Boeri and Van Ours (2008), decentralized collective bargaining (at the company level) can be coordinated at both the national and sectoral levels and produce very good results.

According to Tomassetti et al. (2018), the coordination of collective bargaining has a positive impact on economic performance, as it prevents wage competition and forces companies to increase their productivity in order to be able to pay the wages set. At the company level, productivity agreements can promote innovation and improve performance through compensation and benefits, flexible working hours, work-life balance, skills enhancement, and worker involvement. In addition, collective bargaining, particularly at the company level, has always been seen as a means of facilitating technological change.

However, coordination is widely present in centralized schemes, but also in decentralized models. At this point, Flanagan (2003) expands on Calmfors and Driffill's hypothesis that there is a monotonic relationship between economic performance and the degree of coordination. Other researchers, such as Park (2004), point out that the

combination of coordination and centralization of collective bargaining through "open shop" models yields good results in terms of economic growth.

2.2. Empirical evidence

Understanding the effects of collective bargaining on productivity is essential to the evaluation of collective agreements. Indeed, it is generally argued in the economic literature that collective bargaining systematically increases productivity in order to fully offset wage increases (Hirsch, 1997). Brown and Medoff (1978) were the first to conduct an empirical study on the effects of collective bargaining on labor productivity. Since then, their study has been followed by a series of studies summarized in the book by Freeman and Medoff (1984), "What Do Unions Do?", which showed that, at the time, collective bargaining in the United States was associated, on average, with substantial improvements in productivity. According to these two authors, the increase in productivity is achieved through a collective voice combined with an appropriate institutional response from management.

Brown and Medoff (1979), based on aggregate data from the US manufacturing industry for 1972, measure collective bargaining by union density. Their estimates yielded coefficients between 0.22 and 0.24, implying values (obtained by dividing the consolidation coefficient by 1-α) for c-1 of 0.30 to 0.31. In short, they concluded that unions increase total factor productivity by more than 20%.

However, despite the relevance of their article, subsequent research has shown that their results were neither plausible nor consistent with other evidence. One example is Clark (1984), who provides one of the best large-scale studies and contrasts sharply with the results of Brown and Medoff (1978). He uses data from 902 US manufacturing industries from 1970 to 1980 to estimate productivity equations. He obtains marginally significant coefficients on the union variable ranging from -0.02 to -0.03. Wessels (1985) refines Clark's (1984) results by showing that productivity increases due to high unionization. He also shows that it is difficult to reconcile productivity and wage data with employment data.

In addition, Boal (1990) conducted a study on the effects of collective bargaining on productivity in West Virginia coal mines in the early 1920s. He chose to measure collective bargaining by the unionization rate in his study. The results show that unionization reduces productivity in small coal mines, a result described as economies of scale in labor relations. However, the standard errors were rather large and can probably be linked to the somewhat small sample size (332 observations). Later, Boal (2016) replicated the 1990 article with a much larger panel in the mining and coal sector of the West Virginia (5,960 observations). Overall, unionism reduced productivity by an average of 8%, but there was no evidence of a negative effect in small mining industries.

The study by Cassonie et al. (2002) examines the impact of collective bargaining on the performance of manufacturing industries in Uruguay, using panel data for the period 1988–1995. The collective bargaining factors used are the rate of collective bargaining coverage and the unionization rate. The main results of the estimation of productivity and productivity growth equations using GMM reveal that unionization has direct and positive effects at the industry level. The statistical significance of the union variable in the level equation is low, while collective bargaining coverage at the firm level is highly significant. In terms of productivity growth, the estimated impact of unionization is such that a 10% increase in membership, assessed at the average unionization rate, implies a 0.6% increase in labor productivity growth. As for the impact of collective bargaining coverage on productivity, the coefficient is positive and estimated at 0.5. In other words, a 10% increase in collective bargaining coverage leads to a 5% increase in labor productivity.

Andreasson (2014), in his research, studies the effects of decentralized wage bargaining on the wage structure and performance of Swedish companies for the period 2007–2010. The results of the estimates show that decentralization, when measured at the average company level, has a positive and statistically significant relationship with value added per employee. The effects are very similar in size. For the average company, the effect is 5.3% on productivity and 5.6% for the median company. Still according to these estimates, when the proportion of employees benefiting from two-tier decentralized systems is used instead, decentralized bargaining has only a statistically significant effect on the median productivity of companies. The proportion of employees covered at two levels, however, has a high coefficient of around 20% for productivity. This result could be due to the fact that only a small portion of the workforce is covered by completely decentralized bargaining systems, which is not sufficient to influence the overall performance of the company. Two-tier bargaining, which covers a larger share of the workforce, has a considerable effect compared to centralized bargaining.

In short, more than a decade of research has failed to provide decisive evidence to support or refute the hypothesis of Calmfors and Driffill (1988), which clearly shows the difficulties researchers have encountered in obtaining robust results or even agreeing on the best definition of the effective degree of coordination in negotiations.

The relevance of this review of theoretical and empirical literature lies in the fact that it provides a better understanding of how collective bargaining affects business performance. This causal link will be empirically verified for the case of Senegal using an appropriate econometric model.

III. METHODOLOGY

3.1. Presentation of the productivity model of Brown and Medoff (1978)

In economic literature, the Brown and Medoff (1978) model is the benchmark model in studies on the direct effects of unions on business productivity. It is based on translog Cobb-Douglas production functions in which outputs are linked to inputs. Consequently, the Brown and Medoff (1978) model can be written as follows:

$$Q = AK^{\alpha}(L_n + cL_u)^{1-\alpha} \qquad (1)$$

Where Q is output, K is capital, L_u and L_n are unionized and non-unionized employees, respectively, A is a proportionality constant, α *et* $(1-\alpha)$ are the elasticities of output with respect to capital and labor. The parameter c reflects the differences in productivity between unionized and non-unionized labor. If $c > 1$, then unionized labor is more productive, in line with the collective voice model; if $c < 1$, then unionized labor is less productive, in line with conventional arguments about the deleterious impact of things such as union rules and constraints on merit-based wage dispersion.

After developing equation **1,** we arrive at the estimation equation.

$$Q = \emptyset(K, L_n, L_u) = AK^{\alpha}L^{(1-\alpha)}[(1 + (c-1)P]^{(1-\alpha)} \qquad (2)$$

Where L is the total number of employees, i.e., the number of unionized and non-unionized workers in a company $(L_n + L_u)$, and P represents the proportion of unionized workers (L_u/L) in a company or industry. By dividing all the terms in equation 2 by the total number of **employees** (L), and using the logarithmic form, we obtain:

$$ln(Q/L) = lnA + \alpha ln(K/L) + (1-\alpha)ln[1 + (c-1)P] \qquad (3)$$

Equation **3** embodies an intrinsically nonlinear relationship between the dependent variable and P. Thus, the variable of interest was approximated by the last term on the right-hand side of equation **3** with a Taylor series expansion around the point $c = 1$ and truncating the expansion at the first-order term.

This gives:

$$ln(Q/L) \cong lnA + \alpha ln(K/L) + (1-\alpha)ln[(c-1)P] \qquad (4)$$

The actual effect of unions on productivity, expressed as elasticity and obtained from equation **3,** is:

$$\gamma = \partial ln(Q/L)/\partial P = [(1-\alpha)(c-1)]/[1 + (c-1)P] \qquad (5)$$

The approximate effect, expressed as elasticity and obtained from equation **4,** is:

$$\delta = \partial ln(Q/L)/\partial P \cong [(1-\alpha)(c-1)P] \qquad (6)$$

According to equations 5 and 6, it follows that

$$\delta \gtreqless \gamma \gtreqless 0 \qquad <=> \qquad c \gtreqless 1 \qquad (7)$$

Therefore, if the actual value of $c = 1$, , then $\delta = \gamma = 0$. In this case, both models give the exact effect of unions on productivity. However, when $c \neq 1$, a non-zero productivity effect in either direction is overestimated by the Brown and Medoff model.

The modified estimation equations, corresponding to models (4) and (3), are:

$$ln(Q/L) = \beta_1 + \beta_2 ln(K/L) + \beta_3 P + \beta_4 \ln(Y/\overline{Y}) + \beta_5 T + \in \quad (8) \text{ and}$$

$$ln(Q/L) = \psi_1 + \psi_2 ln(K/L) + \psi_3 ln[1 + (c-1)P] + \psi_4 \ln(Y/\overline{Y}) + \psi_5 T + \eta. \quad (9)$$

3.2. Specification of the empirical productivity model

The Brown and Medoff (1978) model to be specified is as follows:

$$ln(Q/L) = \beta_0 + \beta_1 ln(K/L) + \beta_2 P + \beta_3 \ln(Y/\overline{Y}) + \beta_4 T + \in$$

Where K/L is capital intensity, P represents the unionization rate, $Y/\overline{Y}$ corresponds to real income relative to nominal income, T is a linear trend variable, and finally $\in$ constitutes the error term.

Unlike the work of Brown and Medoff (1978), which focuses on the impact of union presence on labor productivity, our research examines the influence of collective bargaining coverage on labor productivity. The indirect impact of collective bargaining on labor productivity via wages will also be studied. To do this, we introduce these two variables of interest into the model to be estimated. This gives us:

$$ln(Q/L)_{i,t} = \beta_i + \beta_i ln(capint)_t + \beta_i ln(w)_t + \beta_i collbar_t + \beta_i \ln(Y/\overline{Y}) + \beta_i T + \in$$

Where Q/L is value added relative to employment volume. More specifically, it is labor productivity *(prod)*

$collbar_t$ refers to the collective bargaining indicator likely to influence labor productivity. It is measured by the number of employees covered by a collective agreement in sector i at time t.

Added to this is the wage variable *(w)*, which aims to study the indirect impact of collective bargaining on labor productivity. However, it should be noted that wages are an endogenous variable. They are explained by other variables, including the sales growth variable *(salgrth)* and the capital intensity variable *(capint)*.

$$lnw = f(lncapint; lnlabor; lnollbar; lnnewcontr; salgrth)$$

Other explanatory variables are also introduced into the model. These are the collective disputes recorded annually in each sector *(conflict)* between workers and employers. Taking this variable into account makes it possible to assess the

quality of labor relations on company performance (Hubler and Jirjahn, 2003). The other explanatory variables in the model are market concentration marcon) and research and development *(R&D)* activities. According to endogenous growth theory, **R&D** activities play a decisive role in the economic performance of companies. This justifies the choice of this variable in the context of this research.

Thus, by excluding the variables $(Y/\overline{Y})$ and *T* from the model and adding those listed above, the productivity model to be estimated is as follows:

$$ln\,(Q/L)_{i,t} = \beta_0 + \beta_1 ln(w)_{i,t} + \beta_2 (conflict)_{i,t} + \beta_3 RD_{i,t} + \beta_4 collbar_{i,t} + \beta_5 marcon_{i,t} + \varepsilon_{i,t}$$

Using the logarithmic form *(ln)* for certain variables that have just been introduced, the labor productivity model to be estimated is as follows:

$$ln(prod)_{it} = \beta_0 + \beta_1 ln(w)_{i,t} + \beta_2 (conflict)_{i,t} + \beta_3 (lnRD)_{i,t} + \beta_4 ln(collbar)_{i,t} + \beta_5 marcon_{i,t} + \varepsilon_{i,t}$$

With $i = 1; 2; ..…; 15$ and $t = 1; 2; ..…; 5$

3.3. Data sources

In this research, several reports and databases are explored to collect data for all variables over a five-year period (2016-2020) for the labor productivity negotiation model. These include reports from the DSTE, the Ministry of Labor database, the Social Dialogue, Professional Organizations and Relations with Institutions database, and the ANSD's BDEF database.

Table 1: Acronym and measurement of model variables

Variables	Acronym	Measure
Labor productivity	*prod*	Value added / Total number of employees in a given sector
Wages	*w*	Wages actually paid in a given sector.
Coverage of collective bargaining agreements	*collbar*	Number of employees covered by a sectoral collective agreement.
R&D activities	*RD*	Expenditure on R&D activities in a sector of activity.
Market concentration	*marcon*	Sector turnover / Total turnover (%)
Collective dispute	*conflict*	Dichotomous variable that takes the value 1 if there is a dispute and 0 otherwise

IV.   RESULTS AND DISCUSSION

4.1   Descriptive analysis and correlation of variables

The table below shows the correlation between the endogenous variable (labor productivity) and the variable of interest (collective bargaining).

Tableau 2: Statistique descriptive des variables

Variable	Obs	Mean	Std. Dev.	Min	Max
prod	85	8.41e^{+07}	2.22e^{+08}	87252	1.05e^{+09}
conflict	85	0.529	0.502	0.000	1.00
collbar	85	0.529	0.502	0.000	1.00
wage	85	5.15e^{+10}	7.69e^{+10}	8.03e^{+08}	6.28e^{+11}
marcon	85	6.289	1.545	0.038	76
RD	85	2.18e^{+10}	1.03e^{+11}	1.00e^{+06}	6.53e^{+11}

Source: *Author, estimation based on STATA 14*

Descriptive analysis of the data reveals strong heterogeneity in levels of productivity, wages and R&D investment among the companies observed, suggesting significant structural disparities within the sample. The productivity variable shows a high degree of dispersion, with significant gaps between the lowest and highest performing companies.

Collective bargaining (collbar), our variable of interest, present in 52.9% of cases, appears to be an institutional characteristic shared by a significant proportion of companies. Control variables such as wages, market concentration and R&D spending also show considerable variability, justifying their inclusion in explanatory models to better identify the

determinants of productivity. Market concentration remains relatively stable, while wages and R&D spending show extreme variations, probably linked to company size or sector of activity.

These findings prompted us to use the GMM econometric technique, incorporating logarithmic transformations (ln) for certain exogenous variables and a control for multicollinearity, to robustly assess the impact of collective bargaining on company performance.

Furthermore, the results of the correlation table highlight several significant relationships between labor productivity and the exogenous variables studied.

Table 3: Correlation between collective bargaining and labor productivity

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) prod	1.000					
(2) conflict	-0.325	1.000				
(3) collbar	0.210	0.480	1.000			
(4) w	0.044	0.297	0.292	1.000		
(5) marcon	0.051	0.131	0.171	0.236	1.000	
(6) RD	-0.065	0.030	0.199	-0.458*	-0.062	1.000

Source: *Author, estimation based on STATA 14*

The collective bargaining variable (collbar) shows a very weak, positive correlation with productivity (0.0210), suggesting the absence of a direct linear link. This indicates that the mere presence of a collective bargaining framework is not sufficient to explain variations in performance between companies.

On the other hand, the collective conflict variable (conflict) shows a moderate negative correlation with productivity (-0.3253), which could reflect a disruptive effect of social tensions on economic performance.

Control variables such as wages (w), market concentration (marcon) and R&D expenditure (RD) show very weak correlations with productivity, ranging from -0.0658 to 0.0512. This suggests that their influence on performance does not manifest itself in a simple linear fashion, but could be conditioned by interaction effects or thresholds.

The Harris-Tzvalis test, adapted to short periods such as those in our research, is used to highlight the level of stationarity of the variables taken in this research, as shown in the following table:

Table 4: Stationarity of variables

VARIABLES	HARRIS-TZAVALIS	RESULTS
lprod	-3.7841 (0.0001)	Stationary
conflict	-3.5553 (0.0000)	Stationary
marcon	-2.2753 (0.0114)	Stationary
RD	-3.6918 (0.0001)	Stationary
lcollbar	-4.2302 (0.0000)	Stationary
lw	-3.7435 (0.0000)	Stationary

Source: *Author, estimation based on STATA 14*

3.4.   Analysis of results

The table below shows the results of labor productivity model estimates using the system GMM technique, with the use of Rodman's (2009) command to account for the relatively short period.

Table 5: Effects of collective bargaining coverage on labor productivity from 2014 to 2018

Variables	GMM SYS
lnprod	Coefficients
$ln.\mathrm{prod}_{t-1}$	0,737*** (0.023)
conflict	−0,316*** (0.077)
collbar	**−0,997*** (0.128)**
lnw	**0,188*** (0.128)**
RD	0,022** (0.010)
marcon	0,188** (0.181)
Number of groups	17
Obs per group	5
Number of obs	85
Number of instruments	17
Wald chi (2)	3.73e +6
Prob > chi2	0.0000
AR (1)	0.062
AR (2)	0.104
Hansen test	0.465

Significance: *** p<0.01, ** p<0.05, * p<0.1 ,   (.): Standard Errors

Source: *Author, Estimation based on STATA 14*

The period covered by this research is from 2016 to 2020. All conditions that verify the reliability of the model and its estimation using GMM with instrumental variables are valid. Hansen's over-identification test is more effective than Sargan's in two-stage estimates. Hansen's test (0.465 > 0.05) validates the instruments obtained. Similarly, the Arellano and Bond test does not reject the absence of autocorrelation at order 2 (0.104 > 0.05). Furthermore, the number of instruments (17) is equal to the number of individuals (17 sectors).

Regarding the individual significance of the model, all coefficients associated with the explanatory variables are almost significant, with the exception of the one associated with the market concentration variable marcon), which has no effect on the endogenous variable, even at the 10% threshold. The variables wages (log w), collective bargaining coverage (collbar), and conflicts have a significant and positive impact for the first variable and a negative impact for the other two at the 1% threshold. As for the variable "Research and Development Activities" (log RD), it has a significant and positive impact on the dependent variable (log prod) at the 5% threshold.

As discussed in the economic literature (Addison, 2015; Calmfors and Driffill, 1988), negotiation, whether centralized or decentralized, stimulates economic performance (lower productivity and employment and higher unemployment). On the other hand, intermediate bargaining, i.e., at the sectoral level, is a source of economic inefficiency. Our research results seem to confirm this thesis. Indeed, they show that a 1% increase in the coverage of sectoral collective bargaining leads to a 0.99% decrease in the labor productivity of Senegalese companies. However, our results do not corroborate those of Hubler and Jirjahn (2003), who, in studying the impact of works councils and collective bargaining on productivity and wages in Germany, found a positive impact.

Based on the facts, these results accurately reflect the current situation in Senegalese companies. Indeed, sectoral collective agreements are very outdated and still predominate in setting wages and working conditions for employees. Moreover, they do not take into account the specific characteristics of each company. However, a sector of

activity is made up of a group of heterogeneous companies, i.e., they do not have the same specific skills that can be turned into competitive advantages, nor do they have the same production technology. Today, the application of sectoral collective agreements is one of the main sources of deterioration in the productivity of Senegalese companies, leading to a significant number of business closures. In 2017, 275 companies closed, compared to 263 in 2016, an increase of 4.5% according to the DSTE (2017). As a result, 1,764 jobs were lost in the same year.

In addition, our results also indicate that wages have a positive impact on the labor productivity of Senegalese companies. Indeed, a 1% increase in wages leads to a 0.19% increase in labor productivity. These results fully confirm the thesis defended by Freeman and Medoff (1984). These authors have always maintained that the wage increases demanded by unions can be a source of motivation for workers and, consequently, lead to an increase in labor productivity. In conclusion, any wage increase will be offset by improved labor productivity.

V. CONCLUSION AND RECOMMENDATIONS

This article has focused primarily on the economic effects of collective bargaining on Senegalese companies. The economic literature mainly emphasizes that collective bargaining has an impact on economic performance, the socio-economic effects of which can impact both the demand and supply sides of the economy (Brandl and Traxler, 2009, and Aidt and Tzannatos, 2008). However, empirical studies have not shed light on this perplexing and complex relationship. Although empirical results are ambivalent, some empirical evidence confirms that collective bargaining leads to higher wages, which have mixed effects on other economic indicators such as labor productivity.

Furthermore, the theoretical review and empirical evidence have led us to choose the labor productivity model of Brown and Medoff (1978) as the benchmark for assessing the economic effects of collective bargaining. It highlights the relationship between collective bargaining, measured by collective bargaining coverage, and labor productivity over the period 2008–2016. To do this, we used estimation techniques such as GMM with instrumental variables to correct for endogeneity. The dependent variable used to capture company performance in this research is labor productivity.

The results of the estimates are entirely in line with our expectations. They show that collective bargaining reduces the labor productivity of companies in Senegal's. They also reveal that wages contribute to increased labor productivity in Senegalese companies. Consequently, the two objectives of this article have been clearly confirmed by the results obtained.

In terms of economic policy implications, the study invites stakeholders (the government, companies, unions, and employers) to rethink collective bargaining mechanisms so that they become levers for performance, incorporating greater flexibility, targeted dialogue, and consideration of sector-specific characteristics. In sectoral bargaining, only the most representative trade unions are authorized to negotiate with employers, otherwise with employee representatives. On the other hand, bargaining at the company level is more effective than other levels of bargaining, allowing each company to address its own constraints, but also to make strategic choices to compete.

The advantage of promoting decentralized bargaining is that it allows for a wider range of topics to be covered, i.e., it diversifies the issues to be negotiated that are not addressed in sectoral or centralized bargaining. Today, decentralized bargaining allows Senegalese companies to place greater emphasis on issues relating to employment, vocational training, qualifications, the implementation of new forms of work organization, innovation, the right of employees to express themselves, etc.

However, this article has a few shortcomings, the most significant of which is the period covered, which is considered very short (five years of study). This is because statistics on collective disputes and new employment contracts signed annually under collective agreements are only available for this period. As a result, the number of observations (75) is not as high as we would have liked.

In terms of future research, the effects of wage drift, i.e., the gap between actual wages and contractual wages, on the performance of Senegalese companies would be a major contribution to economic research.

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