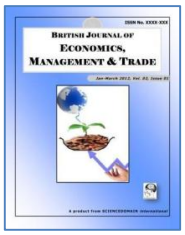

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Mining Companies and Corruption Behavior: A Local Analysis in Burkina Faso

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Mining sector is one of key economic sectors in Burkina Faso. Its contribution to gross domestic product (GDP) and its leadership in the country's export earnings make it the most attractive sector both inside and outside the country. However, this fancy for mining activities remains smeared by a strong presumption of corruption. Through the current research, we analyze factors that explain the corrupt behavior from mining enterprises in their location areas. This local level analysis based on behavioral approach has identified some significant local factors that stimulate corruption in situ. So, using data on corruption presumption, we reached to key results that negative effects of mining activities on local communities' wellbeing can lead these enterprises to corrupt local leaders, religious leaders, civil society organizations leaders, etc.

Keywords: Corruption; mining enterprises; wellbeing; local analysis; change; Burkina Faso.

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1. INTRODUCTION

Corruption in mining sector has been less focused on by rigorous scientific researches or studies in Burkina Faso. There are some overview studies such as EITI reports 2012 and 2013 which dealt with the gap between the amount of taxes paid by mining enterprises to the state and that receive by the later; and RENLAC[1] report 2013 which focused presumption of corruption in mining sector. However, the problem has been broadly addressed through the world and a convergence of ideas is that mining sector is one of the most exposed or vulnerable to corruption particularly in countries with high corruption level according to (1). To [1], with regard to the hardness of legislation in northern countries like USA and UK, the risk to which are exposed mining companies if they do not make their businesses with transparency, lead them to implant themselves in countries where corruption achieves a high level in order to accede to natural resources allowing them to participate to global markets. [2] has addressed corruption in mining industries through a two levels analysis: the supply-side and the demand-side of corruption. From that, he has asserted that an analysis of corruption in mining sector must be done through an analysis of the behavior of actors evolving in the supply-side of corruption and the reasons of this behavior separately with the behavior of actors evolving in the demand-side of corruption and the reasons of that behavior. On this basis, mining industry is generally considered to be on supply-side of corruption whereas bureaucrats or politicians are on the demand-side of corruption [2]. With regard to the supply-side of corruption, [2] has identified several specific factors to mining sector indicating its vulnerability to corruption such as time factor, governmental regulation level, lack of possibility to mining industry to choose its location area, etc. So, the need of investments to be rapidly cost-effective makes mining promoters especially susceptible to underpaid bureaucrats who have the power to accelerate or decelerate the delay of approval or mining construction process. Also, because of nationalism, great financial impact, environmental impact or social impact of mining sector, there is a strong regulation in from governments. As [1] has noticed, this situation makes mining industry being the most greatly exposed to corruption since it must be conformed to national rules and standards of the time. [2] has also found that the impossibility for mining industries to choose their location area in a given country to implement their activities is a real cause of their vulnerability to corruption. If these industries could have such a possibility, then, in a case of corrupt pressure, they would be able to threaten for relocating elsewhere. But, with regard to the limited number of mining sites areas and high number of pressure that are facing mining during exploration and development stages, these industries are often obliged to accept implant themselves in areas with high corruption, where doing clean businesses is difficult [2]. On the demand-side of corruption, [2] has underlined that its degree is too high as on the supply-side of corruption because this type of corruption generally occurs in countries with very weak rates of transparency according to international transparency standards. The reasons are among others the lack of governance, the weak quality of legal systems to operate sanctions to those who do not respect laws, the high implication level of the State in economy just as the interventions of bureaucrats as [3] has noticed.

Other authors have identified explanatory factors of corruption in mining sector. [4] have analyzed the effect of transparency on corruption reduction in countries wealthy in natural resources. They found a correlation between the lack of transparency and high levels of corruption in these countries. Through a deep analysis, they concluded that transparency may affect corruption although transparency remains insufficient itself for reducing corruption and therefore requires other additional reforms. [1] has proceeded in enumerating corruption practices or acts in mining sector. So, because of large amount of machinery and consumable stores necessary for mining operating, assets of all types, even fuel, electricity and water, can be misappropriated without a robust control environment from mining industries. These corruption acts can heavily affect those companies' profitability. Also, payroll fraud can occur in mining activities regarding the large number of mining local contractors and casual labor may exist on the payroll. [1] has then précised that geographical dispersion of mining staff limits the effectiveness of personnel's presence monitoring to their service. So, there is a high risk to have ghost employees who are paid without real work on site or who are affected to ghost projects, such as road construction for example, which are invoiced for but do not exist. These previously described corruption acts are admitted as such because, according to [1], this

[1] *Réseau National de Lutte Anticorruption*

kind of corruption act is always known by at least another person in or outside the mining staff, a colleague for example, who could help identifying the responsible through a whistleblowing mechanism. Another point is that difference in standards of businesses practices, political regimes and the lack of internal control system between mining companies' home countries and their host countries make them a real source of corruption or bribes payments. Indeed, to be conformed to their host countries' standards such as personnel recruitment for example, these enterprises must elaborate conformity programs which heavily cost in time and money. This seeking for conformity more often requires approaches and information from potential partners who need back money [1]. [1] makes to observe that without payments for facilitating that, government approvals may sometimes takes several years to the detriment of already invested capital by these companies. Finally, mining has a strong social context particularly in remote areas where the population's expectation from mining companies is greater than taxes revenues in exchange to resources extraction. The support of local communities through infrastructure building and job supply are thus perceived as a counterparty of social permit or license to operate in these areas. These spending are often done in interactions with political leaders and the state officials. So, [1] has asserted that schools and hospitals building by mining companies are considered to be corruption practices. If no, these companies would have to show that these social operations are efficient, properly led and that they do not serve as means to reward government officials.

In the current contribution, we focus our analysis on a local approach of corruption. The choice of such an approach is justified by the particularity of mining sector, which is identified as a sector enabling us to better understand corruption phenomenon. Indeed, mining sector in Burkina Faso represents since 2009 the first export products of the country and contributes to more than 5 per cent to GDP according to data from the ministry of economy and finances [5]. The importance of the sector at local level is shown by the economic activities stimulation and diversification which it allows, resulting in indirect jobs creation and self-employment according to data of national territory development plan [6]. But, in a so important sector like mining one, corruption practice is not a presumption but rather a reality [7]. Corruption has negative role in the national economy for several reasons. First, the lack of rigorous supervision of mining activities by administration services in accordance to environmental standards leading to national budget receipts' losing since a great amount of minerals is sold without a real control [7]. Second, because of corruption, environmental degradation is accentuated leading to increase climate change effects. This later being important because climate change weakens the national economy productive base such as agriculture, breeding, etc. Finally, [8] and [9] have shown that corruption prevent to the whole economy to be efficient.

Our analysis is still interesting in the fact that since 2013, Burkina Faso has been accepted as a country which is in accordance with the initiative for transparency of mining industries (ITIE), meaning that there would not be corruption practice in this area.

From a sample of about 300 individuals who have been interviewed and covering all the eight mining industries sites areas through the whole country, our analysis tries to confirm the evidence of the phenomenon and then identifies the factors stimulating corruption behavior in such areas usually located in rural municipalities. A cross sampling has considered all actors who intervene in mining sector. So, mining personnel (senior managers, middle managers, workers), services providers in relation with mining enterprises, civil society organizations leaders, religious and custom leaders, local municipalities leaders, tax administration agents (customs services, etc.) have been subjected to an interview in order to catch the corruption concern in the sector.

Most analyses of corruption, as general concept, have addressed the phenomenon through macroeconomic approaches [10,11] and microeconomic approaches [8,12,13]. Our analysis considers that in mining sector, all involved actors are likely to practice corruption. For example, a mining enterprise can corrupt a chief of village in order to avoid an attempt of social protest from populations surrounding mining sites areas because of negative effects of mining activities on their wellbeing. Also, corruption can appear when several services providers in competition must compete for a supply market to the benefit of mining enterprises. This latest case can then join the analysis group of corruption carried out by [8,13,12] because the firm capacity of facing bribes payment will be a significant factor for

obtaining a market beside mining enterprise. Finally, in order to be hired in a mining company site area, corruption can occur between recruiting agents and candidates if these candidates to a job position are numerous [7]. Others factors which could influence corrupt behavior in mining sites areas, and important ones, are relating to the management of negative impacts of mining activity in these areas. Now, negative impact of mining industries is important at social, environmental and sanitary plan [6]. For example, non-restoration of mining sites areas, contamination of waters and soils by chemicals such as mercury, constitute some dangers for humans and animals. Such dangers can provoke the local population irritation, and is then likely to incite mining companies' managers to practice corruption.

Our approach and data support the hypothesis that, at local level, corruption from mining enterprises is subsequent to the clear-cut generated by mining activity on local community-based wellbeing components such as physical capital, human capital, cultural capital, natural capital and financial capital [14]. In other words, corrupt action is undertaken on mining sites areas, when the visible consequences of mining activity are perceptible and thus corruption is generated. Contrary to the generally admitted approach [8,13], corruption is subsequent to the expected effects from mining activities. This hypothesis is opened to criticism because there are several types of corruption on mining sites areas in accordance with the various links of mining chain [7]. But, for local level analysis, we consider that one must take into account the major negative effects induced by mining activities which are more often endured by local communities living in mining sites areas environment [15], from which we can conclude on the hypothesis relevance. Following the introduction, section 2 presents the theoretical framework and section 3 deals with data concern. The section 4 presents and discuss on results while the last section (section 5) makes a synthesis of results in terms of pragmatic implications and recommendations.

2. THEORETICAL FRAMEWORK

Our analysis requires to conceptualizing the notion of a mining enterprise or company for a harmonious understanding. In accordance with [16], we consider a mining enterprise or company as a system. And as such, the enterprise is constituted by elements in interaction which are organized according to a given goal. Furthermore, one can admit that a mining enterprise is an opened system in permanent relationship with its environment in which it draws the main resources able to meet its needs such as energy, raw material, information; and to which are destined the results of its activities such as outputs, wastes, information just as its induced entropy. But, the environment in question is composed by financial, physical, human, natural, cultural and social aspects of wellbeing. For that, the theoretical basis of our contribution can refer to the psychological theory of human behavior of [17]. This theory claims that an individual behavior is conditioned by a set of knowledge resulting in life experiences and which are correlated among them in the situation of environment uncertainty. That justifies why people' reactions are more often anticipative or self-activated on the base of expectations. Considering that mining companies are carrying out their activities inside the areas where are living the local communities, these enterprises remain influencing by the set of social, economic, cultural and environmental values from these communities. However, the enterprise should not be a pawn which is driven by the environmental forces as the theory of conditioned behavior elaborates on. An enterprise is an autonomous entity, which functions with objectives, goals and since its final aims is to generate profit; this later can be against environmental and social standards. So, that is to recognize in accordance with [17] that external factors only do not determine human behavior, and thus the enterprise one because this latter is headed by a group of men. One of the major limits to this model is that the behavior is described as being shaped and controlled either by environmental influences or by internal aptitudes through a unidirectional way. But, in the social cognitive theory or the model of reciprocal causation [18] the behavior, the cognition and the others personal factors and environmental influences are all operating as interacting factors which influence themselves mutually. So, the expectations, the self-perceptions, the objectives and intentions give a shape and a direction to a behavior [19-21]. Regarding the mining sector in Burkina Faso, we suppose that local communities' expectations from mining manna are so large such as local unemployment reduction, the living conditions and the improvement of life level, etc. [1] Unfortunately, these communities' self-perceptions of the distribution of benefits from mining manna show that corruption in this sector is missing their

expectations. So, their objectives and intentions for correcting that can lead them to demonstration, this latter being a shape and direction of their behavior towards mining companies. Conversely, if mining companies managers have great expectations from their activities, particularly gaining super profits for example, their perceptions of the area social environment, custom institutions and formal ones just as their defined objectives and intentions, will contribute to the adoption of a given shape and direction to their behavior towards local communities. From that, corruption can be easily practiced if mining managers expect a potential of social demonstration from local population following or due to negative effects of mines. Also human expectations, beliefs, emotional aptitudes and cognitive competences are developed and shifted by social influences which forward information and activate the emotional reactions through modeling, institution and persuasion [19]. Indeed, people evoke also various reactions from their social environment through their physical characteristics such as age, height, race, sex, physical attraction, rather than what they say and do [22]. This model is completed by the social cognitive theory of organizational behavior self-regulatory and human processes of decision making [23]. According to this model of analysis, human behavior being significantly motivated and regulated by a continuous practice of self-influence, the self-regulation of this behavior, supposed to be computed, is regulated by foresight. In other words, people develop beliefs on what they can do, anticipate the likely consequences of their future actions; define objectives for themselves and otherwise, plan the implementations of actions which are able to produce expected results. However, being cognitively represented in the present, elaborated future events are converted into current motives and regulators. Considering mining companies, it is acceptable that the set of human behavior models developed by [17,18,23] can be applied insofar as these economic entities are a form of social organizations composed by people or individuals whose respective behaviors can be analyzed through these theories and as underlined by [2]. Our analysis is also inspired by the principal-agent theory [24] which enables understanding the influence that incentives have on decision-making behavior of economic agents, particularly mining entrepreneurs. The model shows how a person, the principal, can incite another person, the agent, to adopt a costly behavior for this agent. Regarding mining sector, we can suppose that the principal is mining company and the agent, a custom leader, a municipality leader, etc. By, also, supposing that the principal is not able to observe directly the agent's behavior, the model suggests how the principal can implement an incentive payment to the benefit of the agent in order to incite the latter to act at best in the principal's interests. This situation is a reality when we consider the example in which some leaders of local communities organizations recognize sometimes that they receive some amounts of money from mining companies in order that they act for avoiding any social demonstration initiated by local populations because of mining activities negative effects such as the destruction of environmental resources in the implementation sites [7].

3. EMPIRICAL DISCUSSION

For formalizing our approach, we consider that corrupt behavior of mining companies at local level is determined by several socio-economic, political factors, etc. Considering that a mining company setting up in a given site is an action for local development that has necessarily an effect on local community's wellbeing in accordance with the notion of capabilities [25]. Then, in accordance with [14], we have retained six capabilities areas often targeted by local development interventions aiming to poverty reducing and wellbeing improvement such as natural domain, physical domain, financial domain, social domain, cultural domain and human domain. On this basis, the World Bank has identified some arguments that justify the necessity of supporting mining sector as the engine of development in developing countries wealthy in natural resources [26]. The first argument is historical analogy. According to [26], the World Bank estimates that mines have historically served as viable way of development for national development of countries rich in natural resources such as Australia, Canada and USA and can thus play a similar role in today poor countries. Consequently, mining can lead to long run growth [27]. The second relationship is that mining industries contribute to job creation. According to [26], the World Bank considers mining extraction as a development intervention being able to reduce poverty directly through jobs creation that generate revenue for workers and their families. The third causal relationship is that, mining extraction has an indirect contribution to poverty reduction by generating large revenue for governments to be used in

targeting poverty alleviations programs [26]. The explanation is that the generated fiscal revenue through the collection of taxes from mining operations can be used as a mean to poverty reducing toward targeted intervention policies [28] because mining exports generate with certainty substantial fiscal revenues for governments. The fourth causal relationship is that, mining activity can contribute to poverty reduction by generating a pro-poor economic growth [26]. So, the national income growth would be profitable to all social groups including the poorest. Therefore, the Gross Domestic Product (GDP) per capita growth can also be expected to reduce poverty profiles in the whole [29]. The fifth causal logic is that mining extraction contributes in developing countries rich in mining resources to a transfer of technology leading to poverty reduction [26]. Natural resources-based activities are intended to be knowledge of industries. For example, mining has been the national learning experience in the USA which led to the construction of a strong technological system from which the modern manufacturing is developed on [30]. The sixth argument favorable to the support of the World Bank towards mining is its contribution to infrastructure development. Indeed, natural resources extraction requires investments in certain types of infrastructures, such as roads, rails, which improve physical infrastructures contributing to economic growth [26]. Finally, the last relationship is that mining contributes to poverty reduction through the creation of downstream industries according to [26]. [31] has simply explained the idea by the fact that generated profits from mineral resources extraction could be reinvested in industries which would process and create an add value on oil or mineral before their export.

Empirically, other studies have proved that mining extraction often causes negative effects on local populations' wellbeing. So, according to [28], mining projects create a number of public health risks such as the expansion of sexually transmissible diseases from arriving workers affecting local resident health. To [32], natural resources extraction unfortunately contributes to a number of vulnerability and risks for poor persons such as economic chocks relied to the international goods and services prices volality because these people are lacking diversification in their sources of revenue. According to [26], mining activity can increase the exposition of the poor to various types of social risks. So, there is risk of rapid influx of people leading to inflation. The explanation is that high incomes of mining workers can lead to an increase of local goods and services prices such as food, fuel, land or housing [28].

4. EMPIRICAL MODELING

The major challenge that remains now is how to measure the effect of a local development intervention on each component of the community wellbeing. In the current analysis, it is a matter of proceeding, through some tools of the participatory assessment of development methodology [33], to the identification of the whole changes observed since the setting up of the various mining sites areas until the survey period.

Theoretically, there is a double directional relationship between those changes in these six domains and corruption on mining activities implementation sites areas as shown by the model of reciprocal causation [18]. Indeed (i) the level of corruption in these areas influences the extent of mining activities effects on each domain which contributes to the wellbeing of the community located in mining activities sites areas. So, for example, if corruption is high during mining companies providing step in chemicals, then the effects of corruption on waters and soils pollution will be more severe. (ii) the extent of changes in each of the six domains can influence the corrupt behavior in the mining activities implementation sites areas. That is the case of some custom and religious leaders corrupted by mining managers in order to make avoiding some social crises because of the negative effects of mining activities. The last type of corruption is similar to that [2] has called supply-side of corruption. Regarding our analysis, the second relationship has been considered because this type of corruption has the most important global effects, and the whole local communities feel that more directly by opposition to the corruption between services providers and mining companies or corruption between recruiting agents and candidates to mining job position. In other words, while [2] makes a macroeconomic analysis of corruption in mining sector, so at national level, our analysis is at local level, more precisely the municipality or level of corruption.

The main idea is to analyze to what extent changes due to the setting up of mining companies at local level can contribute to the practice of corruption in this activities sector. In other words, we suppose that corrupt behavior is

explained or determined by induced changes from mining activities in each of the six domains of the local communities' wellbeing: the physical, cultural, social, human, financial or economic and natural.

By attributing through *corrupt* * the latent variable that expresses the practice of corruption (*corrupt*) in mining companies setting up sites areas, we can write that:

$$corrupt^* = corrupt^*(natural\ change, cultural\ change, social\ change, physical\ change, human\ change, economic\ change) \quad (1)$$

With regard to the fact that corruption is a dummy variable (or binary variable), i.e. there is practice or not practice of corruption on these sites areas, we can then use a model of probability to estimate the effects of observed changes in the six domains on the adoption of corrupt behavior. So, the probit model can then be drawn from the latent variable, which is not observable by nature and we can write that as follows:

$$corrupt^* = corrupt^*(natural\ change, cultural\ change, social\ change, physical\ change, human\ change, economic\ change) + \varepsilon \quad (2)$$

$$corrupt = \begin{cases} 1 & si\ corrupt^* > 0 \\ 0 & \text{si}\ corrupt^* \leq 0 \end{cases} \quad (3)$$

In this model, ε represents the stochastic error term. The stochastic error term represents in our model the influence of the unknown factors which haven't been identified to describe the corrupt behavior. This stochastic error is assumed to be independent of the current factors explaining corruption such as natural change, cultural change, etc. It is following the standard normal cumulative distribution function and then independent and identically distributed.

5. DATA

The data used in this paper are primary ones gathered in February 2013 in the framework of a study on presumption of corruption in the mining sector in Burkina Faso [7]. For this study, the survey has focused on the whole of eight formal industrial mining sites areas and by excluding the non formal sites areas in the country. The mining companies studied in this research are industrial ones, i.e. their size is varying between 100 to 250 km square as their activities implementation areas. There are greatly equipped with very heavy machines and employ at least 700 employees. By this way, they cover several villages and municipalities. These mining sites are distant to urban zones such as Ouagadougou and Bobo-Dioulasso to about 150 to 350 km. But, regarding the sub-urban areas, this distance is about 100 to 150 km.

The sample has reported on a categorization of the actors that intervene in the mining sector at local level such as: mining companies' employees including the various mining services managers, engineers, technicians and workers; services providers of mining companies in fuel oils, chemicals, consumables, etc.; municipality leaders; custom and religious leaders; local associations leaders; common interest group leaders; etc. For each sub-category of the targeted actors, some individuals have been randomly selected and covering the municipality area. The study has thus used a sample of about 300 persons who have been interviewed according to their location per mining site area (see Table1 below).

Table 1. Distribution of interviewed per mining site area

Mining site area	Number of interviwed
Essakane	30
SEMAFO	32
Belahouro	39
Youga	46
Bissa Gold	41
Kalsaka	45
Perkoa	37
Taparko	30
Total.	300

Source: Presumption of corruption survey data [7]

The survey has allowed us gathering information of individuals' perception of corruption, the practices or acts and expressions of corruption on mining sites areas, the impacts and/or effects of mining activities on the various domains of local development interventions and their relationship with corruption.

The data show that 87.58% of the interviewed are male and 12.42% are female. They are 20 years old minimum for younger workers of mining enterprises and 80 years maximum particularly for communities' leaders. The average age is about 39 years with a standard deviation of 11 years. Finally, more than 82% of the respondents were comprised between 20 to 50 years. The data also show that 81.82% of interviewed were

educated as follows: 13.79% for primary school, 41.38% for secondary school and 26.55% for university degrees. However, 6.9% are literate and 10.34% of interviewed have never been involved in any education program. The data indicate that 66.2% of the interviewed are salaried by contrast to the 33.8% ones. These salaried are mainly from mining employees and the public administration ones. Also, 21.0% of the interviewed have spent at least 4 to 6 years in mines activities implementation areas by contrast to 20.33% who spent less than 2 years in-situ and surrounding villages. Finally, more than 58% of the interviewed have a direct experience related to mining activities in their location areas. Such information shows that the majority of interviewed have a relatively great control of mining activities, and then makes credible the data collected from them.

The investigation has also revealed that more than the behalf of respondents have experienced corruption or have seen corruption acts in situ. Indeed, the data show that 58% of the interviewed identified some practices of corruption they have experienced directly or indirectly in mining sites areas. For example, when considering mining employees, workers syndicates members interviewed certified that they have experienced some scenes of corruption. To them (19.33%), during recruitment periods, some of the recruited have been asked to promise a part of the salary before being recruited as workers. Considering local civil-organizations leaders particularly breeders organization, some reveal that mining responsible used to give them money or job positions for their relatives and asking them back to make avoiding any social demonstration from their members since they pastures have been entirely destroyed by mining activities without any compensation. According to goods and services providers to mining enterprises, several (7.67%) said that for being attributed a market from mining companies, one should guaranteed a commission of about 10% of the market value to the person in charge of services and product providing in the mining company. And then, the product, particularly chemicals and other goods sometimes have bad quality which causes long run damages to the local environment without any compensation.

6. RESULTS

The probit model is estimated on the base of the data described in the section above. In this section, we discuss first on the construction of variables before presenting an analysis of the results from which will follow the implications in terms of fighting against corruption policies.

6.1 Variables Description

Having an exact measurement of corruption is still a difficult task because corruption is multiform and non observable [34,35]. One distinguishes two measures of corruption: the objective measures and the subjective ones [36]. The objective measures enable to estimate corruption on the base of real information available as the number of public agents blamed for corruption for example or the difference between the real cost of public infrastructures and the price paid by the government. The subjective measures of corruption by opposite enable to assess corruption on the base of investigations near businessmen, international experts or actors in close relationship with the activity suspected for corruption. Several examples of subjective measures of corruption exist such as the corruption indicator of the World Competitiveness Report [10], the corruption index of Transparency International [37,38]. However, the indicators based on the perception of corruption do not always measure the real state of the phenomenon [39] since the information on corruption at the country level is pointed out. The variables we present in this section have been introduced in the previous section.

Corrupt measures the practice of corruption by mining companies, more precisely at local level. This variable comes from the question: *do you think that the negative changes due to mining activity are caused by local corruption?* For answering to this question, several other questions were required especially those related the existence of the phenomenon on these locations and also the inventory of positive and negative changes due to mining activity in the natural domain, physical domain, economic domain, social domain, human domain and cultural domain at local level. The idea is that negative changes such as the destruction of some holy cultural areas in the localities where mining activities are carried out without an equivalent compensation or the displacement of local populations without compensation are sometimes viewed by local populations as due to the corruption of municipalities or villages leaders'. They often justify their perception by the fact that the terms of references of mining

companies activities take into account the amounts for compensation which are not respected in the facts without a punishment of mining managers by the government.

So, the data (see Table 2 below) show that 39.33% of the surveyed persons testify that there is corruption on mining sites areas. According to them, this corruption is due to the negative effects of mining activity in each of the six domains. On the other hand, 40.67% of the surveyed think that corruption has not any link with these changes.

Table 2. Perception of corruption in mining sites

Negative changes	Proportion (%)
No-reply	17.00
Yes	39.33
No	40.67
Don't know	3.00
Total	100.00

Source: Computed from the data RENLAC, 2013

The reasons that justify the different perceptions of surveyed are various. So, those who link the negative changes to corruption, evoke that mining managers do not respect their promises made to the benefit of local populations before their activities implementation process period. Also, some surveyed think that the local and national authorities turn a deaf ear to the complaints of local populations when mining activities cause to them damages without equivalent compensation (example: the case of toxic wastes rejected on the environment) or when the authorities forbid social demonstrations because of these local populations dissatisfaction vis-à-vis to mining companies . Moreover, mining actors are never questioned by the country' authorities when they do not respect the terms of reference of their license that they have signed with the government and which are beneficial for local populations; or when the attributed money to compensate the damages caused by mining activity is misappropriated by a group of individuals at local level. According to the other surveyed, the lack of a mechanism for monitoring mining activities or the lack of transparency in the management of the fund allocated by mines enterprises to the local municipalities is a source of corruption. Finally, we found from the survey that local leaders are corrupted because they are the main collaborators or intermediates between mining leaders and the whole local populations.

For the populations who think that there is not relationship between corruption and the negative effects of mining activities, their arguments are focused on the fact that these negative effects are collateral ones for all mining activities which are known by public authorities and which must be taken into account during the mining license negotiations' period. Also, the lack of civic spirit and dishonesty of some members of the society are some elements that lead to certain negative effects that one observes sometimes.

Following the analysis of the perception of corruption in mining sector, the net effects of changes due to mining activities have been estimated. The estimate of net effect of changes was based on the whole sample of surveyed. The net effect has been computed from the weights or extents of changes noticed in each of the six domains: the net effect is negative or positive. Four main positive changes (so, which are favorable to the domain of intervention preservation) have been identified per surveyed and four other main negative changes (so unfavorable to the domain of intervention preservation). The weight of each change is then estimated per surveyed on the base of a score scaling from 0 to 10. In the case of favorable changes, the score is positive and this latter is negative when changes are unfavorable. The net effect has been deduced by summing the two types of changes scores. This allows us reconstructing a new database that makes a census of the whole net effects estimated per interviewed person of the sample. So, the following variables have been derived from this exercise.

- *ch _ natural* is the net effect of changes in the natural domain due to mining activity in its implementation location area. The variable measures the perception that have surveyed about the global impact of mining activities on the natural wellbeing of the local communities.
- *ch_ cultural* is the net effect of changes in the cultural domain due to mining activity in its implementation site area. In other words, it is the perception of the influence that mining activities have occurred on the cultural wellbeing of the local communities.
- *ch _ physical* is the net effect of the changes in the physical domain due to mining activity in its implementation site area. The physical domain takes into account the definition of this aspect of wellbeing by [14]

in addition to the set of local physical infrastructures.

Ch _ social is the net effect of changes in the social domain due to mining activity in its implementation site area. In other words, it is the perception of the influence that mining activities have occurred on the social wellbeing of the local communities.

ch _ economic is the net effect of changes in the economic domain due to mining activity in its implementation location area. The variable measures the perception that have surveyed about the global impact of mining activities on the economic wellbeing of the local communities.

ch _ human is the net effect of changes in the human domain due to mining activity in its implementation location area. The variable measures the perception that have surveyed about the global impact of mining activities on the human wellbeing of the local communities.

Table 3 below then informs on descriptive statistics of these different explanatory variables. These data enable us to observe that in the natural domain, all the cumulated positive and negative changes give a net (or global) negative effect of about -7.42 in 10 as average with a standard deviation of 10.37. In the physical domain, the global effect is positive and is about 4.39 in 10 as average with a standard deviation of 7.44. A comparison of the net average effects in the both domains shows that in the natural one, the extent of negative changes is higher than the physical domain extent. In the human domain, the changes net effect in average is estimated to 2.19 in 10 with a standard deviation of about 7.97 showing that the whole changes observed on mining sites areas are beneficial to local communities. In the economic domain, the changes net effect is computed to 1.78 in 10 with a standard deviation of about 7.86. This value is positive showing that the set of changes that occurred on the various mining sites have a positive effect on local communities' economic wellbeing. With regard to the social domain, the net effect of changes that occurred on mining sites areas is estimated to 0.37 in 10 as average with a standard deviation of about 6.70. As this value is positive, the changes due to mining activities implementation have a positive global effect on the local communities' wellbeing particularly in its social aspect even if this value remains weak. Finally, the net effect of changes observed in the mining sites areas on the cultural domain is assessed to -1.92 in 10 at average with a standard deviation of about 9.10. This negative value shows that in the cultural domain, the changes due to mining activities are not beneficial for the local communities. In other words, the changes have negatively influenced on these communities wellbeing in its cultural aspect.

6.2 Estimation

For estimating the model, one can face some difficulties if there are errors in the explanatory variables' measurement also called errors of right [40]. This usually implies the presence of biases in the estimation of the model parameters. In other words, when the errors of right occur, there is a problem of endogeneity, meaning that the estimated parameters are not convergent. The biases in the model estimation can also come from simultaneity between the dependent variable and at least one of the explanatory variables. Therefore, the tests that enable to check up if the convergence of the estimated parameters have been led in the framework of this work. When these biases appear or are suspected, several estimation methods can be used such as an IV Probit estimation, the method of [41]. But, as has suggested by [42], these methods are not robust. (8) has made a comparative estimation of four methods such as the IV Probit, MLE, simple Probit, and the method of [41]. He found that IV Probit and the method of [41] are less powerful than the simple probit. However, as these tree methods are unable to correct the problems of endogeneity, he has used the estimate method by 3SLS. In our situation, based the basic hypothesis assuming that corruption is subsequent to the changes in the intervention domains, we have then proceeded to the estimate of a simple probit.

Table 3. Descriptive statistics of the explanatory variables

	ch_natural	ch_physical	ch_human	ch_economicq	ch_social	ch_cultural
Mean	-7,42	4,39	2,19	1,78	0,37	-1,92
Minimum	-36	-18	-27	-18	-19	-32
Maximum	24	31	30	28	25	25
St. Dev.	10,37	7,44	7,97	7,86	6,70	9,06

Source: Computed on SPSS from the survey data of RENLAC, 2013

6.3 Analysis of the Results

Empirically, it is obvious that the corrupt behavior of mining enterprises is stimulated by changes intervened in these mining activities implementation sites areas. These changes, expressing by damaging effects or benefits (respectively negative net effects or positive net effects) on the local communities' wellbeing constituted by natural, economic, cultural, human, social, physical aspects. Thus, the induced changes due to mining activities on the natural aspect of the local communities increase of about 0.17 point the probability that mining enterprises adopt a corruptive behavior. As seen in the Table 3, the net effect in average that is induced by mining activities on the natural domain is negative, meaning that mining activity causes, generally, some nuisances to the quality of the natural environment in which are living the local communities. For example, the destruction of certain forests entirely, the withdrawal of certain agricultural fertile lands, the monopolizing of some natural water reserves developed by mining companies to the detriment of the local communities, the pollution of waters due to chemicals, etc., have as consequences to deprive these communities to their natural rights of using these resources. And as the compensations to the benefit of local communities are usually below the losses extent, the mining enterprises use corruption through some local leaders such as villages' leader, custom responsible, municipalities' leaders, in order to foil all initiatives of social demonstration which could cause disastrous effects on the expected results of these mining enterprises. Similarly, the induced changes by mining activities on the cultural wellbeing, of the local populations living in the location areas of mining activities implementation, stimulate of about 0.043 point the probability that the mining enterprises practice corruption at local level. So, the destruction of holy areas which have high traditional value because of mining activities, can lead to the losses in certain cultural values thus reducing the local communities cultural wellbeing. And, as the compensations are not usually equivalent to the losses, because a lost or destroyed holy cultural site due to mining activities cannot be restored by generating the same value as before. So, the mining enterprises managers can be stimulated to practice corruption for avoiding any social tension with the local communities. The physical changes due to mining activities on these latter location areas contribute to increase the probability that mining companies resort to corruption of about 0.027 point. This is a reality insofar as the implementation of mining is followed by the implementation of some infrastructures in terms of housings, roads, etc. Sometimes, for achieving that, mining enterprises require to scarper or relocate certain villages entirely or a group of given individuals. But, more often, the promises of compensation are not respected or partly honored by mining enterprises with the complicity of some local leaders who have received bribes from mining companies. Another way is that the funds allocated by mining companies in order to compensate the losses inflected by these companies to the local communities are often misappropriated entirely or partly paid by some local leaders to the local populations.

Our results also show that the induced changes due to mining activities on the social wellbeing contribute to increase the probability of adopting a corrupt behavior of about 0.007 point. This result is interesting because in the process of local development, mining companies contribute to the creation and financing of activities of certain civil society organizations (OSC) particularly women associations, youth association in the sectors of breeding, short term breeding, gardening, etc. And, because of the financial support, these mining companies can use corruption in order to influence them to adopt a behavior which is favorable to their activities stability. For example, the members of these OSC can decide that they do not participate to any social demonstration initiated by the whole local communities because of the nuisance caused by mining activities then reducing these communities' wellbeing, if it is admitted that these OSC have a great influence at local scale.

Table 4. Estimate of the Probit model

Variable	Coefficient	Std. Error
const	.153	.1223
ch_natural	.017**	.009
ch_physical	.027**	.0143
ch_humin	.023	.0142
ch_economic	-.019	.0148
ch_social	.007**	.0129
ch_cultural	.043***	.0139

Pseudo R2: 0.1176; LR: 40.364 with a probability of .000; % correct forecasts: 71.37; Source: Results of Probit on SPSS17.0

7. CONCLUSION

Corruption is practiced in the mining sector in Burkina Faso and particularly in the implementation sites areas of mining industries. The results of the analysis have allowed us identifying that the majors stimuli of corrupt behavior adopted by mining companies are at first linked to the negative effects caused by mining activities on the natural wellbeing of the local communities where these mining are implemented. Then, the damaging effects of mining activities on the cultural wellbeing of these local communities are also a factor that leads to the adoption of corruption just as the changes induced by these mining in the communities' physical living areas. Finally, the effects of induced changes due to mining on the social wellbeing contribute to the adoption of a corrupt behavior from the part of mining companies in Burkina Faso. The reasons justifying this perception of the actors evolving in these mining locations are mainly the fact that any punishment occurs when the mining enterprises miss to accomplish their obligations yet signed by themselves during the license attribution period. For proof, we frequently see social demonstrations from local communities living in the surroundings the mining sites areas. Demonstrators from these communities are deprived people of their natural resources because of mining activities without seeing the benefits that generate these activities for their own life (7). In addition, the guilty silence national and local authorities is a sign that these latter are corrupted by mining companies.

For fighting against corruption of mining enterprises at local level, the local and national authorities must work in an inclusive manner with the local populations in order to oblige mining companies to really respect the terms of reference of their license contract. So, through an operational inclusive system of monitoring and assessment of mining activities, the development of programs for mining activities damaging effects compensation to the benefit of local communities will be carried out effectively and seriously. In addition, the punishment system must be operational through this framework so that any corrupted behavior suspected or effective must automatically be punished with spread information at public level on that fact.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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