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Original Paper

Analysis of Aid Absorption in Burkina Faso: Could Donors' Coordination Play an Effective Role?

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Abstract

This study assesses absorption level of aid in Burkina Faso and analyzes the factors that determine this level. The analysis postulates that the level in absorbing aid is low and assumes that this level is determined by the multiplicity of donors and by mechanisms used to coordinate aid. To test this assumption, the study uses secondary data collected from 10 sectors of public administration over the period 2000-2019. Aid allocated to these sectors represented at least 75% of total aid received by the country during this period. The assessment indicate that about 58.46% of aid allocated to these sectors was effectively spent. Factors determining this absorption level were estimated using a Tobit model. The results conclude that the limiting factors lie both in donors' behavior and in aid coordination mechanisms. Thus, better donors' coordination could be an effective mechanism to improve aid absorption in these sectors.

Keywords

Aid, Absorptive Capacity, Tobit Model

1. Introduction

To finance its development, Burkina Faso has benefited since its independence from external resources that was mainly some Official Development Assistance (ODA). This aid gained importance in the 2000s with the international community mobilization in fighting against poverty. Thus, foreign aid more than tripled over the decade 2000-2009, rising from US $ 381.62 million in 2000 to US $ 1,257.79 million in 2009. It grew by around 44.96% over the decade 2010-2019, going from US $ 1,066.36 million in 2010 to US $ 1,545.80 million in 2019.

Despite this continuous increasing of aid since 2000, we note that progress in socio-economic conditions remains weak, especially comparing with ambitious development programs that the country has experienced. Indeed, referring to the Human Development Index (HDI) evolution, it certainly indicates a slight improvement in life quality, but its level of 0.43 in 2018 reveals that the country remains among the poorest in the world. This situation is further highlighted by the monetary poverty indicators. The incidence of poverty certainly shows a downward trend over the period 2000-2019, but poverty is still high because it is estimated that 40.1% of the population lives still below the poverty line in 2018. This monetary poverty is strongly felt in terms of health, with high level of infant mortality (estimated on average at 74.52 ‰ between 2000 and 2018, with 53.6 ‰ in 2018) and in terms of education with an average enrollment rate estimated at 79.45% over the same period, of which 97.54% in 2018.

This socioeconomic situation in Burkina Faso, characterized by many gaps to be filled, raises up the issue of national development policies effectiveness in general and that of aid in particular. This issue of aid effectiveness can be seen and analyzed first through the capacity of the economy to absorb financial resources, especially aid resources allocated to the country. Indeed, according to data from the Public Investment Program (PIP) of the Ministry in charge of finances, the average execution rate of investments over the period 2010-2019 is estimated at 71%, with a negative slope in the dynamic of execution (see figure 1 in appendix). In other words, about 29% of the planned investment amounts was not spent during the period. It is estimated that more than 41% of these amounts uninvested was official development assistance.

Such a situation highlights the aid absorption issue and the causes of this absorption. Based on public investment spending dynamic in Figure 1 in the appendix, we wonders about the real level of the aid absorption that the international community is mobilizing to support Burkina Faso’s development efforts. We wonders also about the factors that determine this aid absorption level.

This issue is as important as aid absorption is crucial to achieve development goals. The problem can be assessed in the very essence of aid effectiveness analysis, and absorption constitutes the basic condition of this effectiveness in terms of achieving objectives assigned to aid. According to Hansen and Tarp (2000), aid impact on economic growth is not linear due to the existence of limited absorptive capacities of recipient countries. This is the conclusion that Kébré (2018) reached in his analysis of aid effect on the economic growth of WAEMU countries. The results of his estimates indicated that aid positively affected economic growth with diminishing marginal return. Such result is the signature of insufficient absorption capacities of these economies which should be better analyzed to determine the factors.

This study assesses the absorption level of external aid in public sectors and analyzes the factors determining this level over the period 2000-2019. The analysis starts from the postulate that, on one hand, the absorption level of aid is low and, the other hand, multiplicity of donors and aid coordination mechanisms are its causes. The remainder of the study is organized into three sections. First,

knowledge is mobilized through a review of previous works on the issue. Then, we assess absorption level of aid in the sectors chosen. Finally, based on the literature, we analyze the determinants of aid absorption using an econometric model.

2. Literature Review on Aid Absorptive

2.1 Importance of Absorptive Capacity in Aid Effectiveness Analysis

The concept of absorptive capacity takes on a certain complexity that explains its limited use in economic theory. Guillaumont (1971) attempted a very general definition of absorptive capacity in these terms: "... the complex idea of progress makes it possible to define absorptive capacity as the maximum investment generating progress, or more precisely as the volume of investment such that any additional investment in the same period no longer results in any progress. Defined in this way, absorptive capacity notion joins that of optimum investment". The complexity of this definition lies in optimum investment as conceived by the author, that has little connection with optima of economic growth models (which refers to the product); it is more akin to general notion of economic progress (encompassing all economic aspects of social and political realities on which usefulness of investment depends on). Cohen and Levinthal (1990), for their part, based on firm theory, provided more precision by defining absorptive capacity as the ability of an organization to acquire, assimilate knowledge from another institution, then transform them in order to better exploit them.

In aid area, the notion of absorptive capacity is intimately linked to economic literature on aid effectiveness. Indeed, debate on aid effectiveness in this literature has mainly focused on the impact of aid on recipient countries' development (economic and social). In this dynamic, analysis was generally content to look for correlations between aid flows and development indicators, without worrying about underlying mechanisms. However, if we want to increase aid effectiveness, we need to understand the mechanisms by which this aid affects development. This is why, from 1990s, the idea that relationship between aid and growth was not necessarily linear entered the debate, leading to a new wave of analyzes. These studies then attempted to demonstrate that aid effectiveness on growth could be conditional and depend on certain factors specific to recipient economies. The culminating article of this literature is that of Burnside and Dollar (2000) who considers that aid would only be effective and positively impact economic growth in countries with good institutions and having implemented sound economic policies. It fueled debates and several studies subsequently undertook, with varying degrees of success, to confirm these results.

In the same vein, other papers have identified natural and structural factors that can also influence the impact of aid; the latter can effectively have a so-called "compensatory" effect and mitigate the negative impact of these exogenous shocks on growth (Collier & Dehn, 2001). Thus, Chauvet and Guillaumont (2004) have shown that aid was more effective in countries highly exposed to external shocks such as sudden fluctuations of terms of exchange and significant climatic variations. Subsequently Dalgaard, Hansen and Tarp (2004) observed that aid was less effective in countries

geographically close to the tropics, highlighting the fact that the returns induced by aid, especially in the agricultural sector, would be limited by a too low productivity caused by the climatic conditions of these areas. Finally, other studies (Collier & Hoeffler, 2002; Kosack, 2003) have also underlined preponderance of institutional quality in the performance of these flows.

The renewed interest in absorptive capacity of aid follows efforts to disburse aid since the early 2000s to support international development programs (MDGs, SDGs). Analyzes then looked at potentially negative effects that these massive inflows of financial flows could have on developing countries. They observed that large volumes of aid could lead to an increase in the effective exchange rate and harm exporting industries, thus leading to a situation of "Dutch Disease" where aid granted would harm economic growth (Bevan, 2005; Lensink & White, 2001; Rajan & Subramanian, 2005; Svensson, 2006).

In this sense, other studies have highlighted the fact that a large flow of aid beyond absorptive capacity of recipient country can also compromise aid effectiveness. Under this approach, above a certain threshold, an additional dollar of aid received would be relatively less effective. For example, the studies of Hadjimicheal et al. (1995) and Hansen and Tarp (2001) have shown that marginal returns to aid become negative when these flows exceed 25% of GDP, while Durbarry et al. (1998) and Lensink and White (2001) have shown that this threshold is rather around 40% of GDP.

2.2 Factors Limiting Absorptive Capacity of External Aid

As mentioned in the previous section, several factors are likely to affect the volume of aid that can be productively absorbed. The literature agrees that absorptive capacity depends on factors such as the quality of institutions, administrative management and donor procedures. Their interaction can either hinder absorption or stimulate it, depending on the institutional environment and the behavior of agents (recipient governments and donors in particular).

- ✓ *Institutional constraints*

Several institutional and macroeconomic factors contribute to hindering the level of external resources absorption in general and aid in particular. Among these are mainly economic policies choices and investments effectiveness.

Regarding economic policies choices, the analysis framework is based on two distinct but related concepts which are aid absorption and expenditure (Bevan, 2005; Shekhar, Berg, & Hussain, 2005). According to these authors, aid absorption occurs when the current account gap (excluding aid) widens as a result of increasing in aid. This concept measures the degree to which aid results in an actual transfer of resources in terms of increased imports, or reducing in domestic resources allocated to production for export. On the other hand, aid is spent when budget gap (excluding aid) widens as a result of increasing in aid. Based on these rather distinct definitions, absorption depends on exchange rate policy and policies influencing import demand, while aid spending depends on fiscal policy. According to Shekhar et al. (2005), absorption-expenditure combination defines four possible macroeconomic reactions to increasing in aid (aid is absorbed and spent, aid is neither absorbed nor

spent, aid is absorbed without being spent, aid is spent without being absorbed). From these reactions, it emerges that three elements can be potential sources of the weakness of aid absorption and expenditure: low level of international reserves, high level of inflation, lack of coordination of monetary and fiscal policies. These elements highlight the need for organizational effectiveness in an economy that depends on institutions and policies quality. And concerning external aid, there is a consensus that aid is effective only in an environment of appropriate policies (Banque-Mondiale, 1998; Burnside & Dollar, 2000). Otherwise, the poor quality of institutions and corruption mean that an important part of aid allocated for development does not reach target groups. They are recurrent problems in developing countries (Jelovac & Vandeninden, 2008).

The importance of economic policy choices is pointed up to contain Dutch disease resulting from aid flow (Van-Wijnbergen, 1985). Indeed, a sudden increase in aid requires implementation of import policies necessary for production that can absorb this aid flow. Otherwise, this sudden increase can lead to an increase in demand for international non-tradable goods and an increase in relative price which is detrimental to competitiveness. This is why the risk of “Dutch disease” due to a sharp increase in aid is a concern for policy makers (Adam, 2005; Bevan, 2005; Buffie, Adam, O’Connelm, & Patillo, 2004; Gupta, Powell, & Yang, 2005).

With regard to investments effectiveness, it relies on the main function of aid which is to supplement national capital formation to achieve a growth rate that can be maintained without additional external resources. But as Chenery and Strout (1966) point out in their double deficit model, growth objective achievement is conditioned by investments effectiveness. It is this efficiency that determines wealth producing in a country. Indeed, efficient allocation of resources for wealth creation depends on a set of exogenous and endogenous factors such as existence of a stock of human or physical capital (infrastructure) without which investment profitability is lower. These include education or work experience (Benhabib & Spiegel, 1994) and physical capital (Hall & Jones, 1999). A shortage of these levers hinders investments effectiveness. This is highlighted by the “Lucas paradox” that, in a neoclassical growth model, capital is all the more productive as it is scarce. We therefore expect capital to be more productive in poor countries; and this should lead to a significant flow of external resources. However, there is a low absorption of these resources in developing economies. This situation results from a shortage of human capital, in particular skilled and semi-skilled labor (Martens, 1994). As these economies suffer from a lower stock of capital per unit produced than in rich countries, capital should be much more profitable there than in rich countries. But this is not the case. This paradox is explained by the presence of externalities due to human capital which make capital accumulation less productive in poor countries.

- ✓ *Agents behavior*

Aid framework gathers several actors, the two main ones being donors and recipients. These actors develop behaviors which can be a source of obstacles to effective absorption of aid. These behaviors

would derive their basis essentially from the principal-agent problem, the multiplicity of actors and the way in which aid is delivered.

Regarding the Principal-Agent problem, agency theory considers that individuals have divergent interests such that relationships are conflicting. The agency relationship is a contract in which the principal uses services of the agent to perform, on his behalf, any task that implies a delegation of decision-making power to the agent (Jensen & Meckling, 1976). In this situation, the principal controls game rules without having all useful information, while the agent complies with rules while controlling a uncertainty margin that gives him informational advantage (Curien, 1994). This information asymmetry gives rise to conflicts in the contract performing.

It is in such environment of information asymmetry that take place aid relationships with the two involved actors. The imperfections of the Principal-Agent relationship proceed from the erratic behaviors (free-rider) of the two actors that result from moral hazard and adverse selection problems. The Samaritan's dilemma, highlighted by Buchanan (1975), is present in any assistance relationship. Thus, a country receiving aid would have less interest in opting for good poverty reduction policies, avoiding its aid decreasing (Kahn & Sharma, 1981; Pedersen, 2001).

Faced with these pernicious incentives, authors have tried to find solutions to address them. Azam and Laffont (2003) proposed conditional aid that would oblige recipient countries to invest these resources in poverty reducing. However, Collier (1997) has made reservations about this idea. According to him, donors are unable to commit not to support a country in need even if the latter does not respect all the conditionalities: the threat would not be credible. Torsvik (2005), using a two-period model, has reached to reduce perverse incentives, but still remains skeptical about the feasibility of this solution; it is too close to conditionality of which the threat credibility would be in doubt. That is why he suggested using organizations that are less averse to poverty in order to counter the harmful effects of aid. In this logic, Hagen (2006) used aversion to poverty as his analysis starting point. For him, in order to contain perverse incentives, aid should be delegated to organizations that are less averse to poverty. He therefore suggested increasing the multilateral aid and reducing bilateral aid. Other authors suggested delegating aid to NGOs, because of the competition that exists among them and can reduce pernicious incentives (Masud & Yontcheva, 2005).

Regarding the multiplicity of actors, the lack of coordination of donors and aid agencies can create serious collective action problems and limit the success of development actions (Svensson, 2006). Marshall Plan recipients have dealt with a single donor, while current aid includes multiple bilateral, multilateral and NGO agencies. The presence of this myriad of donors affects effective use of aid because of various collective action problems that is characterized by proliferation (increasing number of actors) and fragmentation (scattering of donors activities). Svensson (2006) noted that the proliferation of donors generates:

- ✓ transaction costs associated with multiple rules and procedures in management of projects and programs financed by aid (Berg, 1993);

- ✓ costs related to non-exploitation of economies of scale resulting from implementing projects (each donor focusing on its own projects);
- ✓ costs relating to financial possibilities and management ability of the recipient country (Knack & Rahman, 2004). Indeed, donors prefer to deliver aid to support directly projects by working with ministries rather than budget support. In addition, they tend to support only capital expenditure (investments) while urging the recipient country government to provide complementary inputs (personnel and maintenance). This is a burden on the government budget and can create a commons tragedy where roads are built but not maintained, schools and health centers built without human resources to operate them. Finally, donors with their projects attract local experts by offering them higher salaries (Knack & Rahman, 2004). This can create a distortion that affects overall allocation of skills in the receiving country.

As in any market, aid market has advantages of competition and disadvantages of market failures, calling for more coordination (Klein & Harford, 2005). Coordination has a double objective, namely aid must serve the recipients priorities and responsibility for development programs rests with those recipient countries. This coordination must therefore be done around the recipients objectives in order to minimize transaction costs due to multiplicity of actors.

- ✓ *Allocation way of aid*

One of key aspects for aid effectiveness is its quality which raises three important concerns affecting significantly aid absorption. It is about effectiveness of aid allocation, its predictability and additionality (erosion of public administration capacity).

Indeed, the issue about effectiveness of aid allocation is linked to two factors, namely resources scarcity and information and data imperfection that lead donors to make trade-offs in investment sectors without real dialogue with recipient country. As any investment, aid involves risks, the minimization of which requires availability of information and reliability of data (assessments) on investments and the main drivers of economic growth. This information does not always exist and its reliability is often not guaranteed by recipient countries. The donor, in this asymmetry of information, seeks a balance between financial risk and development results. Its risk aversion is driven by the requirements to preserve financial results and tends to keep aid below its optimal trajectory in terms of development results (Ndikumana, 2012). Aid effectiveness is constrained by the fact that resources could be allocated to sectors with low return on investment and with weak impact on growth.

In addition, these allocation efficiency issues are compounded by the difficulty of aid predictability often explained by inconsistency in some donors decisions. These donors often modify their aid targets and preferences without recipient country really knowing whether these evolutions result from a rigorous analysis of the expected gains from investments. This instability makes investment planning more difficult and tends to reduce the profitability of both public and private investments.

Finally, financial additionality stems from role that aid plays in attracting public and private resources. On public side, aid can and should help mobilize tax resources by increasing administration capacity.

Instead of that, aid often tends to have a disincentive effect on domestic resources mobilization (Kébré & Ouédraogo, 2018; Ostrom, 2001). As aid is fungible, especially budget support, it relieves pressure on the government to increase taxes that is politically unwanted. In addition, the fact that aid depends on counterpart resources to be disbursed by the recipient country exacerbates destabilizing trend of aid delivery system. Due to the same budgetary constraints that oblige it to resort to aid, the recipient country cannot provide the counterpart resources required to aid disbursement. As a result, the general logic of the aid delivery system often tends to aggravate the erosion of state capacities rather than strengthen them.

3. Some Stylized Facts about Aid Absorption in Burkina Faso

The objective of this section is to present stylized facts that will better characterize the phenomenon of aid absorption in Burkina Faso and better guide the analysis of its determinants. In this sense, the first step will be to highlight the problem of aid effectiveness through its relationship with economic growth, and secondly to assess and analyze the level of aid absorption and finally to discuss its possible causes.

3.1 Statistical Highlighting of aid effectiveness Problem

As noted above, aid absorptive capacity is mostly appreciated through the dynamic of link between aid and economic growth. It is such a connection that allowed Hansen and Tarp (2000) to conclude that aid effect on economic growth is not linear due to limited absorptive capacities in recipient countries.

Figure 1 below, which connect aid to economic growth, allows to appreciate relationship between growth and aid. It point out a positive direct link between aid and economic growth materialized by coefficient of the variable x in the equation. This relationship suggests that aid effectively contributes to increasing GDP in Burkina Faso. However, the equation reveals a nonlinear relationship between aid and growth. Indeed, the positive effect of aid on economic growth has a decreasing marginal return materialized by a negative coefficient of the variable x^2. This result suggests the presence of a threshold from which aid negatively affects economic growth. It is the signing of a limited absorptive capacity of aid in Burkina Faso which should be assessed and further analyzed.

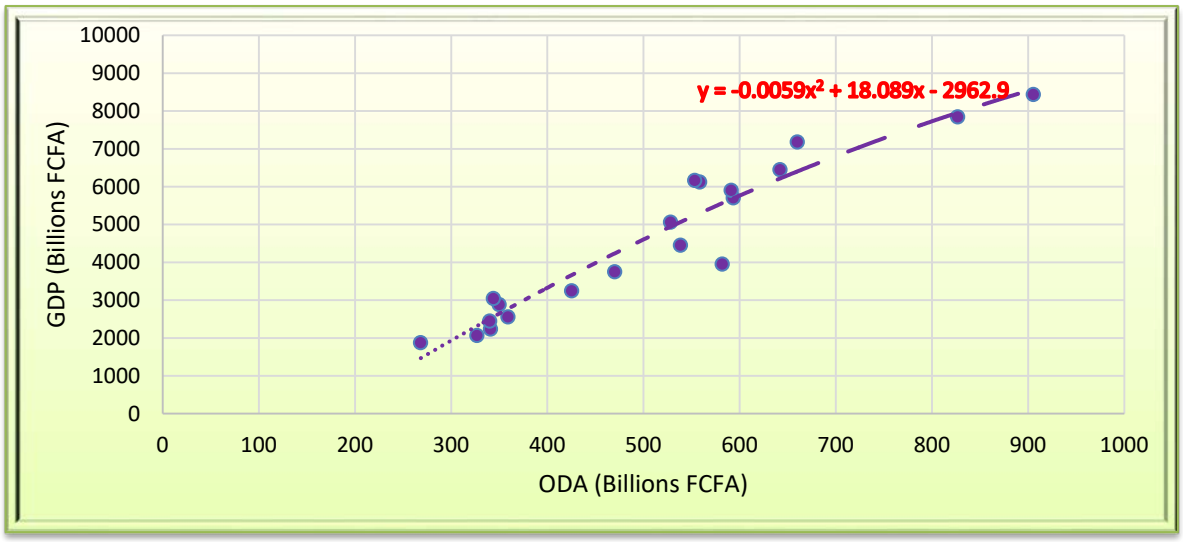

Figure 1. Relation between GDP and Aid over the Period 2000-2019

3.2 Aid Absorption Level in Burkina Faso

The assessment of aid absorption covers the 10 main sectors of the economy that received, over the period 2000-2019, the most important part of foreign aid. These selected sectors received around 75% of aid over this period. This evaluation only concerns aid budgeted, in investment part, and the indicator used to approximate absorption is aid expended compared to aid forecast in the budget per year. The assessment shows that 58.46% of aid registered in the Public Investment Program (PIP) was actually spent. Thus, sectors could only absorb 58.46% of aid allocated to them over the period; the unabsorbed part representing 41.54% of aid budgeted for these sectors. It can therefore be concluded that the absorption of external aid is average. For a developing country characterized by many needs and scarcity of financial resources, such a level of absorption is very worrying, especially considering that a part of this aid (and not negligible) constitutes loans.

Figure 2 below highlights the evolution of this absorption over the period. In general, there is a bearish tendency in aid absorption materialized by the negative slope. Over the period, there was only one year where absorption level was above 80% (in 2003 with an estimated rate at 96.64%). There was even a year when the absorption rate was estimated at only 17.80% (in 2017 probably due to multiple strikes that the public administration experienced). Faced with such a situation, it seems important to investigate further in order to understand the possible reasons limiting the absorption of aid received from our donors.

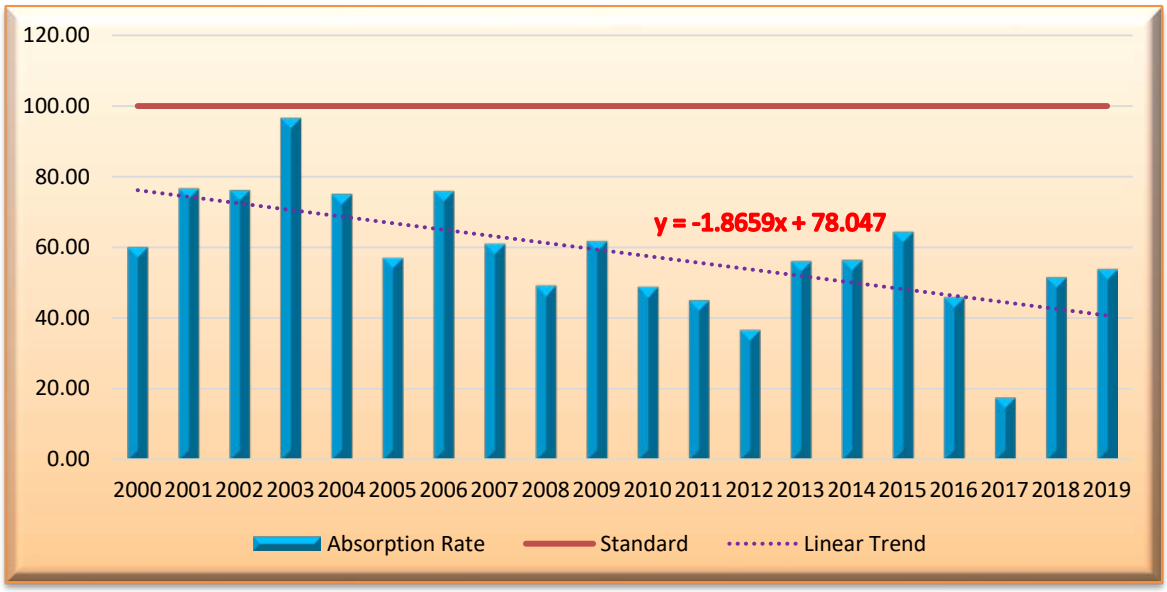

Figure 2. Evolution of Aid Absorption in the 10 Sectors from 2000 to 2019

3.3 Possible Causes of the Low Absorption Rate of Aid

Faced to this average level of aid absorption, several reasons are put forward in the economic literature on the issue. In Burkina Faso's case, one of these reasons seems to emerge from the statistical analysis of PIP data, which is linked to what the economic literature has called institutional constraints. In fact, from 2011, it intervened a reform in aid management within the ministry in charge of finances. Until 2011, most of the management process of aid, comprising several functions, took place within the General Directorate of Cooperation in collaboration with other directorates of the ministry and other ministerial departments. In order to improve the level of aid mobilization and absorption, the ministry therefore initiated this reform, which had as a guiding principle: "one structure, one main function". Thus, the functions which were concentrated within a single directorate were apportioned to 4 directorates.

The statistical analysis pointed out the effect of this institutional reform on aid absorption. A priori, this institutional shock was not able to contribute to reversing the downward dynamic in aid absorption. Worse, statistics show a worsening of the low level of absorption with an average rate of 67.24% over the period 2000-2010 versus 47.72% over the period 2011-2019. In addition, before the reform, about 32.76% of aid budgeted in the PIP had not been spent (2000-2010); after a decade of implementing the reform, it is estimated that unspent aid is on average 52.28% per year. However, the dynamic analysis before and after the reform indicates that the negative slope after reform is lower than that before. It would therefore be premature to conclude that the reform has exacerbated the low level of aid absorption; a more in-depth econometric analysis would make it possible to draw an informed conclusion.

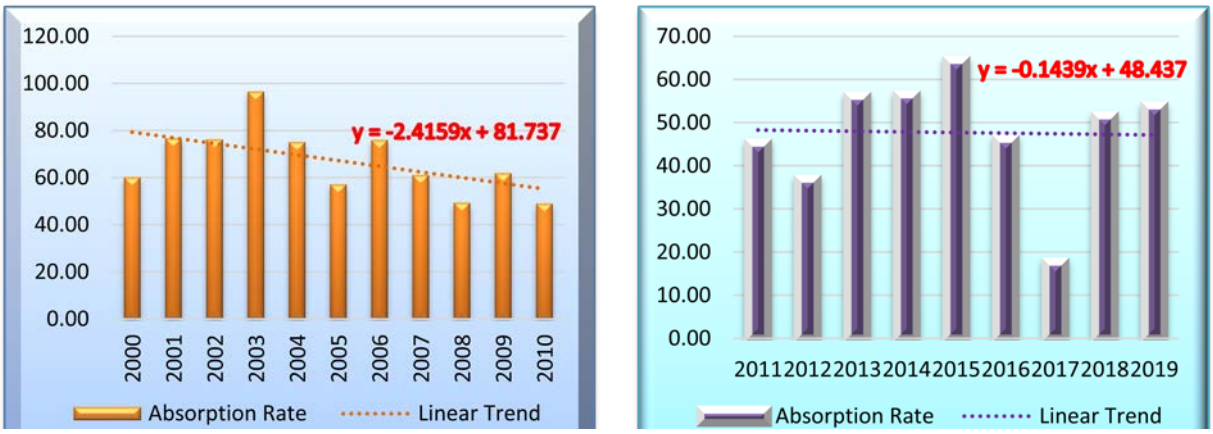

Figure 3. Dynamics of Aid Absorption Rate before and after the 2011 Reform

Beyond this institutional shock, other factors relatively to stakeholders' behavior and the way aid is allocated are likely to explain the average level of absorption. In this sense, from 2000 to 2019, it is estimated that around 12 donors intervened annually in each of these 10 selected sectors. In large sectors (in terms of aid allocated) such as agriculture, water, education and health, the number of donors can sometimes reach 20. This number of stakeholders is also driving up the number of projects implemented. There are around 33 executing projects per year, sometimes with around a hundred in the large sectors mentioned. These numbers of interventions and donors can be a constraint if there are no effective coordination mechanisms and if each donor requires the use of its own procedures.

Statistics clearly show the existence of coordination mechanisms in these sectors, but donors do not seem to adhere to them. Indeed, for better coordination of aid in these sector, a number of instruments are used including "Sector Budget Support" and "Common Basket (Note)". Through sector budget support, the sector authorities are initiating a framework for permanent dialogue with sector donors around sector policy and strategies and invite them to financially support the implementation of related development actions. Through the Common Basket, the sector authorities initiate a framework for dialogue with donors around a specific sector program. Donors and authorities agree on the main principles of program implementation and disburse resources in a common basket for implementation of the program.

Statistics over the period indicate that donors have shown very little interest in these two coordination tools. Sector budget support disbursements represented about 2.23% of aid received by the sectors. As for disbursements in common basket, they are estimated at 5.11% of aid received over the period. The low use of these instruments suggests that donors favour project aid without a common fund, which gives them more opportunity to impose their own procedures in project implementation. To be convinced, assessment shows that about 40.71% of aid disbursements over the period were spent without going through the budget. This situation has especially been exacerbated over the past 10 years,

during which the off-budget execution rate of investments financed through aid rose from 33.15% in 2010 to 77.39% in 2019.

4. Econometric Analysis of Factors Determining Aid Absorption

The stylized facts presented in the previous section revealed an average level of aid expended and factors whose statistical behavior suggests that they are determinants of that level. The purpose of this section is to deepen the statistical analysis through an econometric analysis of factors explaining this level of aid absorption. In this sense, after presenting the model and the estimation method that will be used, we will discuss the results based on the literature presented above.

4.1 Analysis Model and Estimation Method

To build the analysis model of aid absorption, it is important to better understand absorptive capacity notion. Absorptive capacity is very close to efficiency which draws its foundations from microeconomic optimization theory. Unlike effectiveness, which establishes a link between results achieved and objectives, efficiency refers to link between means used and results achieved. It is in this sense that we can affirm that absorptive capacity of external aid is very close to efficiency notion.

As Guillaumont (1971) pointed out, absorptive capacity refers to optimum investment, which is defined as the maximum investment that generates progress. Thus, aid absorptive capacity is a measure of efficiency of sectors in expending aid resources. Under the assumption of an optimal allocation of resources based on results-based management, a sector unable to absorb aid allocated to it will not be able to achieve its development objective.

Therefore, the analysis of factors determining aid absorption could be inspired by the method of efficiency measurement through production frontiers models. These models were mainly used to estimate production functions in a sector of activity and to estimate the technical performance resulting from them. Their approach is subdivided into two main methods namely the parametric method and the non-parametric one.

In parametric method, sector is considered as a unit of production which aims to maximize its outputs for a given level of inputs. This behavior of the sector can be modeled from its estimated production function which allows its efficiency to be evaluated (Cohn & Cooper, 1997). The limit of this approach is that it is recommended when the functional form of the production function is well known. However, the production function in public sector is not a priori known.

The non-parametric method estimates the efficiency levels of the production sector from distance function (Kirjavainen & Loikkanen, 1998). This method, called DEA (Data Envelopment Analysis), is most often used for its empirical nature, and also because it is generally recommended when the functional form of the production unit is not known, or when it produces several outputs.

The two approaches achieve the same results when returns to scale are constant and different results when returns to scale are variable (Afonso & Aubyn, 2006; Domazlicky & Primont, 2006; Lee & Worthington, 2008). Figure 3 below provides a better understanding of these two approaches.

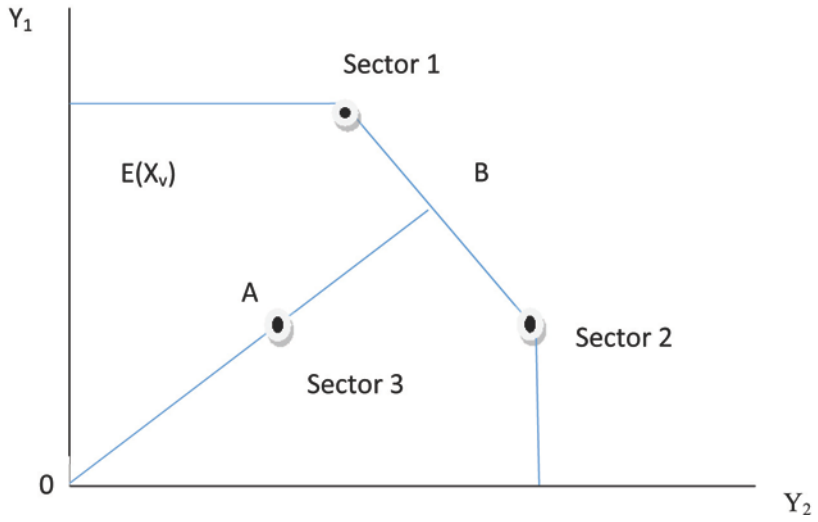

Figure 4. Production Set and Distance Function (from Domazlicky and Primont (2006))

If E (Xv) represents the production set, that is to say, all output levels that can be obtained from a vector of variable inputs; it is possible to determine technical efficiency of each sector by specifying distance function. According to Shephard (1970), the distance function establishes a relationship between observed production and optimal production. This distance function is defined in the following relation:

$$D_0\left(X_v, Y\right) = Min\left\{\lambda : \frac{Y}{\lambda} \in E\left(X_v\right)\right\} \quad (1)$$

Where D_0 is the distance function that has for arguments the vector of inputs and the vector of outputs of sectors. The production set E (X_v) is defined in the space between the two axes and the production frontier. Production carried out in sectors 1 and 2 is optimal because it produces on the frontier. For each, the value of the distance function λ^* is equal to unity. Inverse of the distance function $[D_0(X_v,Y)]^{-1}=1/\lambda^*$ gives the greatest increase in outputs under the constraint that the observed production does not exceed the optimal production. According to Farell (1957), the inverse of the distance function represents the measure of technical efficiency. A sector is efficient if it maximizes its production for a given level of inputs; in other words, if its level of technical efficiency is equal to unity (the production achieved is equal to the optimum production). Otherwise, the sector will be considered inefficient.

For a sector i (i = 1, 2, ..., I), the value of the distance function is obtained by solving the following linear optimization problem:

$$\begin{cases} Min\left[D_0\left(X_v, Y_i\right)\right]^{-1} = \max \lambda \\ sc \begin{cases} \sum_i^l Z_i Y_{im} \geq \lambda Y_{im} & m = 1,...., M \\ \sum_i^l Z_i X_{iv} \geq \lambda X_{iv} & \mathrm{v} = 1,...., V \\ Z_i \geq 0 & i = 1,...., I \end{cases} \end{cases} \quad (2)$$

In relation (2), i represents the sector, M the number of outputs produced by the sector, Z a variable which defines the weighting or the weight of each input v on the basket of inputs, V is the number of inputs used by the sector.

Given the fact that DEA method generates efficiency levels from information on the inputs and outputs of firms, the specification of the production function requires the selection of inputs and outputs as a preliminary. The selection of inputs can be done from the perspective of the production model.

But in our analysis, the objective is not to analyze technical efficiency of these selected sectors. Rather, it is about analyzing factors that explain aid use. Of course, the analysis is in the same way as efficiency because the absorptive capacity measures the ability of sector to maximize its objectives (socio-economic performance) using aid that is allocated. In fact, in recent years, the mechanism for allocating financial resources in public sectors has been based on results-based management; which assumes that resources is optimally allocated to allow sectors to achieve their objectives. Based on this assumption, progress made by sector in terms of results can be assessed through the level of allocated resources use.

The assessment of sector's performance through the use of financial resources is approximated by the indicator "amount of expenditure compared to amount of financial resources allocated". Concerning aid, absorption indicator will be "amount of aid expended compared to amount of aid allocated". The closer this indicator (absorption rate) is to 1, the higher the probability that the sector will reach its objectives.

Thus, the distance function could allow analysis of factors explaining aid absorption in public sectors. The absorption ratio takes values in the range of [0 1]. This equation cannot be estimated by ordinary least squares (OLS), but by censored models such as the generalized and censored Poisson model or the censored Tobit model. Indeed, the censored regression models are particularly recommended when the values of the endogenous variable belong to a precise interval. The Poisson model is often recommended when the values of the dependent variable are natural numbers. On the other hand, the Tobit model is used when the dependent variable is continuous in an interval and the probability that the dependent variable takes zero values is positive.

In the current case of analysis of aid absorption, the dependent variable is continuous in the interval [0 1]. Since the values of the dependent variable do not show a series of natural integers, the generalized Poisson model cannot be used. Likewise, the censored Tobit model is not appropriate because the

dependent variable does not admit zero values (Greene, 1995; Maddala, 1983). To get around this difficulty, we rather seek to explain the non-absorption of aid through the non-absorption rate indicator which takes zero and positive values and is continuous in the interval [0 1]. The dependent variable is now censored by keeping in the sample the cases for which the value of the dependent variable is zero. A censored Tobit model can therefore be used to explain the sectorial non-absorption of aid.

Thus, if Y_{it} represents Aid non-absorption rate (1-Absorption rate) of sector i at time t, the model can be written:

$$\begin{cases} Y_{i,t} = X_{i,t}\beta + \mu_{i,t} \\ Avec \quad \begin{cases} Y_{i,t} = Y_{i,t}^{*} & \text{si} \quad Y_{i,t}^{*} \succ 0 \\ Y_{i,t} = 0 & \text{si} \quad non \end{cases} \end{cases} \tag{3}$$

In relation (3):

- ✓ X is a vector of explanatory variables;
- ✓ β is a vector of parameters to be estimated;
- ✓ Y * is a latent variable which can be considered as a threshold above which non-discretionary variables affect the sector's non-absorption rate (Afonso & Aubyn, 2006; Greene, 1995; Kirjavainen & Loikkanen, 1998; Luoma, Jarvio, Suoniemi, & Hjerppe, 1996; McCarty & Yaisawamg, 1993).

Assuming that errors are normally distributed, estimation of the censored Tobit model above will be performed through the maximization of the log-likelihood that is written:

$$Log\left(L\right) = \sum_{i=1}^{n} Log\left[1 - \Phi X_{i,t}\frac{\beta}{\delta}\right] + \sum_{i=1}^{n} Log\left(\frac{1}{\sqrt{2\pi\delta}}\right) - \frac{\sum_{i=1}^{n}\left(Y_{i,t}X_{i,t}\beta\right)^{2}}{2\delta^{2}} \tag{4}$$

Where n is the number of observations, and δ the standard deviation.

4.2 Presentation of Variables and Data Sources

Regression of model (3) requires an appropriate choice of variables. In addition to the endogenous variable, we can retain two categories of explanatory variables. The choice of these two categories is based on an economic literature that identifies in stakeholders' behavior and aid coordination mechanisms the sources of low aid absorption.

The endogenous variable is "Non-absorption rate" of aid from the sector. It is obtained through data from the PIP which summarizes allocations budgeted for sectorial investments and actual expenditures on these investments. It is assessed using the indicator: Actual expenditures compared to budgetary allocation of aid.

Regarding the exogenous variables, the variables used are those which allow a better understanding of the organizational differences between the sectors and their capacity to coordinate aid and projects.

The first category that assesses stakeholders' behavior contains variables relating to the multiplicity of donors and the way in which they disburse their aid:

- ✓ number of donors intervening in the sector;
- ✓ number of externally financed projects in execution in the sector;
- ✓ volume of aid disbursed off-budget;
- ✓ variability of aid disbursed.

These variables are expected to negatively affect aid absorption rate.

The second category of variables captures coordination mechanisms set up. It's about:

- ✓ part of aid disbursed as sectorial budget support;
- ✓ number of donors using the "Common Basket" instrument;
- ✓ absorption rate of national counterpart (amount spent/amount budgeted for the sector);
- ✓ absorption rate of investments on own resources (amount spent/amount budgeted for the sector);
- ✓ the institutional reform that implemented from 2011 (1 after the reform and 0 before).

These variables are expected to positively affect sectorial absorption rate of aid.

The data used for analysis come from the Ministry of Economy, Finance and Development. They cover the period 2000-2019 and concern projects implemented in the public administration sectors.

The sectorial distribution in Burkina Faso defines four categories of sectors that are production, production support, social sectors and administrative infrastructure and equipment. 10 sectors are selected for this analysis. These sectors benefited, over the period 2000-2019, from around 75% of aid received. It's about:

- ✓ in production area: agriculture, breeding and environment;
- ✓ in production support area: water and development of hydro-agricultural, energy and transport;
- ✓ in social sectors: education and training, health and social action;
- ✓ in infrastructure area: administrative infrastructure and equipment.

4.3 Discussion of Results

The results of the estimated model of factors determining sectorial non-absorption of aid are presented in Table 1. The estimations of this censored Tobit model is executed on Stata 14. The model estimates non-absorption indices of overall aid, grants and loans received. Overall, the estimates present satisfactory results because Chi2 coefficients are significant at 1% level, whether it concerns total aid, grants or loans. Detailed results are shown in Table 1. Table 2 shows the marginal effects.

Table 1. Results from Estimates of Non-Absorption Indices for Total Aid, Grants and Loans

Variable	Total Aid	Grant	Loan
Variables determining Donors' behavior			
Projects	0.0009	0.0008	0.0012
	(0.73)	(0.59)	(0.80)
Donors	-0.0119*	-0.0142**	-0.0130*
	(-1.81)	(-1.90)	(-1.65)
Out_Budget	0.0012***	0.0007**	0.0006**
	(4.49)	(2.29)	(2.14)
Stand_deviation	-0.0006	-0.0005	-0.0007
	(-0.99)	(-0.79)	(-0.97)
Variables determining Coordination mechanisms			
Donors_FC	0.0427	0.0480	0.0639*
	(1.48)	(1.47)	(1.87)
Sq_Donors_FC	-0.0088**	-0.0101**	-0.0120**
	(-2.20)	(-2.15)	(-2.08)
Part_abs	-0.0004	-0.0036	0.0009
	(-0.18)	(-1.23)	(0.31)
Intern_input	-0.1407*	-0.1886**	-0.2030**
	(-1.80)	(-2.13)	(-2.14)
Intern_Invest	0.0196	0.1440**	-0.1361*
	(0.30)	(1.91)	(-1.72)
Reform	0.0748**	0.1519***	0.0330
	(2.11)	(3.06)	(0.62)
Number of Observations	200	200	180
Number of Sectors	10	10	9
Left-censored Observations	7	8	7
Uncensored observations	193	192	173
Wald Chi2	63.28***	56.45***	36.59***

NB: ***, **, * indicate that variable is significant at level of 1%, 5% or 10% respectively

Table 2. Results from Marginal Effects Estimates

Variable	Total Aid	Grant	Loan
Variables determining Donors' behavior (dy/dx)			
Number_Projects	00022	0.0002	0.0001
Number_Donors	-0.0028*	-0.0044**	-0.0015*
Out_Budget	0.0003***	0.0002**	0.00007**
Stand_deviation	-0.0001	-0.0001	-0.00008
Variables determining Coordination mechanisms (dy/dx)			
Donors_FC	0.0102	0.01495	0.0073*
Sq_Donors_FC	-0.0021**	-0.0031**	-0.0013**
Proj_Abs	-0.0001	-0.0011	0.0001
Intern_input	-0.0339*	-0.0587**	-0.0232**
Intern_Invest	0.0047	0.0448**	-0.0155*
Reform	0.0171*	0.0432***	0.0035

NB: ***, **, * indicate that variable is significant at level of 1%, 5% or 10% respectively

From the estimates results analysis, the following conclusions emerge:

- ✓ *From stakeholders' behavior, the number of donors and off-budget aid are significant determinants*

As mentioned above, 4 variables allow to assess the effect of stakeholders' behavior on aid absorption. These variables were expected to negatively affect aid absorption rate in the 10 selected sectors. Among these variables, two, namely the number of donors and off-budget aid, were found to be significant determinants.

Number of donors is negatively related to explained variable at 10% while off-budget aid is positively related at 1%. We thus note that it is the sign of this previous variable that is in accordance with the expected effect. On the other hand, the number of donors negatively affects the non-absorption rate, whether it is grants at 5% or loans at 10%. Contrary therefore to certain authors who see in multiplicity of donors a brake on aid absorption (Birdsall, 2009; Svensson, 2006), the results indicate that in the sectors concerned by the analysis, the number of donors does not constitute an obstacle to aid absorption. Rather, the presence of an additional donor helps to improve absorption of external aid, whether it's grants or loans.

The combination of these two results would rather highlight the problems of collective, even hyper-collective action in the disbursement of aid (Severino & Charnoz, 2008; Severino & Ray, 2012; Svensson, 2006). The presence of multiple donors in a sector certainly offers additional financing possibilities, but seems to generate coordination difficulties so that a large part of aid allocated to the sector escapes the budgetary system, thus having a negative effect on aid absorption. This would be due

to the lack of coherence of aid with budgetary resources of the country that does not guarantee a certain effectiveness of aid. Indeed, as aid comes in addition to budgetary resources, its expenditure off-budget is detrimental to its absorption because certain conditionalities of aid disbursement depend on the implementation of activities financed by budgetary resources.

- ✓ *The coordination of stakeholders has emerged as a significant factor for aid absorption.*

Regarding coordination mechanisms, 5 variables were retained, the expected effect of which is that they positively affect aid absorption in the sectors. Among these variables, 4 were actually found to be significant determinants.

Thus, the number of donors disbursing in a Common Basket contributes to worsening rate of non-absorption of loans. However, by squaring this variable, it changes sign and its effect becomes negative, whether it is total aid, grants and loans. This result suggests that from a certain threshold of donors, their coordination around a Common Basket contributes to solving the problems of inconsistency of interventions (Severino & Ray, 2012), thus improving the level of absorption of aid in the sector. Coordination through the Common Basket is an effective mechanism for improving aid absorption if the sector manages to concentrate as many donors as possible in the use of this instrument. This result is the signing of the instrument's capacity to organize and merge donors' preferences and their procedures around major investment programs, thus creating consistency of aid with budgetary resources.

Likewise, mobilizing budgetary resources (national counterpart) to execution of projects financed by aid improves aid absorption rate (grants and loans). Indeed, the results indicate that an increase in execution rate of budgetary resources in these projects leads to a decrease in the level of aid non-absorption, thus suggesting the effectiveness of mobilizing budgetary resources on aid absorption. Such a result take up the very logic and philosophy of external aid, which is that it provides recipient country with additional resources enabling it to create new production capacities and better employ those that already exist. Therefore, for aid to be used efficiently, it must always be complemented by domestic resources.

The third variable which explains the level of absorption of sectorial aid is the institutional reform that took place from 2011. The results indicate that this reform (dichotomous variable) is positively linked to non-absorption rate of aid. Thus, contrary to its spirit, the reform had a negative effect on aid absorption, especially on grants. This result is the signing that the will to improve aid absorption through this institutional reform has not had the expected effects. It suggests that the idea of devoting one function per directorate in the management of aid within the ministry in charge of finance did not respond effectively to absorbing external aid received.

5. Conclusion

The purpose of this paper was to assess the level aid absorbed and to analyze its determining factors. To achieve this goal, we used a secondary database from 2000 to 2019 and covering 10 sectors that received the major part of aid during his period.

The assessment indicates that, over the period, about 58.46% of aid budgeted for these 10 selected sectors was actually spent. In other words, an estimated 41.54% of aid was not absorbed over the period. These initial results allow to conclude that there is an average level of absorption of aid in Burkina Faso and suggest a limited absorptive capacity.

Based on these results and using a Tobit model, we estimated the factors that determine this level of aid use. These estimates indicate that these limiting factors lie both in stakeholders' behavior and in aid coordination mechanisms. Regarding stakeholders' behavior, it is not so much the multiplicity of donors that hinder aid absorption in these sectors, it is rather the non-integration of aid into the budget system precisely because of donor procedures. Concerning to coordination mechanisms, it is above all the 2011 institutional reform that negatively affects aid absorption.

In the light of these results, two economic policies can be formulated. The first calls on sectorial authorities to rely more on the "Common Basket" instrument as it constitutes an effective mechanism which ensures better absorption of aid. This approach has the advantage of being able to mobilize donors and reconcile their preferences and procedures around common development actions. This would allow aid to fully play its role of complementary resources to domestic resources for financing investments. The second economic policy implication is related to the institutional reform that took place in 2011. As the results reveal its negative effect on aid absorption, it would be appropriate to revisit this reform, if not canceled, for more efficiency in terms of aid absorption.

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Appendix

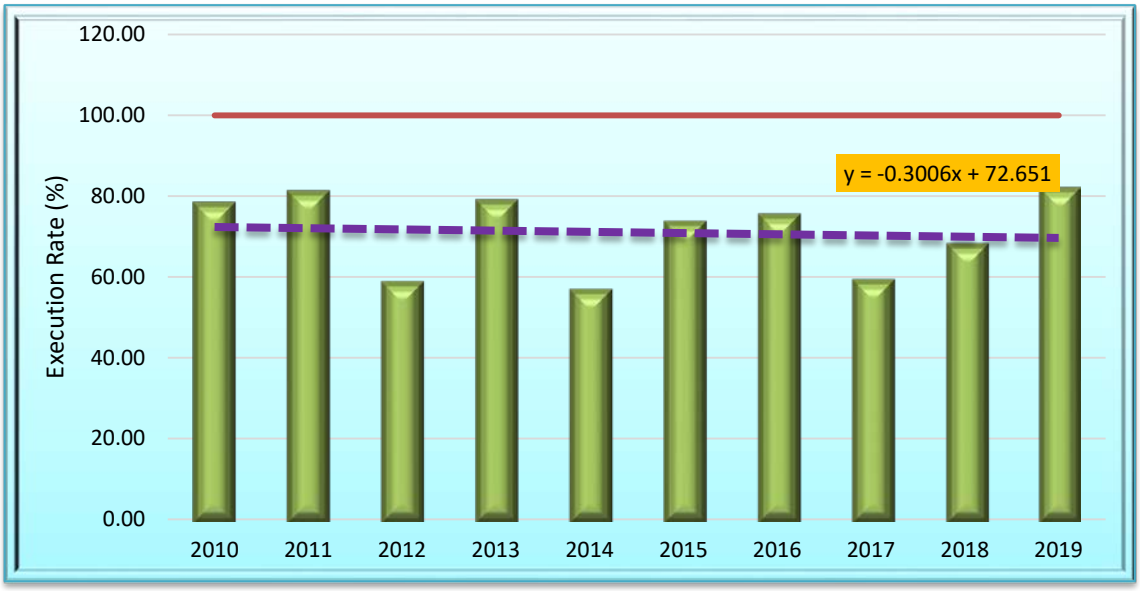

Figure 1. Evolution of Expenditure Rate of Investments Budgeted over the Period 2010-2019

Note

The Common Basket, also known as the Common Fund, is a coordination mechanism that allows several donors to finance a project by putting their aid in one basket. The advantage of this mechanism is the harmonization of disbursement and supervision procedures by donors who are members of this common basket.