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海地政府農業支出之決定因素：2007-2020 時間序列分析

Determinants of Government Agriculture Expenditure in Haiti: A Time Series Analysis over the Period 2007-2020

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海地政府農業支出之決定因素：2007-2020 時間序列分析

Determinants of Government Agriculture Expenditure in Haiti: A Time Series Analysis over the Period 2007-2020

本論文係 Yvrose Charléus Guerrier 君（R09627048）在國立臺灣大學農業經濟學研究所完成之碩士學位論文，於 2022 年 6 月 20 承下列考試委員審查通過及口試及 格，特此證明。

This is to certify that the Master thesis above is completed by Yvrose Charléus Guerrier (Student ID R09627048) during his studying in the Department of Agricultural Economics at National Taiwan University, and that the oral defense of this thesis is passed on June 20th, 2022 in accordance with decisions of the following committee members:

指導教授 Advisor：

口試委員 Committee members：

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Dedication

This study is dedicated to:

- My family especially my father Mr. Christal Etienne Guerrier and my mother Mrs. Rosaire Antoine for their unconditional support in my life.
- My daughter Ms. Rosenerjhy I. Charléus for giving me the strength to pursue higher education.
- Centre de Techniques de Planification et d'Economie Appliquée (CTPEA) especially the Department of Planning for its significant contribution to my education.
- Ministry of Planning and External Cooperation (MPCE) of Haiti for allowing me to pursue higher studies, for assisting me in my data collection and for the relevance of the thesis topic to its mission and responsibilities.
- Ministry of Economy and Finance (MEF) of Haiti for the relevance of the thesis topic to its mission and responsibilities.
- Ministry of Agriculture, Natural Resources and Rural Development (MARNDR) of Haiti for the relevance of the thesis topic to its mission and responsibilities.

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Abstract

Government Expenditure impacts on the economic system through different layers. The challenge for government agencies is not only to get their role right but also to limit their interventions within a threshold based on the level of the country's economic development. In recent years, there has been a growing interest in government agriculture expenditure (GAE) in developing countries. Many academics set out to analyze agricultural public spending or its impact on agricultural GDP or GDP. This study aimed to investigate the determinants of government agriculture expenditure (GAE) in Haiti from 2007 to 2020. This study also presented the magnitude and type of relationship between public agricultural expenditure and other literature-suggested factors. It also looked at the composition of agricultural public expenditure, namely agricultural investment expenditure and agricultural operating expenditure according to Aschauer's theory (1989). The paper considered government agriculture expenditure as an endogenous variable according to Wagner's law (1883). Confirmatory Unit root test and OLS Estimators were used as an empirical approach. The results showed that agricultural GDP has a statistically significant impact on government agriculture expenditure in Haiti, and the effect is significant at a 5% level of error. The results also showed that government investment in agriculture and government consumption in agriculture have a statistically significant impact on government agriculture expenditure in Haiti, and the effect is significant at a 1% level of error. The size of the coefficient is greater for agricultural GDP compared to government investment in agriculture and government consumption in agriculture since agriculture value added reflects the performance of agriculture. However, the size of the coefficient is greater for government consumption in agriculture than government investment in agriculture, which is not consistent with the

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literature review since investment expenditures in agriculture are productive expenditures that boost the agriculture sector.

Key words: Government Agriculture Expenditure, Haiti, Time Series Analysis, OLS, ADF test.

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Chapter 1. Introduction

1.1. Background and Motivation

As described by Frenkel and Razin (1987), there are three layers through which the introduction of government impacts on the economic system. First, from the perspective of the representative individual, the public goods provided by the government enter directly into the utility function. Second, from the perspective of the economy as a whole, the activities of the government absorb resources and provide public consumer and producer goods. Third, from the perspective of the rest of the world, the activities of the government are transmitted internationally through its direct and indirect effects on world goods and capital markets.

Since the effects of the introduction of government on the economic system are significant, the challenge is not only to have the role of government right but also to define a threshold for the level of government intervention in the economy. This threshold is nothing but an optimal government size that can still support economic growth. Nouira and Kouni (2021) conducted a study seeking to examine government's optimal size and its effect on economic growth in selected developing and Middle East/North Africa (MENA) countries from 1988 to 2016. Based on a recent literature, they found that a government expenditure threshold effect on economic growth exists for all panel groups. Actually, the threshold is between 10% and 20% for developing countries, between 20% and 30% for MENA countries and between 10% and 30% for all panel groups.

Frenkel and Razin (1987) examining an optimal size of government, argue that if the supply of public goods is optimal, the consumption-smoothing drive that characterizes private consumption in the absence of public goods also applies to the larger definition of consumption that encompasses both private and public goods. When public goods are optimally provided, supply

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shocks result in a positive association between the levels of consumption of private and public goods. Government spending must thus be done in a way that will improve the economy of the nation. Since agriculture is one of the key sectors capable of generating economic benefits for developing countries, government must provide an optimal provision of agricultural public goods and services through government agriculture expenditure. Government agriculture expenditure (GAE), referred as all of the government's operating and development expenditures related to agriculture incurred within a specific fiscal year, has recently drawn a lot of attention not only from government agencies but also from international agencies.

In 2003, many African developing countries have endorsed the "Maputo Declaration on Agriculture and Food Security" in which they commit to the allocation of at least 10% of national budgetary resources to agriculture and rural development policy implementation within five years. This commitment can be seen as a renewed emphasis on agricultural development where the government has a major role to play. This decision also supposed that the allocations will be transformed into expenditures, which is far from true considering the gap between budgetary allocations and actual expenditures. In 2011, World Bank published a standardized book dedicated to practitioners analyzing government agriculture expenditures in developing countries in which a step-by-step methodology according to the Budget Cycle Framework (BCF)[1] is provided. This focus came at a period of time where development agencies not only put interest in the amount but also in the quality of government agriculture expenditures.

From 2018 to 2020, during Jovenel Moise's term in office, under the impetus of the "Caravan of Change", government agriculture expenditure in Haiti has significantly increased as an attempt to

[1] Budget Cycle Framework (BCF): Strategy and Planning – Formulation – Execution – Monitoring and Evaluation.

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address the preceding governments' disregard of this sector in their development goals. Indeed, the agricultural sector has shown a relatively poor performance over the past years. According to the estimates of the National Coordination of Food Security (CNSA) in 2009, domestic production provided 49% of the needs for food, imports, 46% and aid food, 5%. The agriculture sector in Haiti contributes less and less to the Haitian Economy. Together with forestry and fisheries, agriculture contributes to about 17 % in 2020 of Haiti's annual Gross Domestic Product (GDP) against approximately 30% in 1988 as observed in Figure1.1 below.

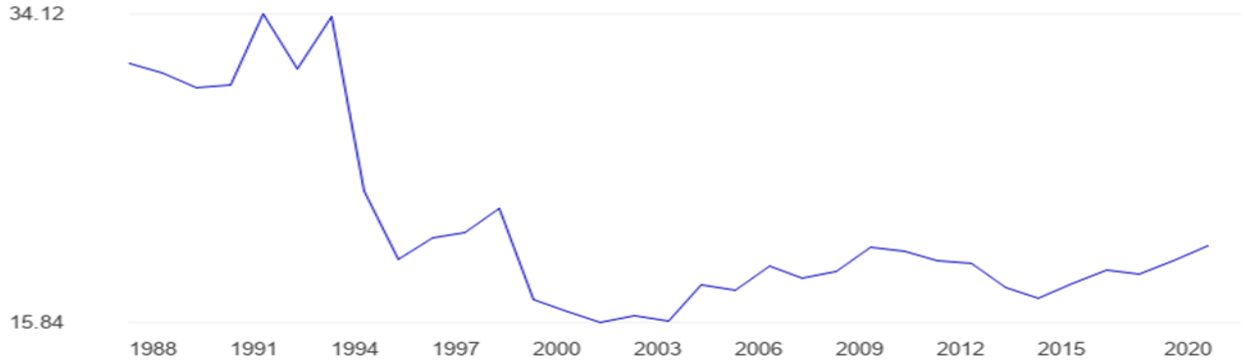

Figure 1.1: Value Added in Agricultural Sector as Percent of GDP in Haiti, 1988 – 2020

Source: The GlobalEconomy.com

However, most of the rural households depend on the agriculture sector. The collapse of the agricultural sector has a domino effect. Agriculture jobs fall to 29% in 2019 against approximately 40% in 1991. Figure 1.2 below shows a picture of it.

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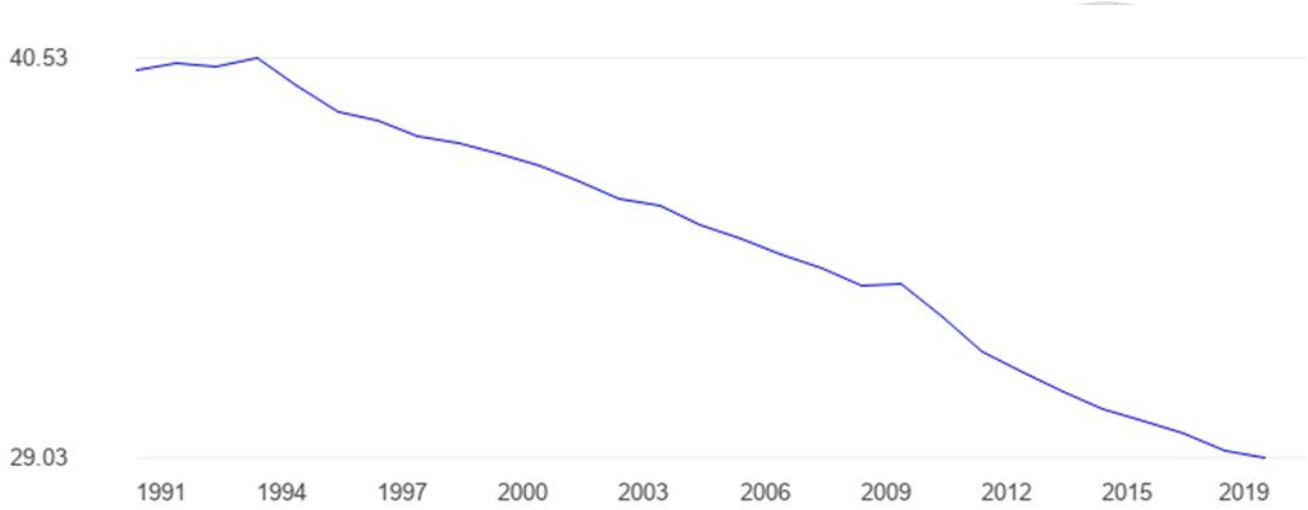

Figure 1.2: Employment in Agriculture as Percent of Total Employment in Haiti, 1991 - 2019

Source: The GlobalEconomy.com

1.2. Problem Statement and Objectives

The figures on agricultural value added and agricultural employment stated above shed light on the bleak agricultural performance in Haiti. The Haitian Government ought to take the necessary measures to reverse the situation. The agricultural sector has a potential capacity to build economic growth and boost jobs considering its great contribution to the Saint-Domingue[2] Economy before the Haitian Revolution (1804). A focus on government agriculture expenditure might be profitable for the country. But, even so, this focus should be triggered within an integrated public expenditure framework. That is to say government expenditure in healthcare, education and infrastructure should go hand in hand with public expenditure in agriculture.

There is a lack of empirical studies regarding government agriculture expenditure (GAE) in Haiti. Some studies based on basic statistical descriptive analysis can be found.

[2] Former name of Haiti before the independence in 1804

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Damais (2007) in a report on the review of Public Expenditure Management and Financial Accountability (PEMFAR) over the period 2001-2007 using statistical descriptive analysis concluded that in general, the analysis of public expenditure in favor of the rural sector showed that budget allocations and expenditures seem disconnected from choices and sector priorities, that allocations and expenditures are highly unstable and fluctuate from one year to another, that expenditures have decreased in real terms in recent years, that budget allocations are not managed effectively and that they are subject to very little monitoring/control of their efficiency and impact. That said, efforts have been made in recent years towards an increase in allocations in real terms and relative to other sectors of the economy.

Giordano (2016) analyzed public and private financial flows as they shape the development of the agricultural and rural sectors in Haiti. He sought to test three hypotheses: 1) Public funding of the agricultural sector responds only imperfectly to agricultural public policies and that the sector suffers from under-investment. 2) The weakness of the Haitian Government coupled with the specific dynamics of the donors, leads to a lack of integration and coherence of the actions from the donors over time, which compromises the effectiveness of their commitments. 3) The actions towards the agricultural sector carried out by the public Authorities do not seem to create sufficient incentives for the expansion of private investments. As a methodology, he analyzed financial flows to agriculture by objective, geographical area and sub-sector and presented them in the form of a Sankey diagram. Financial flows were analyzed from 2005 to 2014. The results showed that quantitatively public spending on agriculture in the budget does not meet policy objectives. The results also showed that substantial financial flows to agriculture from donors are off-budget and follow the donors' own strategies, objectives, programs and projects. Finally, these results showed that funding from donors and the Haitian Government are lower than investments made by farmers.

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This research aimed to reduce an empirical gap regarding government agriculture expenditure by analyzing the determinants of government agriculture expenditure in Haiti from 2007 to 2020. This sample period was chosen because the data available could not be found for a longer period of time for all the variables retained. This study sought to answer crucial questions, which will address concerns regarding government agriculture expenditure in Haiti and facilitate policy makers in their decision-making:

I. What are the signs and magnitude of the factors explaining government agriculture expenditure in Haiti?
II. Are they statistically and economically significant?
III. To what extent does agricultural gross domestic product impact on government agriculture expenditure in Haiti?

To achieve that, along with linear multiple regression analysis with Ordinary Least Squares (OLS) estimators was used Augmented Dickey-Fuller Unit Root Test (to check stationarity of the time series data), a confirmatory analysis to confirm the results of the usual unit root test. Model diagnostic inspection analysis was also used to determine the model's statistical adequacy and fitness of fit.

The general objective of the study is to investigate the determinants of government agriculture expenditure in Haiti from 2007 to 2020 and specific objectives are:

I. Assess the relationship between government agriculture expenditure and the selected variables;
II. Define economically and statistically the degree of significance of the selected variables to government agriculture expenditure;

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III. Examine the impact of agricultural gross domestic product on government agriculture expenditure.

This study is outlined in six (6) chapters. The paper is introduced in Chapter 1. It contains the following points: background and motivation of the study; problem statement and objectives. Chapter 2 develops government agriculture expenditure patterns in Haiti. Chapter 3 presents the literature review which is divided between theoretical and empirical literature. Chapter 4 develops the methodology used in this paper. Chapter 5 displays the results and discussions of the paper. Chapter 6 includes the summary, conclusion, limitations, and recommendations.

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Chapter 2. Government Agriculture Expenditure in Haiti

This chapter presents government agriculture expenditure in Haiti. The first section is to discuss the budget procedures, stakeholders and funding. The second section is to highlight budgetary, fiscal, monetary and agricultural policies influencing expenditures in agriculture. Finally, the size of government agriculture expenditure, the gap between allocations and expenditures, and the composition of government agriculture expenditure are introduced.

2.1. Budget Procedures, Stakeholders and Funding

Several procedures backed up by legislation shape budget planning, execution, monitoring and evaluation in Haiti. They provide the guidelines for all sectors including the agricultural sector[3] patronized by the Ministry of Agriculture, Natural Resources and Rural Development (MARNDR). The most notorious are first, the Decree of October 4, 1984 creating within the Ministry of Planning and External Cooperation a fund called "Public Investment Fund" and Order of September 17, 1985 setting the terms of application of the Decree of October 4, 1984; second, the Decree of January 29, 2016 establishing the procedures, and the necessary modalities for the formulation and management of the Public Investment Program (PIP) and Order of January 22, 2016 setting the procedures for registering a project in the Public Investment Program; And third, the Law replacing the Decree of February 16, 2005 on the process of designing and executing Finance Laws: Law LEELF May 4, 2016 where the decision about programme budget adoption is made. This legislation is accompanied by a regulatory framework supported by a long-term strategic plan broken down into a three-year action plan and procedures application Manuals:

[3] The description of Haitian agricultural sector is present in Appendix 1.

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Haiti's Strategic Development Plan (PSDH, 2012); Manual of Budget Preparation and Execution Procedures (2005); Public Investment Management Procedures Manual, Volume I and II (2014).

Different stakeholders[4] are involved in the preparation, execution, monitoring and evaluation of the budget in Haiti. The Ministry of Planning and External Cooperation (MPCE) designs development policies and strategies. Therefore, it is in charge of the development budget. The Ministry of Economy and Finance (MEF) designs economic policies such as fiscal, budgetary and monetary (with the Central Bank "BRH") policies and is the Treasurer of the Republic of Haiti. It is in charge of the operating budget. The procedures state that all sectors including the agricultural sector, ought to yearly submit their operating expenditure programming at the MEF and their public investment program at the MPCE following the publication of the "Lettre de Cadrage[5]" by the Prime Minister. The MPCE and the MEF join through budget conferences with the sectors where the latter ones justify the amounts of expenditures programmed for both operation and investment. From the indicative expenditure ceiling submitted by the MEF, the MPCE allocates financial resources to programmes and projects from all sectors including the agricultural sector. After the preparation of the PIP, the MPCE submits the document to the MEF for consolidation. After consolidation of the budget that's to say after putting together the operating and investment budgets as a whole, the MEF submits the document "Projet de Loi de Finance" to the Parliament for approval by June 30th. Failing the existence of a Parliament, the document is submitted to the Council of Ministers for approval. Once approved and published in the official newspaper "Le Moniteur", the document "Loi de Finance" is set for execution. All sectors including the agricultural sector periodically send disbursement letters to the MPCE for projects accompanied

[4] Appendix 2 provides detailed information on the mission and responsibilities of relevant ministries.
[5] It sets the main macroeconomic guidelines and defines the main lines of the budgetary policy for the fiscal year.

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by the appropriate documents. The MPCE submits afterwards disbursement requests to the MEF for investment projects. All sectors including the agricultural sector periodically and directly send disbursement letters to the MEF for operating expenses accompanied by the appropriate documents. Once disbursements are executed, all sectors including the agricultural sector submit execution reports. At the end of the fiscal year (September 30th), the MEF submits a whole budget execution report "Projet de Loi de Règlement" to the Superior Court of Accounts and Administrative Litigation (CSCCA) for approval. Once public procurement on goods and services is audited and approved, the document becomes "Loi de Règlement".

The budget of Haiti including the agricultural budget is financed from several funding sources: 1) Public Treasury Fund; 2) Other Internal Funds (Equity funds of Autonomous Bodies and Public Enterprises, other national funds); 3) Bilateral and multilateral resources such as loans and grants from international agencies. In other words, public resources are made up of domestic resources, foreign resources, domestic borrowings and foreign borrowings. In figure 2.1, were examined the trends in overall budget funding in Haiti from 2007 to 2020.

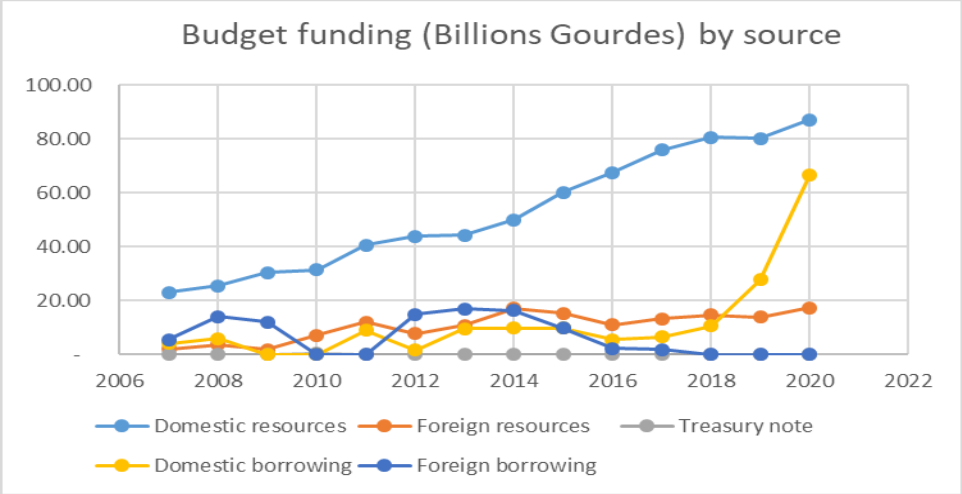

Figure 2.1: Trends in Overall Budget Funding in Haiti, 2007 - 2020

Source: Ministry of Economy and Finance (MEF) of Haiti

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As shown in figure 2.1, budget funding relies most on domestic resources from 2007 to 2020. A sharp upward schedule is observed in domestic resources which keep increasing over the years. Recently, domestic borrowings have been also increasing while foreign resources have been decreasing. Foreign borrowing shows a sharp peak during 2012, 2013 and 2014 due to Petro Caribe funds.

2.2. Fiscal, Budget, Monetary and Agricultural policies

Efficient public spending in all sectors including the agriculture sector presupposes the implementation of appropriate policies and reforms. From 2007 to 2020, a lot of policies and reforms have been adopted.

First, the decision made by the Haitian Government to increase the ratio of tax revenue on GDP from 10% to 13-14%. To achieve that, the government has announced in 2009 that it will seek to modernize the collection agencies operations and strengthen the fight against fraud, tax evasion and corruption. Also, it will proceed to the application of new customs tariffs in conformity with the Common External Tariff (CET).

Second, the government will proceed to the improvement of the allocation of public expenditure by regularly increasing the relative weight of investment spending allocated to sectors that foster economic growth such as agriculture, infrastructure, health and education while decreasing public consumption. To lower the operating budget, it groups together for the fiscal year the purchases of public supplies to enable credit savings and controls the payroll. To improve public expenditure management at the central level, the government revises the procedures for planning, implementing and executing the budget, at the same time, it consolidates internal control mechanisms and builds institutional capacity. In 2015, to ensure more effective handling of

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government revenue and expenditure, the Haitian Government launched the Single Treasury Account (CUT). The advent of the Single Treasury Account puts an end to the Special Treasury Account for Development. As experience proved in some developing countries that by focusing on the development budget alone, planning agencies could overlook the operating budget funding needed to operationalize projects, compromising their long-term sustainability, particular attention is now given in Haiti not only to a Medium-Term Expenditure Framework (MTEF) but also to a formulation of programme budgets. Through the MTEF, resources are planned together even if the separation between the investment and operating budgets is maintained. The formulation of programme budgets allows for professionals to take into account the links between resource allocation and performance. This reform seeks to improve the efficiency as well as the quality of public expenditure. This reform aims to put an end to the means-end link in resource allocation. This reform is designed to allow macro-economic and sectoral policies to align on planned public expenditure and actual expenditure carried out. The transition is initiated by designating 3 pilot sectors: health, education, and agriculture. In 2016, The Haitian Government also seeks to increase the implementation capacity within the sectors by training civil servants on Cost-Benefit Analysis Methodology in order to maximize the effectiveness of spending in the sectors by focusing on projects with economic profitability that meet priority needs. In 2017, about 80 researches adopting the Cost-Benefit Analysis methodology were carried out in Haiti on economically profitable projects within the framework of "Haiti Prioritizes: an alternative development" plan led by Copenhagen Consensus Center (CCC) and presented to the Government of Haiti. In 2016, the Haitian Government instituted the Planning, Programming and Budgeting System (PPBS) as a framework for rational budgeting. Experience has shown that while the MTEF has been implemented successfully at various levels in Tanzania, Ghana, Malawi, Ethiopia, Mozambique,

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South Africa, and Uganda, the PPBS has proven to be challenging to improve the policy relevance of public expenditures and links to performance that were initially anticipated. According to the OECD's and developing nations' experiences, it was in fact challenging to define programs properly, especially when goals exceeded conventional administrative borders. It also was challenging to set appropriate goals and indicators of performance. Programmes were developed based on what the institutions were already doing rather than referring to policy goals since resources were still handled by administrative structures. The vast quantity of data needed to assess the relative importance of programmes and their effectiveness is difficult for decision-makers to assimilate. The collection of information was not always regular, some agencies were unwilling to comply, and institutions showed little desire to give information that may undercut their claims for more financing (Caidan and Wildavsky, 1980; Dean, 1989; Sekwat,1992). Developing countries concentrated more on short-term stabilization development policies.

Third, the containment of Haiti's debt at less than 4% of GDP. The government will not accumulate arrears either on its external debt. To achieve that, the government seeks to promote cash management within the institutions in order to incur expenses within the limits of authorized budget resources during the fiscal year. The government also seeks to use monetary funding as little as possible or to maintain the threshold to reduce inflationary tendencies.

Alongside these budgetary, monetary and tax policies influencing agricultural public expenditure, agricultural policies have been formulated to guide these expenditures. The most notorious under the period of study is agricultural development policy 2010-2025 broken down into a three-year action plan including PTRA 2013-2016. The three-year agricultural recovery program is a program of the Haitian Government, spread over 3 years. Its objective is to contribute to the modernization of the agricultural sector, ensure better governance of the sector, increase agricultural productivity

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with a view to increasing food self-sufficiency from its estimated level of 50% to a level of 60% for the increase in the income of the farmers, to increase the exports agriculture by at least 40% and to increase the vegetation cover to 15% (MARNDR, 2013). Five approaches were prioritized for the implementation of the PTRA:1) A territorial approach that promotes potential agro-ecological zones, with a concentration of production in irrigated areas and areas of wet mountains; 2) A sectoral approach, aimed at bringing together the various players in the sector around priority sectors; 3) Market orientation; 4) A public/private partnership; 5) An integrated watershed approach. Francois (2018), analyzing factors such as identified needs, target population, goals, and outcomes, concluded that the PTRA evaluability study showed that the programme is not mature enough for an effect evaluation.

Along with local policies, classifications produced by international agencies such as OECD (2014) and FAO (2015)[6] have been taken into account in the agricultural budget itself and in health, education and infrastructure budgets. The agricultural budget manages "agriculture-specific expenditure" such as payments to agents in the food and agriculture sector and general support to the food and agriculture sector. Other sectors budgets handle "agriculture-supportive expenditure" such as rural infrastructure (rural roads, rural water and sanitation, rural energy), rural education and rural health. These classifications channel actions supporting the agricultural sector in terms of efficiency-seeking. These two types of agricultural expenditures described by FAO reflect some of the objectives presented by OECD.

The Haitian Government, as a result of its commitment to Millennium Development Goals (MDGs) 2000-2015 and Sustainable Development Goals (SDGs) 2016-2030 in agriculture, orientate

[6] A detailed description of OECD and FAO's classification is presented in Appendix 3 and Appendix 4.

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expenditures in agriculture towards these goals while setting priorities on goal 2 among others: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.

2.3. Size of Government Agriculture Expenditure

The share of government agriculture expenditure in total government expenditure, in agricultural gross domestic product, and in budgetary resources for the agricultural sector was presented. Further, the share of budgetary resources for the agricultural sector in overall budgetary resources was presented as well. The latter is consistent with the Maputo Declaration (2003) which stipulates those allocations in agriculture should represent 10% of the national budgetary resources. As shown in Table 2.1, the agricultural budget for 2009, 2013 and 2016 with a share of 8.02%, 7.54% and 9.53% respectively is approaching the budgetary objectives in accordance with the Maputo Declaration. However, when focusing on government agriculture expenditure, we observed that there is a significant gap between allocations in agriculture and agricultural expenditures. The range is between 8.15% in 2009 and 63.04 % in 2020. This gap can be explained by a lot of factors: gap between planned and actual financial resources, delay in the adoption of the national budget by parliament, absorptive or implementation capacity deficit of the agricultural sector, bureaucracy, etc. Examining the share of government agriculture expenditure in agricultural gross domestic product, the range is between 0.47% (in 2009) and 4.65% (in 2018). Investigating the share of government agriculture expenditure in total government expenditure as well, the range is between 1.06 % (in 2009) and 3.87% (in 2018). In sum, the figures showed that government agriculture expenditure is not substantial compared to allocation in agriculture, agricultural gross domestic product, and total government expenditure.

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The figures also showed that allocations in agriculture compared to national budgetary resources are not substantial as well.

Table 2.1: Size of Government Agriculture Expenditure in Haiti, 2007-2020

Year	GAE (% TGE)	GAE (% GDP)	GAE (% AGDP)	GAE (% Allocations in agriculture)	Allocation in Agriculture (% national budgetary resources)
2007	1.59%	0.11%	0.50%	14.85%	5.55%
2008	1.44%	0.12%	0.61%	20.55%	4.04%
2009	1.06%	0.09%	0.47%	8.15%	8.02%
2010	2.99%	0.22%	1.06%	20.75%	6.56%
2011	1.59%	0.16%	0.81%	12.21%	7.02%
2012	2.66%	0.30%	1.55%	25.52%	5.59%
2013	2.26%	0.31%	1.61%	18.78%	7.54%
2014	2.39%	0.34%	1.87%	29.48%	5.83%
2015	1.29%	0.21%	1.23%	17.19%	6.11%
2016	1.77%	0.26%	1.53%	13.69%	9.53%
2017	1.84%	0.30%	1.83%	26.14%	6.32%
2018	3.87%	0.77%	4.65%	56.35%	6.15%
2019	3.21%	0.62%	3.80%	45.11%	6.15%
2020	2.39%	0.68%	4.11%	63.04%	3.40%

Source: Ministry of Economy and Finance (MEF) of Haiti

Consistent with FAO's Classification, the figure below sought to study the trends on the evolution of government expenditures in agriculture, health, education, and infrastructure. As shown in figure 2.2, under the period of study, government agriculture expenditure falls short of public

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expenditures in health, education and infrastructure. It has not even passed the 4% mark of total public expenditure.

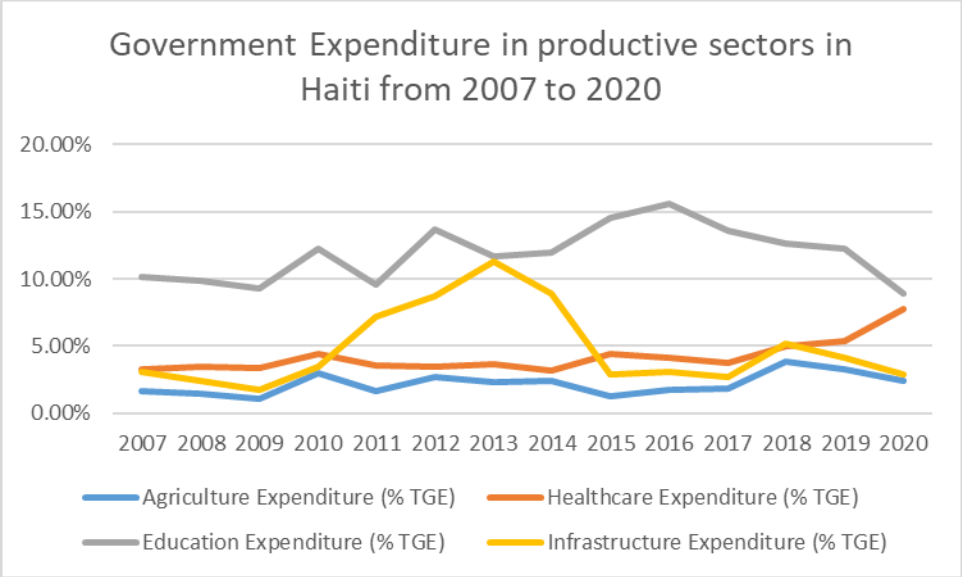

Figure 2.2: Size of Government Expenditure in Productive Sectors in Haiti, 2007-2020

Source: Ministry of Economy and Finance (MEF) of Haiti

2.4. Composition of Government Agriculture Expenditure

This section discusses the composition of government agriculture expenditure. According to the budget nomenclature, the national budget of Haiti is composed of the recurrent budget and the investment budget. One big difference in the Haitian budget nomenclature compared to that of other countries is that capital expenditures are calculated as operating expenditures. The agricultural budget code in the Ministry of Economy and Finance's financial account system is 1113.

As shown in Figure 2.3, both kind of government expenditures in agriculture are volatile. We observed for both a moving average trend line, which showed fluctuations. Recently, it appears

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that government consumption of agriculture is being overtaken by government investment in agriculture.

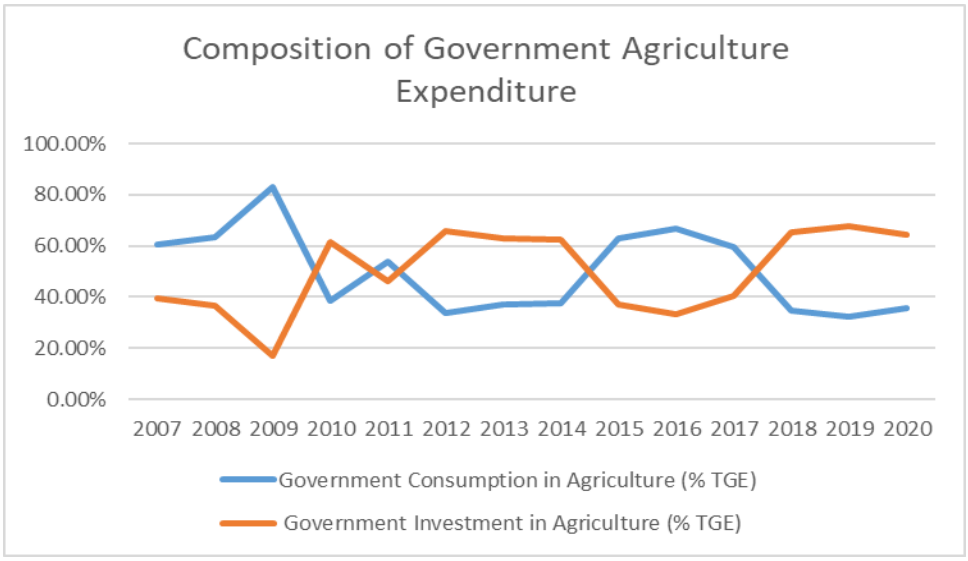

Figure 2.3: Composition of Government Agriculture Expenditure, 2007-2020

Source: Ministry of Economy and Finance (MEF) of Haiti

Since government consumption in agriculture is not negligible, we sought to display the main components. Figure 2.4 showed that although all the expenditures items are consistent over the years, three main components can be identified: Public Expenditure on Wages, Public Expenditure on Goods and Services, and Public Expenditure on Small Equipment.

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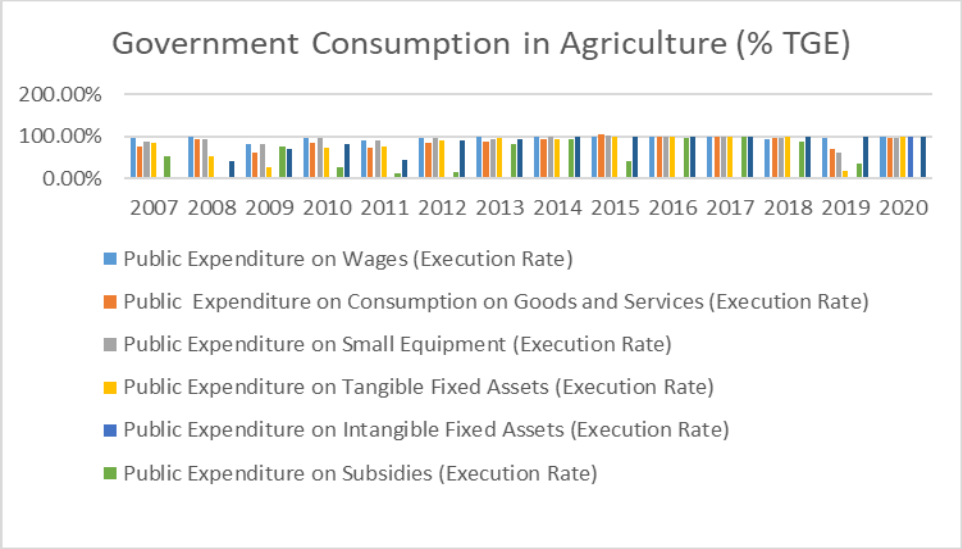

Figure 2.4: Government Consumption in Agriculture, 2007-2020

Source: Ministry of Economy and Finance (MEF) of Haiti

Figure 2.5 showed that budgetary resources from the operating budget are more likely to be disbursed than budgetary resources from the investment budget. This gap can be explained by the nature of funding that finances the two types of budgets, the procedural requirements related to disbursement for the two types of budgets, absorptive capacity of the agricultural sector etc.

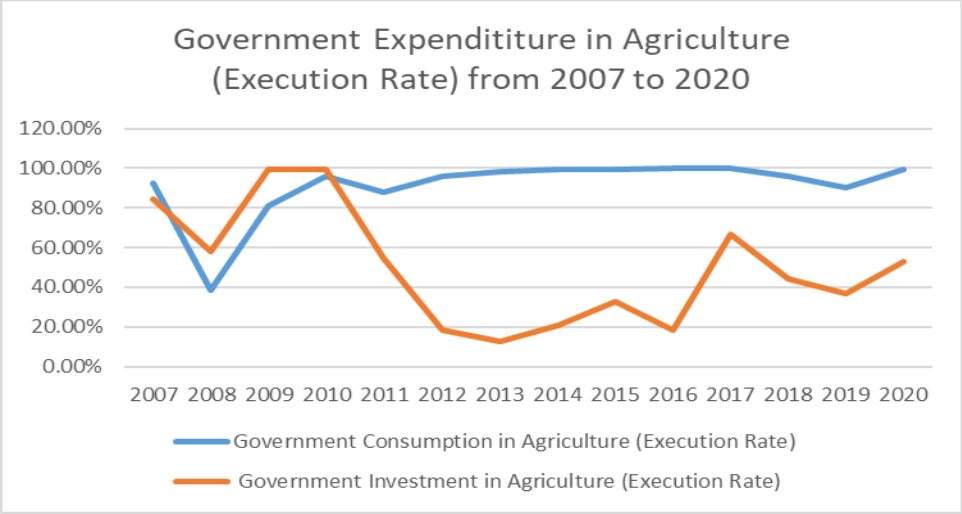

Figure 2.5: Government Expenditure in Agriculture (Execution Rate), 2007-2020

Source: Ministry of Economy and Finance (MEF) of Haiti

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Chapter 3. Literature Review

This chapter presents the theories and empirical studies that examine the links between government spending and the literature-suggested variables that may affect it. It also discusses the direction of the causality.

3.1. Theoretical Literature

Known as Wagner's *law of state* or the *law of increasing state spending* (1883), according to the principle, public spending always increases as income growth rises in every nation. This theory claims that the development of a society is accompanied by an increase in the need for regulation and an increase in the demand for collective services or public goods, some of which, such as education and healthcare, have the characteristics of superior goods (income elasticity greater than 1). The facts support the hypothesis that the size of government rises as long as the wealth of society increases.

Still in line with the work of Wagner (1883), Peacock and Wiseman (1961) come up with the *positive theory of public expenditure* or the *displacement effect* which claims that a time of social upheaval causes an increase in government spending. As a result, government spending increases irregularly rather than continually. A rise in government spending makes it difficult for actual income to pay the higher levies. Therefore, when public spending is increased from the prior level, tax rates likewise rise to keep up with the rising spending that never returns to the previous level, leading to the accumulation of public debt.

Aschauer (1989), instead of taking public expenditure as a whole, split it into productive expenditure and consumption expenditure in the *public expenditure composition theory*. Aschauer (1989) considers that public expenditure can enter either the utility function of consumers or the

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production function of producers. While in the first hypothesis the substitution between public and private expenditure is probably strong, in the second, on the other hand, public expenditure is essentially complementary to private expenditure. Under these conditions, while an increase in expenditure entering into the utility function of consumers probably has a weak multiplier effect due to substitution behaviors, an increase in expenditure entering into the private production function can increase the marginal profitability of the capital, and thus stimulate investment, rather than crowding it out. The literature also identifies public expenditure in education, healthcare, infrastructures, research and development as helping to foster economic growth (Barro, 1990; Lucas Jr, 1988; Mushkin, 1962; Romer, 1990).

In contrast to these three interventionist theories, arises the *neoclassical counter-revolution* (1980s) which can be divided into three component approaches. The first one "the free-market" approach argues that markets are self- efficient. By this, it means that the top signals for investments in new ventures are given by product markets; values of goods and resources are reflected in product and factor prices; firms are aware of what to produce and how to produce it competently; labor markets properly answer to these new industries. Competition is effective and technology is available and almost free. Additionally, information is flawless and essentially free to obtain. Therefore, any government interference in the economy is viewed as being unproductive and distorting. The second one "the Public-choice theory" (or "new political economy") approach portrays government as the instrument of special interest groups as likely to generate distortions as to correct them. The net result is a misallocation of resources. So, minimal government is the best government. The third one "the market friendly" approach recognizes that there are many imperfections in developing-country product and factor markets and that governments do have a key role to play in facilitating the operation of markets through market-friendly interventions and

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by providing a suitable climate for private enterprise. The market-friendly approach also differs from the free-market and public-choice approaches of thought by accepting the idea that market failures are more widespread in developing countries in areas such as investment coordination and environmental outcomes. Moreover, phenomena such as missing and incomplete information, externalities in skill creation and learning, and economies of scale in production are also endemic to markets in developing countries (Todaro and Smith, 2020).

In light of this set of theories stated above, reducing government interference in agriculture was a key issue for development agencies in the 1980s. Numerous early efforts were more harmful than beneficial. A notorious example in Haiti is Agricultural and Food Price Policy of 1987 justified by the lack of food supply (rice, maize, millet, beans, sugar, chicken parts, and pork meat). It has been accentuated in 1994 and characterized by low tariffs and elimination of quantitative restrictions. Instead of reducing the prices of commodities and fostering export promotion, this policy has weakened the agricultural sector[7]. The imports grow much faster than exports after the implementation of the policy discouraging local farmers. Moreover, in developing countries, policies for structural adjustment called for dismantling public ownership. As an illustration, government trading monopoly "Minoterie d'Haiti" has been privatized.

One of the sectors thought to be completely competitive is agriculture. However, there are numerous illustrations of market failures in the agricultural sector, including agricultural extension (farmer training) services and research and development, monopolies in input supply and purchasing farmer output. Other examples include information asymmetries in product quality, environmental externalities, economies of scale in marketing, and missing markets (weather

[7] A figure displaying this effect is presented in Appendix 5.

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insurance, credit). It is important to overcome the monopsonistic dominance that allows large farmers to dictate wages to landless laborers in local labor markets. Additionally, institutions and infrastructure need to be provided. (Todaro and Smith, 2020).

Government also has a role to play in agriculture to alleviate rural poverty. Farmers that are poor are unable to take advantage of chances that may help them prosper. They lack collateral, hence they are unable to receive credit. Farmers may have to take their kids out of school to help in the fields because of lack of credit. This helps perpetuate poverty across generations. Farmers may be less productive and unable to afford improved health and nutrition as a result of their limited access to these resources. Due to a lack of information and missing markets, farmers are unable to acquire insurance. Due to a lack of insurance, they grow risk averse out of concern about falling below poverty line. Without intermediaries, they can't specialize (and without specialization, middlemen are not incentivized to step in). Without assistance, it is difficult to avoid these poverty traps. (Todaro and Smith, 2020).

3.2. Empirical Literature

Below are presented the determinants of government agriculture expenditure based on empirical literature.

Agricultural Gross Domestic Product

The reaction of the agricultural sector is normally defined as the growth of the Agricultural Gross Domestic Product (AGDP), in real terms or at constant prices, which is an important indicator of growth in the volume of production. Agriculture comprises value added from forestry, hunting, and fishing as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.

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In this approach, derived from Wagner's law, since the causal relationship runs from national income to government spending, it may be assumed that public spending is an endogenous component or an outcome. Peacock and Wiseman's research on public spending in the UK from 1891 to 1955 indicated that Wagner's Law was still relevant. They came to the conclusion that governments have seen significant increases in revenue throughout time as a result of economic improvements, which has led to a rise in public spending.

Le Pen (1983) reviewed the main methodological choices that are likely to affect the value of income elasticity of public spending, as determined by econometric models. He found that except for the case of public consumption expenditures in real terms, it seems impossible to draw from the existing literature the conclusion of an invalidation of "Wagner's Law, in its empirical sense. Recent studies found a positive relation between per capita income and government expenditure (Martinez-Mongay, 2002). However, government spending cannot go beyond a certain threshold. Some studies attempted to define an optimal size of government.

Lawal (2011) using OLS estimates finds that agricultural expenditure is volatile and that government funding to the agricultural sector affects directly the contribution of agriculture to GDP. Ademola et al. (2013) using OLS and Confirmatory Unit root test found a significant relationship between economic growth of Nigeria and government spending in agriculture.

Government Investment in Agriculture and Government Consumption in Agriculture

Government Investment in Agriculture refers to government acquisition of goods and provision of services in the agricultural sector for investment purposes whereas Government Consumption in Agriculture refers to government acquisition of goods and provision of services in the agricultural sector for consumption purposes. The literature links the level of government agriculture

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expenditure to the composition of government agriculture expenditure as a means to consistently analyze its implications for agricultural development.

According to an analysis by Mogues et al. (2012), public investments in irrigation, agricultural extension, and research and development are crucial to the expansion of production. He claimed that various agricultural investment strategies contribute differently. He discovered that even in the long run, R&D investments typically had the greatest impact on sectoral growth. They discovered that the former returns on R&D investments are typically more constant and steady than the latter ones when comparing them to other forms of agricultural public spending. They suggested that as the scale of the effects of various functional expenditures in agriculture might not be constant, agricultural public spending might vary depending on the desired commodity. They noted that ex-ante evaluations show that investments in export crops have a less impact on the overall economy than investments in staple crops. They also noted that attention has been focused on how effectively agricultural expenditure as a whole contributes to welfare and development, rather than on the individual components of agricultural spending, such as R&D, irrigation, or other functions, or the investments specifically targeted at certain commodities. They recommended that policy finally focus on the productive aspects of agricultural expenditure based on several research. Furthermore, they claimed that public investment might either make private investments more profitable or it may drown out private investments through macroeconomic impacts. As a result, either a positive or negative overall impact on private investment is possible.

Rota-Graziosi et al. (2021) in order to measure and determine the quality of public expenditure in developing countries, link the level of public expenditure to the composition of public expenditure and compute the effectiveness and the efficiency of these expenditures. They found out that public expenditure efficiency is upgraded as long as the country's income increases. In this study, instead

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of discriminating consumption expenditure in comparison to investment expenditure, they see it as a tool that may emphasize or amplify the effect of the latter. Another interesting perspective from this study is the simultaneous analysis of the key areas (healthcare, education and infrastructure). The methodology consists in a calculation of a one-dimensional performance indicator and calculation of efficiency scores by country, based on a stochastic frontier approach.

Government Capital Stock

Government Capital Stock is referred as expenditures in health, education and infrastructure and identified as productive. In general, it is advised to reallocate public funds to infrastructure, research and development, education, and health in order to boost the accumulation of both physical capital and human capital.

According to Lucas (1988), public investment in education raises the level of human capital and is a key driver of long-term economic growth. Barro (1990) emphasized the significance of public infrastructure investment for economic growth. Romer (1990) emphasized the significance of funding for research and development. Easterly-Rebello (1993) used cross-section data for 100 countries for 1970-1988 and panel data for 28 countries for 1870-1988. They found that public transportation, communication and educational investment are positively correlated with growth per capita. Bleaney et al. (2000), using panels of annual and period-averaged data for OECD countries during 1970-1995, isolating long-run from short-run fiscal effects, found that when education and health were separated out, there is no evidence that they have any smaller impact on growth than other productive expenditures. Benos (2009) found that public expenditures on infrastructure (economic affairs and general public services) exert a positive impact on growth and government expenditures on human capital enhancing activities (education, health, housing-

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community amenities, environment protection, recreation-culture-religion) and social protection do not have a significant effect on per capita growth.

Most of the studies empirically conducted have showed that these key areas have a great impact on GDP per capita and therefore are productive. The point here is, as stated in FAO's classification, these key areas also constitute supportive fields that accompany or amplify agricultural production. The effect of government capital stock on government agriculture expenditure is positive.

Inflation Rate

Inflation Rate is the rate at which prices increase over time, resulting in a fall in the purchasing value of money. Fischer (1993) argues that inflation rate is an indicator through which a government manages its economy. Macroeconomic policies aim to keep inflation at a minimum while maintaining high rates of economic growth. High and erratic inflation carries a number of drawbacks (Cost-push inflation). Unpredictable inflation may have an impact on future investment project profitability or the fiscal deficit, which alters the degree of government investment.

The effect of inflation on the amount of public spending is covered by Tanzi et al. in 1987. They argue that the behavior of nominal interest payments connected to the service of the public debt makes it impossible to generalize the automatic relationship between the amount of public expenditure and the rate of inflation. Thus, the indirect impacts of inflation rate on fiscal deficit are investigated, and the authors challenge the traditional definition of fiscal deficit that can exaggerate the extent of the fiscal adjustment required by a nation in the event that the rate of inflation rises. They looked at the situation of a nation with significant inflation and a domestic debt to GDP ratio of 20%. They came to the conclusion that restoring fiscal balance is unlikely to call for increases in revenue or decreases in noninterest public spending of that size because a

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smaller adjustment would suffice because the fiscal adjustment made would lower the rate of inflation and, consequently, interest payments. Ex post, the traditional deficit would be lower than the fiscal adjustment made ex ante. A measure that corrects the deficit ex post for the effects of inflation may cause it to overlook its ex ante influence on inflation, according to the authors.

In order to determine how much inflation has affected New York City government spending, Greytak et al. (1974) created an index of inflation for the city's expenditures. While there is a lot of variation within the functional categories of expenditures, they discovered that between 1965 and 1972, inflationary price rises may be attributed to around 30% of the growth in overall expenditures in New York City. Only little more than half of the overall increase in expenditures can be attributed to an increase in the quantity of products and services the New York City government provides.

The effect of inflation rate on government expenditure is positive on sign but negative in value. This explains the great difference between nominal value and real value in economics.

Trade openness

Trade openness describes how a nation's economy is structured in relation to global trade. The actual volume of an economy's reported imports and exports serves as a measure of how open it is. Trade openness is determined by adding up a country's exports and imports as a percentage of its GDP (in percent). Governments may manage the process of globalization in part by changing the amount and makeup of their spending.

The "compensation hypothesis" (Garrett, 1998; Rodrik, 1998) holds that governments respond to globalization by increasing spending, either as a means of compensating those negatively affected (such as workers in import-competing sectors) or, more generally, as a means of offsetting the

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volatility and insecurity brought on by increased exposure to global markets. In the 1980s and early 1990s, Rodrik (1998) discovered a significant positive correlation between trade openness and government expenditure that extended to practically all categories of spending and was evident in both developed and developing nations. The terms of trade volatility and the product concentration of exports were two indices of external risk that Rodrik (1998) discovered to have positive and statistically significant interaction terms. Since Rodrik's ground-breaking study in 1998, there has been a sizable amount of empirical research on the connection between globalization and expenditure.

Other expenditure measures have mixed results. Shelton (2007) discovers evidence of a positive correlation between trade openness and overall expenditure, but Gemmell et al. (2008), Benarroch and Pandey (2012), and Liberati (2007) discover evidence of a negative relationship between openness to trade and capital flows. Benarroch and Pandey (2012) find evidence of a favorable correlation between trade openness and spending on housing, defense, and education when they break down spending by sector. Shelton (2007) also discovers some data supporting a favorable correlation between trade openness and spending on defense, education, and transportation. However, these analyses show no indication of a significant correlation between trade openness and any other spending categories. In their 2008 study, Gemmell et al. found less evidence of a connection between trade openness and broken-down government spending. They do discover evidence, nevertheless, that the stock of inbound FDI continually raises social welfare, health, and general public spending while steadily lowering spending on transportation, housing, education, and economic services. Epifani and Gancia (2009) and Shonchoy (2012) indicate that trade openness has a considerably favorable and statistically significant link with consumption spending

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(2016). Benarroch and Pandey (2008, 2012) do not discover any proof of a statistically significant correlation.

According to the "efficiency hypothesis" (Garrett, 2001; Gemmell et al., 2008; Sinn, 2003; Stiglitz, 2002), governments may have been under pressure to cut spending as a result of the process of accelerated financial globalization due to a decline in tax revenues as a result of global competition to attract and retain mobile financial capital. The second factor has to do with how international trade has changed since the early 1990s due to the fragmentation of manufacturing across international boundaries, which Baldwin refers to as the "second unbundling" (2016). Due to the fact that effective participation in international trade now frequently involves inbound foreign direct investment (FDI), the rivalry among nations to draw FDI may once again put downward pressure on government spending, at least in areas not seen as being economically productive. The fact that there is a negative correlation between globalization and government spending can be seen in the fact that during the 1990s and 2000s, there was a general decline in government spending as a share of GDP. This coincided with a rapid rise in international trade and capital mobility (Chinn and Ito, 2006, 2008; Lane and Milesi-Ferreti, 2007; World Bank, 2002).

According to Anderson and Obeng (2020), it is best to use caution when making straightforward comparisons of overall trends. In order to determine whether there is any evidence of a weakening or reversal of the positive relationship between globalization and government spending during the 1990s and 2000s in comparison with earlier decades, which could aid in explaining the emergence of the political backlash against globalization since the early 2000s, they provide a detailed empirical assessment of the relationship between globalization and government spending for the 1990s and 2000s. Additionally, they seek to determine whether any evidence of a bad relationship is more pronounced for financial globalization measures, which reflect the increased international

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mobility of capital and finance, than for trade globalization measures, which reflect the global mobility of goods and services. Finally, they explore the topic of whether the compensation theory and Rodrik's emphasis on the importance of the link between trade openness and government expenditure differ between nations, for example, between those that are more or less susceptible to external instability (1998). The 'hyper-globalization' of the 1990s and 2000s had varying and conflicting consequences on government expenditure, according to the study's findings. De jure financial globalization tends to minimize it, which is compatible with the efficiency theory, whereas de jure trade globalization tends to increase it, consistent with the compensation hypothesis. They also discovered evidence of the beneficial effects of de facto trade globalization, but these effects were far less pronounced in the 1990s and 2000s than in the 1970s and 1980s.

Natural Disaster

Disaster is defined as a loss of resources and productive capacity that is large in relation to the income and wealth of the affected country. While some empirical studies find the effect of natural disaster on government spending positive, others find it negative.

Noy and Nualsri (2010) estimate and quantify the fiscal consequences of natural disasters. They find out that in developed countries, fiscal behavior in the aftermath of disasters can best be characterized as counter-cyclical. In contrast, it can be featured as pro-cyclical decreased spending and increasing revenues in developing countries following large natural catastrophes. These pro-cyclical fiscal dynamics are likely to worsen the adverse consequences of natural disasters on middle and low-income countries.

Fidrmuc et al. (2015) calculate the fiscal multiplier resulting from changes in the government's spending. In order to account for expenditure shocks that are both unanticipated and unrelated to

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the prior health of the economy, they take into account surges in government spending in U.S. states after natural disasters. They discover that these have a powerful stimulative impact on the local economy, as seen by the value the fiscal multiplier captures. This conclusion is derived either by using the states' own exposure to natural disasters or, alternatively, by using the exposure to catastrophes of surrounding states.

Bello (2017) find that only a shock in the variable "Other climatic catastrophes" in the first and third years made the inpatient rehabilitation facility (IRF) corresponding to the Latin American and Caribbean nations statistically relevant in the case of the growth rate of real per capita public spending. Only in the first year in the case of storms and the first and third years in the case of other climatic catastrophes was that reaction statistically significant and positive for the Caribbean countries. The reaction to shocks in the variables of all forms of catastrophe in the Central American nations was statistically significant and favorable. In the case of storms, the reaction continued for the first two years, while it persisted for three years in the case of other climatic catastrophes. The reaction time for geological disasters was a year. In six out of nine situations, the findings indicate that the pace of growth of per capita government spending rose as a result of a disaster. However, the findings for per capita GDP imply that this response was inadequate to stop a decline in this indicator's growth rate. It's possible that institutional limitations in each nation or the amount of budgetary slack present before the occurrence have had an impact on the response. This provides a compelling case in support of national catastrophe risk reduction plans being institutionally strengthened and integrated into national public investment strategies.

The financial impact of natural catastrophes on China's provincial governments is empirically examined by Miao et al. (2020). They conclude that natural catastrophes have minimal impact on a province's tax revenues while increasing its overall government spending and intergovernmental

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payments collected by the federal government. Earthquakes and tropical storms in particular have a greater effect on spending and intergovernmental transfers. They also demonstrate that, compared to provincial governments in lower-income Chinese provinces, governments in higher-income provinces suffer greater increases in expenditure and intergovernmental transfers in the wake of natural catastrophes.

Table 3.1: Definition of the Variables Retained

Variables	**Definition**
Government Agriculture Expenditure (GAE)	All of the government's operating and development expenditures related to agriculture incurred within a specific fiscal year.
Agricultural Gross Domestic Product (AGDP)	Net output of agricultural sector after adding up all outputs and subtracting intermediate inputs.
Government Investment in Agriculture (GIA)	Government acquisition of goods and provision of services in the agricultural sector for investment purposes.
Government Consumption in Agriculture (GCA)	Government acquisition of goods and provision of services in the agricultural sector for consumption purposes.

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Government Capital Stock (GCS)	Expenditures in health, education and infrastructure identified as productive.
Inflation Rate (IR)	Rate at which prices increase over time, resulting in a fall in the purchasing value of money.
Trade Openness (TO)	Orientation of a nation's economy in relation to global trade. The actual volume of an economy's reported imports and exports serves as a measure of how open it is.
Natural Disaster (HRC and EQK)	A loss of resources and productive capacity that is large in relation to the income and wealth of the affected country.

Table 3.2: Summary of the Empirical Findings

Studies	**Results**
	Agricultural GDP
Peacock and Wiseman (1961) Le Pen (1983)	-A significant rise in government revenue as a result of economic growth over time, leading to a rise in public expenditure; - Except for the case of public consumption expenditures in real terms, it seems impossible to draw from the existing literature the conclusion of an invalidation of "Wagner's Law, in its empirical sense.

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Lawal (2011)	-Agricultural expenditure is volatile and the contribution of the agricultural sector to the GDP is directly correlated with government funding for the sector.
	Government Investment in Agriculture and Government Consumption Expenditure
Mogues et al. (2012) Rota-Graziosi et al. (2021)	- Returns on R&D investments in terms of reducing poverty are not only frequently greater but also more consistent than those of other forms of agricultural public spending. - Ex-ante assessments reveal that investments in export crops have a smaller economic impact than investments in staple crops. - Agricultural spending as a whole has a positive impact on welfare and development. -Policy should focus on the productive aspects of agricultural spending. - Public expenditure efficiency is upgraded as long as the country's income increases.
	Government Capital Stock
Lucas (1988) Barro (1990)	- Public investment in education raises the level of human capital, which may be considered as a key driver of long-term economic growth; - Government spending on public infrastructure fosters economic growth;

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Bleaney et al. (2001)	-When education and healthcare are separated out, there is no evidence that they have any smaller impact on growth than other productive expenditures.
	Inflation Rate
Tanzi et al. (1987) Greytak et al. (1974)	-If the rate of inflation rises, the conventional measure of fiscal deficit may exaggerate the extent of the fiscal adjustment required by a nation; -Since a lesser adjustment would be sufficient, since the fiscal adjustment made would lower the rate of inflation, it is doubtful that restoring fiscal balance will necessitate an increase in income or a decrease in noninterest public expenditure of a proportionate scale; -Although there is a lot of variety within the functional categories of expenditures, inflationary price rises may be held responsible for around 30% of the growth in overall expenditures in New York City between 1965 and 1972.
	Trade Openness
Rodrik (1998) Benarroch and Pandey (2008) & Gemmell et al. (2008)	- In the 1980s and early 1990s, there was a strong positive correlation between government expenditure and trade openness that extended to virtually all spending categories and was seen in both industrialized and developing nations; - For total spending, there is no evidence of a relationship with trade openness and capital flows.

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Liberati (2007) Shelton (2007)	- Openness to trade and capital flows have a negative correlation with overall spending. -Except for education, defense, and transportation spending, this analysis finds no evidence of a significant correlation between spending and trade openness.
	Natural Disaster
Noy and Nualsri (2010) Fidrmuc et al. (2015) Miao and al. (2020)	- In developed countries, fiscal behavior in the aftermath of disasters can best be characterized as counter-cyclical. In contrast, it can be featured as pro-cyclical decreased spending and increasing revenues in developing countries following large natural catastrophes; - Increases in state government expenditure in the United States following natural catastrophes to cover unforeseen spending shocks that are unrelated to the economy's prior status; -While having minimal impact on a province's tax collections, natural catastrophes boost the overall amount of government spending and intergovernmental funds received from the federal government.

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Chapter 4. Research Methodology

This chapter presents the methodology used in the study. The first two sections introduce the empirical model specification and estimation method. The last section is to discuss the model validation tests.

4.1 Empirical Model Specification

In this study, a linear multiple regression model was used to investigate the determinants of government agriculture expenditure in Haiti. Given that the relationships between the outcome variable and some independent variables may not be instantaneous or may be subject to reverse causality issues, lagged variables were used. Besides, to capture the non-linearities in the relationships, we take the log of several variables. The model specification is as follow:

$$\log(GAE_t) = \beta_0 + \beta_1 \log(AGDP)_{t-1} + \beta_2 \log(GIA)_{t-1} + \beta_3 \log(GCA)_{t-1} + \beta_4 \log(GCS)_{t-1} + \beta_5 IR_{t-1} + \beta_6 TO_{t-1} + \beta_7 HRC_{t-1} + \beta_8 EQK_{t-1} + \varepsilon_t$$

Where, t is the time period (t = 2007, …, 2020). The dependent variable $\log(GAE_t)$ is the natural logarithm of the total government agriculture expenditure at time t. The independent variables are respectively $\log(AGDP)_{t-1}$, $\log(GIA)_{t-1}$, $\log(GCA)_{t-1}$, $\log(GCS)_{t-1}$, IR_{t-1}, $TO_{t-1,}$ HRC_{t-1} and EQK_{t-1}. $\log(AGDP)_{t-1}$ accounts for the natural logarithm of agriculture value added at time t-1; $\log(GIA)_{t-1}$ represents the natural logarithm of government investment in agriculture at time t-1; $\log(GCA)_{t-1}$ expresses the natural logarithm of government consumption in agriculture at time t-1. $\log(GCS)_{t-1}$ stands for the natural logarithm of government capital stock at time t-1; IR_{t-1} accounts for the inflation rate at time t-1; TO_{t-1} represents trade openness at time t-1; HRC_{t-1} accounts for the hurricanes at time t-1 and EQK_{t-1} represents the dummy variable earthquake at time t-1 that takes

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1 if year is less than 2010 and 0 otherwise. The coefficients of interest are β_1, β_2, β_3, β_4, β_5, β_6, β_7, and β_8. And the error term at time t is ε_t.

Heteroscedasticity robust and clustered standard errors were used to rid the model of possible heteroscedasticity issues and potential autocorrelation problems. The errors were clustered at the year level to allow for some correlation within year clusters.

Based on the summary of literature review, the expected sign for each independent variable is presented in Table 4.1.

Table 4.1: Expected Signs of the Variables

Variables	**Symbol**	**Expected Sign**
Agricultural Gross Domestic Product	AGDP	(+)
Government Investment in Agriculture and Government Consumption in Agriculture	GIA and GCA	(+)
Government Capital Stock	GCS	(+)
Inflation Rate	IR	(+)
Trade Openness	TO	(+) or (-) accordingly
Natural Disaster	HRC and EQK	(+) or (-) accordingly

The hypotheses to be tested were:

H_0: : $\beta_1 = 0$ Agricultural GDP has no significant impact on government agriculture expenditure in Haiti at 5% level of significance.

H1 : $\beta_1 \neq 0$ Agricultural GDP has significant impact on government agriculture expenditure in Haiti at 5% level of significance.

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4.2. Empirical Method

Since there were only 14 observations (yearly intervals) for all the variables included in the model, this prevented us from using stronger statistical tests. In this study, Augmented Dickey-Fuller (ADF) Unit Root test to check stationarity of the time series data and the estimation technique Ordinary Least Squares (OLS) were used.

Stationarity

In the study of time series, the stationary process has been crucial. It is important to check for stationarity because many useful analytical tools and statistical tests and models rely on it.

A stationary process refers to a time series process where the marginal and all joint probability distributions remain unchanged over time. In a stationary process, the mean, variance and autocorrelation structure are invariant over time and there exist no periodic fluctuations (seasonality).

Formally defined, the stochastic process $\{x_t: t = 1,2, \ldots\}$ is stationary if for every collection of time indices $1 \leq t_1 < t_2 < \ldots < t_m$, the joint distribution of $(x_{t1}, x_{t2}, \ldots, x_{tm})$ is the same as the joint distribution of $(x_{t1+h}, x_{t2+h}, \ldots, x_{tm+h})$ for all integers $h \geq 1$. Note that h is the time distance between them. That is to say, the sequence $\{x_t: t = 1, 2, \ldots\}$ is uniformly distributed. Stationarity does require that the nature of any correlation between adjacent terms is the same across all time periods.

A very different concept is that of weak dependence, that limits how closely associated the random variables x_t and x_{t+h}, can be as h rises. It is easiest to talk about weak dependence in terms of stationary time series. Roughly speaking, a stationary time series process $\{x_t: t = 1, 2, \ldots\}$ is weakly dependent if x_t and x_{t+h} are "almost independent" as h increases without constraint. Similar

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reasoning applies if the sequence is nonstationary; however, in this case, we assume that the idea of being nearly independent is independent of the sequence's starting point, t.

A stochastic process is referred to as nonstationary if it is not stationary. If the time series is not stationary, one of the following methods can usually make it stationary. The data can be differenced. As an illustration, we develop the new series from the series Zt.

$Y_t=Z_t-Z_{t-1}$.

The original data will have one point more than the differenced data. Even if the data can be varied several times, one difference is typically sufficient. If the data contain a trend, we may model the residuals from that fit by fitting the data to a certain sort of curve. We often pick a straightforward fit, such a straight line, because our goal is to find the fit that simply eliminates the long-term trend. By calculating the series' logarithm or square root, non-constant variance may be stabilized. To make all the data positive before applying the transformation for negative data, we may simply add a suitable constant. To get projected (i.e., fitted) values and projections for future points, this constant may subsequently be removed from the model.

The methods mentioned above are designed to produce series with fixed location and scale. Despite the fact that seasonality also violates stationarity, the time series model often explicitly takes this into account.

Augmented Dickey Fuller test

Augmented Dickey Fuller test (ADF Test) is a common statistical test used to test whether a given time series is stationary or not. It is one of the most commonly used statistical test when it comes to analyzing the stationarity of a series. The test has a specific distribution simply known as the Dickey–Fuller table for critical values. Because the null hypothesis H_0 assumes the presence of a

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unit root, the p-value of z(t) obtained by the test should be less than the significance level ($z < 0.05$) to reject the null hypothesis. If there are unit roots, the series is not stationary. If there are no unit roots, then we conclude the series is stationary.

Another way to assess the stationarity of a time series process is to compare the calculated DFT statistic with a tabulated critical value. A series is stationary when the absolute value of the reported statistic is greater than the critical value.

The augmented Dickey-Fuller statistic used in the ADF test is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit root.

Ordinary Least Squares (OLS)

In statistics, ordinary least squares (OLS) is a technique for estimating a multiple linear regression model's unknown parameters. By minimizing the sum of squared residuals, the ordinary least squares estimates are produced. By minimizing the sum of the squares of the differences between the observed dependent variable's (variable being observed) values in the given dataset and those predicted by the linear function of the independent variable, OLS selects the parameters of a linear function of a set of explanatory variables. When the regressors are exogenous, the OLS estimator is consistent, and according to the Gauss-Markov theorem, it is the best linear unbiased estimator when the errors are homoscedastic and serially uncorrelated. When the errors have finite variances, the OLS technique gives minimum-variance mean-unbiased estimate. OLS is the maximum likelihood estimator with the additional presumption that the errors are normally distributed.

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4.3. Model Validation Tests

To validate the model, Residual Normality Test and Ramsey Regression Equation Specification Error Test (RESET) were used. As the model already has robust standard errors, the model is already corrected for heteroscedasticity. As standard errors are clustered, the model is already corrected for autocorrelation issues.

Residual Normality Test

The residuals must have a normal sample distribution with a zero mean and constant variance in order to comply with the requirements of the Classical Linear Regression Model (CLRM). If this condition is violated, t-statistics and F-statistics may not be valid. The regression residuals allow for detecting misspecification problems. To test Residual Normality, Kernel Density Estimation has been used. In statistics, Kernel Density Estimation (KDE) is a non-parametric way to estimate the probability density function of a random variable. Kernel Density Estimation is a fundamental data smoothing problem where inferences about the population are made, based on a finite data sample. It helps us to better analyze the studied probability distribution than when using a traditional histogram. It displays the distribution of values in a dataset using one continuous curve.

Ramsey Regression Equation Specification Error Test (RESET)

In statistics, the Ramsey Regression Equation Specification Error Test (RESET) is a general specification test for the linear regression model. It is a F test of the joint significance of the squares, cubes, and maybe higher powers of the fitted values from the first OLS estimation. It is a generic test for functional form in a multiple regression model. More specifically, it tests whether non-linear combinations of the fitted values help explain the response variable. The intuition behind the test is that if non-linear combinations of the explanatory variables have any power in explaining

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the response variable, the model is misspecified in the sense that the data generating process might be better approximated by a polynomial or another non-linear functional form.

Consider the model

$\hat{y} = E\{y \mid x\} = \beta x.$

The Ramsey test then tests whether $(\beta x)^2$, $(\beta x)^3$,…, $(\beta x)^k$ has any power in explaining *y*. This is executed by estimating the following linear regression:

$y = \alpha x + \gamma_1 \hat{y}^2 + \ldots + \gamma_{k-1} \hat{y}^k + \varepsilon,$

and then testing, by a means of a F-test whether γ_1 through γ_{k-1} are zero. If the null-hypothesis that all γ coefficients are zero is rejected, then the model suffers from misspecification.

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Chapter 5. Data and Empirical Results

This chapter introduces the empirical results obtained from the data processing. Throughout this chapter, we will first present the data source, trend analysis and descriptive analysis; second, we will interpret the empirical results and the tests results.

5.1 Data Source, Trend Analysis and Descriptive Analysis

Data Source

In this study, we seek to analyze a time series data from 2007 to 2020. The data used are secondary data that stem from different sources. The data on government agriculture expenditure and on government capital stock have been collected from budget execution report from the Ministry of Economy and Finance of Haiti. The data on agricultural gross domestic product and inflation rate have been collected from the Haitian Institute of Statistics and Informatics (IHSI). The data on trade openness measured by value of food imports over export merchandises come from Food and Agriculture Organization (FAO). The data on natural disaster measured by number of hurricanes and earthquake occurred in Haiti from 2007 to 2020 have been collected from Bureau of Mines and Energy (BME) of Haiti and Civil Protection Office of Haiti. The software Stata 16.1 is used to analyze the data.

Trend Analysis

A temporal trend analysis of the variables retained over the period 2007-2020 showed some fluctuations in the variables. The relationship between government size and macroeconomic stability is not linear.

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Examining the dependent variable “LNGAE” (panel A), we observed some volatility in its series while it displayed a clear upward trend. After a sharp drop observed in 2009, this series peaked in 2018, which reflects that government agriculture expenditure has increased over the years. Nevertheless, one should be careful about this conclusion since the values presented are nominal i.e., they are not adjusted for inflation.

Exploring “LNAGDP” (panel B), the series shows some variability while displaying a clear downward trend over the years. Actually, it peaked in 2012 before drastically dropping in 2019 and 2020, which attests to a decline in the performance of agricultural production.

. Looking into “LNGIA” (panel C), the series showed a sharp upward trend over the years. We observed a sharp drop in 2009 but rapidly it increased in 2010. A simultaneous evolution of the LNGAE and LNGIA series was observed, which series are of particular interest in the present study.

Digging into “LNGCA” (panel D), the series showed a sharp upward trend over the years. It peaked in 2018 before showing a slight drop in 2019 and a slight rise in 2020.

Examining “LNGCS” (panel E), the series displayed a clear upward trend over the years. We observed a constant trend from 2013 to 2017 before showing a sharp increase.

Inspecting IR (panel F), the curve showed a clear volatility of the inflation rate. Specifically, the series showed a clear drop in IR in 2010 and in 2014 before exponentially increasing over the past years. Generally, the inflation rate increases in Haiti following the rise in food and oil prices on the world market. The inflationary trend can also be explained by a decline in the performance of agricultural production.

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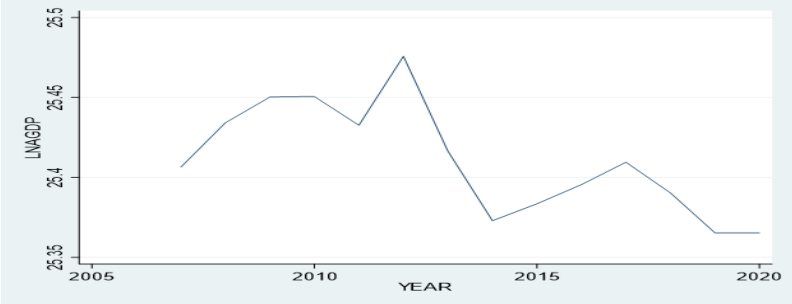
Investigating TO (panel G), the series showed that food imports have dominated for long over food exports. We observed a sharp decrease in food imports in 2007 and in 2020. The series seemed to display a clear downward trend from 2016 to 2020. But the ratio food imports/food exports are still important (>1).

Scrutinizing HRC (panel H), the series showed that natural shocks on agricultural activity in Haiti are considerable. They can destroy people lives, damage rural infrastructures or ravage crops. Over the period under study, Haiti has undergone from serious hurricanes like Fay, Isaac, Sandy and Matthew.

Panel A: LNGAE



Panel B: LNAGDP

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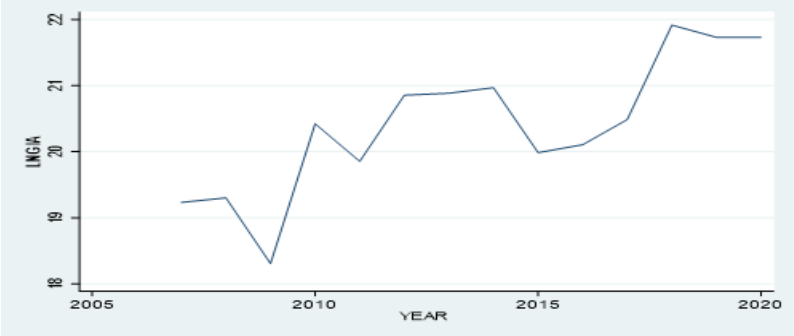
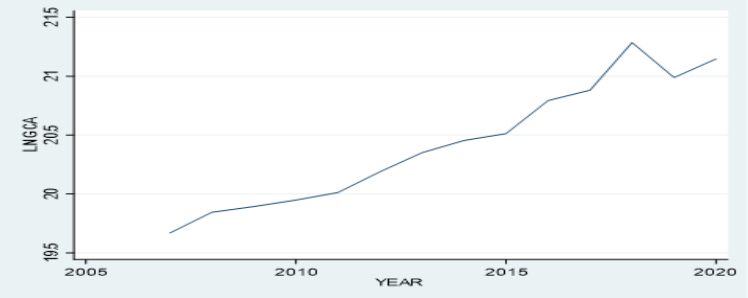
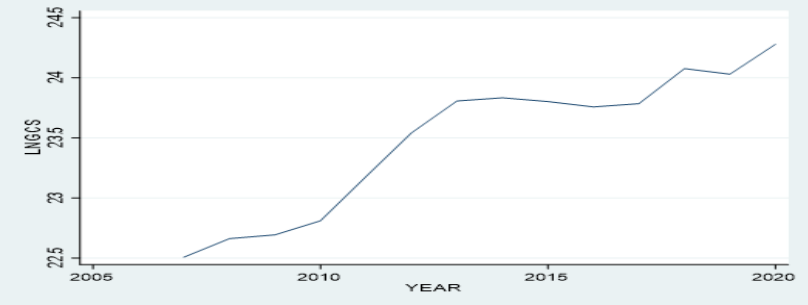


Panel C: LNGIA



Panel D: LNGCA



Panel E: LNGCS

Panel F: IR

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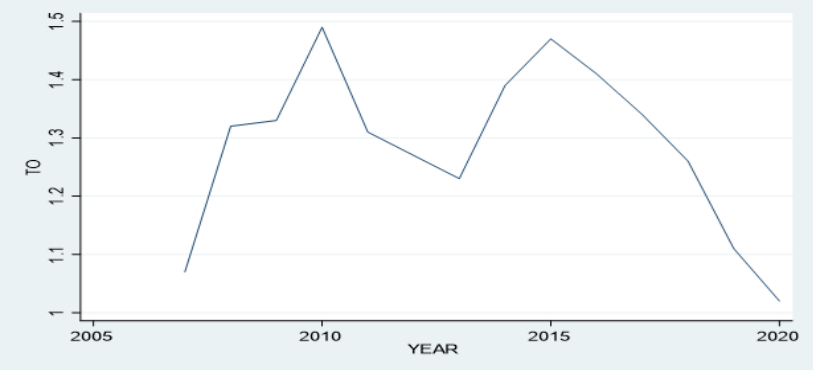

Panel G:TO

Panel H: HRC

Figure 5.1: Trends on the Variables Retained, 2007-2020

Descriptive Analysis

Following is a summary statistic of the variables retained over the period 2007-2020. As mentioned earlier, our sample has 14 observations (yearly intervals). As shown in Table 5.1, the range of the dependent variable LNGAE is [20.08; 22.34] and the average value is 21.17. The median is equal to the mean for the variables LNAGP and HRC, which explains that the distribution is symmetric. The mean is lower than the median for the variables LNGAE, LNGIA, LNGCS and TO, which means that the distribution is negatively skewed or the data appears to be left-skewed. The mean is greater than the median for the variables LNGCA, IR and EQK, which means that the

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distribution is positively skewed or the data appears to be right-skewed. LNGAE, LNAGDP, LNGCA, LNGCS, IR, TO and EQK show a low standard deviation, which means data are clustered around the mean. LNGIA and HRC show a high standard deviation, which indicates data are more dispersed around the mean.

Table 5.1: Descriptive Statistics of the Data Used in the Model

Variables	Mean	Median	Max	Min	Std. Dev	Variance	Skewness	Kurtosis
LNGAE	21.17	21.23	22.34	20.08	0.723	0.522	0.0897	2.066
LNAGDP	25.41	25.41	25.48	25.37	0.0344	0.00119	0.304	2.052
LNGIA	20.41	20.45	21.91	18.31	1.042	1.085	-0.304	2.431
LNGCA	20.43	20.40	21.29	19.67	0.525	0.275	0.195	1.730
LNGCS	23.48	23.77	24.28	22.51	0.594	0.352	-0.486	1.754
IR	0.0904	0.0648	0.228	0.0302	0.0568	0.00323	1.118	3.494
TO	1.287	1.315	1.490	1.020	0.142	0.0201	-0.489	2.364
HRC	1	1	4	0	1.240	1.538	1.255	3.640
EQK	0.286	0	1	0	0.469	0.220	0.949	1.900

5.2. Empirical Results

Stationarity Test Results

Table 5.2: Augmented Dickey-Fuller Test for Unit Root Results

Variables	ADF Level	In First Difference ADF	In Second Difference ADF	P-value of z(t)	Decision
LNGAE	-3.129 (-3.600)	-4.929* (-3.600)		0.0003	I(1)
LNAGDP	-3.001 (-3.600)	-3.352 (-3.600)	-4.305* (-3.600)	0.0031	I(2)
LNGIA	-3.000	-4.879*		0.0003	I(1)

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	(-3.600)	(-3.600)			
LNGCA	-3.166 (-3.600)	-5.298* (-3.600)		0.0001	I(1)
LNGCS	-1.350 (-3.600)	-3.068 (-3.600)	-4.896* (-3.600)	0.0003	I(2)
IR	-0.717 (-3.600)	-5.183* (-3.600)		0.0001	I(1)
TO	-1.970 (-3.600)	-3.669* (-3.600)		0.0245	I(1)
HRC	-3.177 (-3.600)	-5.224* (-3.600)		0.0001	I(1)
EQK	-1.487 (-3.600)	-3.637* (-3.600)		0.0269	I(1)

Note: (*) indicates the rejection of the null hypothesis (H_0) at 5%. The numbers in parentheses correspond to the critical values at 5%.

A series is stationary when $z<0.05$ and if the absolute value of the reported statistic is greater than the critical value. Then, we reject the null hypothesis H_0 that the series has a unit root. If there are no unit roots, then we conclude the series is stationary. So, the series of LNGAE, LNGIA, LNGCA, IR, TO, HRC and EQK are stationary in first difference ADF. The series of LNAGP and LNGCS are stationary in second difference ADF. Therefore, this regression is not spurious. It can be used for hypothesis testing, prediction and forecasting.

OLS Estimators Results

The regression model obtained by regressing $\log(gae)_t$ on $lnagdp_{t-1}$, $lngia_{t-1}$, $lngca_{t-1}$, $lngcs_{t-1}$, ir_{t-1}, to_{t-1}, hrc_{t-1}, eqk_{t-1} is:

Table 5.3: Summary of OLS results

Variables	LNAGDP	LNGIA	LNGCA	LNGCS	IR	TO	HRC	EQK
Elasticity	1.081	0.423	0.572	0.116	-0.115	- 0.185	-0.0367	0.142
R^2	0.9988							
DW	2.488467							
Prob (F-statistic)	0.0000							

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It can also be summarized as:

$Log(gae_t) = -29.10 + 1.081\ lnagdp_{t-1} + 0.423\ lngia_{t-1} + 0.572\ lngca_{t-1} + 0.116\ lngcs_{t-1} - 0.115\ ir_{t-1}$

(12.38) (0.461) (0.0244) (0.0593) (0.0885) (0.423)

$- 0.185\ to_{t-1} - 0.0367\ hrc_{t-1} + 0.142\ eqk_{t-1}$

(0.116) (0.0118) (0.0555)

The model is statistically significant at a 5% level of significance as the p-value for the model is 0.0000 ($p<0.05$). The variables $lnagdp_{t-1}$, $lngia_{t-1}$, $lngca_{t-1}$, $lngcs_{t-1}$, and eqk_{t-1} have a positive impact on government agriculture expenditure whereas ir_{t-1}, to_{t-1}, and hrc_{t-1} have a negative impact on government agriculture expenditure.

The estimated equation is a log-log model. So, the coefficient of $lnagdp_{t-1}$, $lngia_{t-1}$, $lngca_{t-1}$, and $lngcs_{t-1}$ represents the positive elasticity of $lngae_t$ with respect to $lnagdp_{t-1}$, $lngia_{t-1}$, $lngca_{t-1}$, and $lngcs_{t-1}$. The size of the coefficients of $lnagdp_{t-1}$, $lngia_{t-1}$, and $lngca_{t-1}$ are quite high.

On average, holding everything else constant a one percentage point increase in agricultural gross domestic product at time t-1 is predicted to increase government agriculture expenditure at time t by 1.081 percentage points. This explanatory variable is statistically significant at 5% level of error with a t-value of 2.34. β_1 is not surprising since it shows that there is a strong correlation between $lngae_t$ and $lnagdp_{t-1}$. The slope parameter is of primary interest in this study. The magnitude of the effect is bigger for agricultural gross domestic product than government investment in agriculture and government consumption in agriculture. The result is not surprising since the agricultural gross domestic product measures the value added of agricultural sector.

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On average, holding everything else constant, a one percentage point increase in government investment in agriculture at time t-1 is associated with a 0.423 percentage points increase in government agriculture expenditure at time t. This effect is highly statistically significant even at 1% level of error with a t-value of 17.33. Government investment in agriculture has been seen by theoretical and empirical literature as an engine to boost the agricultural sector growth.

On average, holding everything else constant, a 1% increase in government consumption in agriculture at time t-1 is associated with a 0.572% increase in government agriculture expenditure at time t. This effect is highly statistically significant even at 1% level of error with a t-value of 9.63. Government consumption in agriculture has been seen by theoretical and empirical literature as a support to government investment in agriculture. The magnitude of the effect is lower for government investment in agriculture than government consumption in agriculture, which is not consistent with the literature review.

On average, holding everything else constant, a 1% increase in number of hurricanes at time t-1 is associated with a 0.0367% decrease in government agriculture expenditure at time t. This effect is statistically significant at a 1% level of error with a t-value of -3.10. The negative t-value indicates a reversal in the directionality of the effect, which has no bearing on the significance of the difference between groups. This effect is a little bit surprising based on the idea that hurricane occurrence is an environmental externality that affects the agricultural sector growth and might increase government agriculture expenditure. The possible explanation about the fact that the number of hurricanes has a deterrent effect on government agriculture spending in Haiti is that the agricultural budget does not capture the expenses of environmental externalities. This result is also in line with Noy and Nualsri (2010).

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On average, holding everything else constant, a 1% increase in earthquake occurrence at time t-1 is associated with a 0.142% increase in government agriculture expenditure at time t. This effect is statistically significant at a 5% level of error with a t-value of 2.55 for accounting for the impact of earthquake in government agriculture expenditure evolution since 2010 (when occurred the major earthquake in Haiti). The agricultural sector has been one of the key sectors expected to foster economic growth after losses endured in the earthquake.

The effect of government expenditures in health, education and infrastructure as well as the effect of inflation rate and trade openness on government agriculture expenditure is not statistically significant. This means that government agriculture expenditure evolves independently of these explanatory variables. The magnitude of the effect of $lngcs_{t-1}$. ir_{t-1}, and to_{t-1}, which equals to 0.116, -0.115, and -0. 185 respectively, is not significant as well. The t-value of $lngcs_{t-1}$. ir_{t-1}, and to_{t-1}, which equals to 1.31, -0.27, and -1.60 respectively, means that it is statistically insignificant in the model.

R-squared or goodness-of-fit measure or coefficient of determination is a measure of how large the error variance is relative to the variance of y. The R-square value is 99.88%, which means that 99.88% of the variation in dependent variable is explained by explanatory variables in the regression equation. $R^2 = 0.9988$ is not surprising with its high value, which shows that the regression equation is significant.

The intercept parameter -29.10 is significant at a 5% level of error with a t-value of -2.35. In a linear regression, a significant intercept means that treatment is significant. The intercept parameter is not a cause for concern regarding the dependent variable. This simply means that the expected value on government agriculture expenditure will be less than zero when all independent

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variables are set to zero. Therefore, the intercept parameter does not have a useful interpretation because the explanatory variables are not close to zero for the population of interest.

The number of observations is n =14 < 30 observations, which allows for stronger statistical tests under normal circumstances.

In this study, clustered standard errors were used. Clustered standard errors are a special kind of robust standard errors that account for heteroscedasticity across clusters of observations. robust standard errors are used to obtain unbiased standard errors of OLS coefficients under heteroscedasticity. The smaller the standard error, the less the spread and the more likely it is that any sample mean is close to the population mean. In our model, the variables $lnagdp_{t-1}$, $lngia_{t-1}$, $lngca_{t-1}$, $lngcs_{t-1}$, ir_{t-1}, to_{t-1}, hrc_{t-1}, and eqk_{t-1} displays a robust standard error of 0.461, 0.024, 0.059, 0.088, 0.423, 0.116, 0.012 and 0.055 respectively. Although some robust standard errors are smaller than some others, in general the model displays low standard errors. This means that the sample mean is close to the population mean.

5.3. Testing of Results

The value of d-statistic = 2.488467 says that the residuals have relative independence and there is no serial correlation between them.

Residual Normality Test

Figure 5.2 presents Kernel Distribution Estimation Plot which depicts the probability density function of the continuous or non-parametric data variables. The peaks of a density plot help display where values are concentrated over the interval. In this figure, we observe that the kernel density estimate curve has no skew. This means that the mean is equal to the median.

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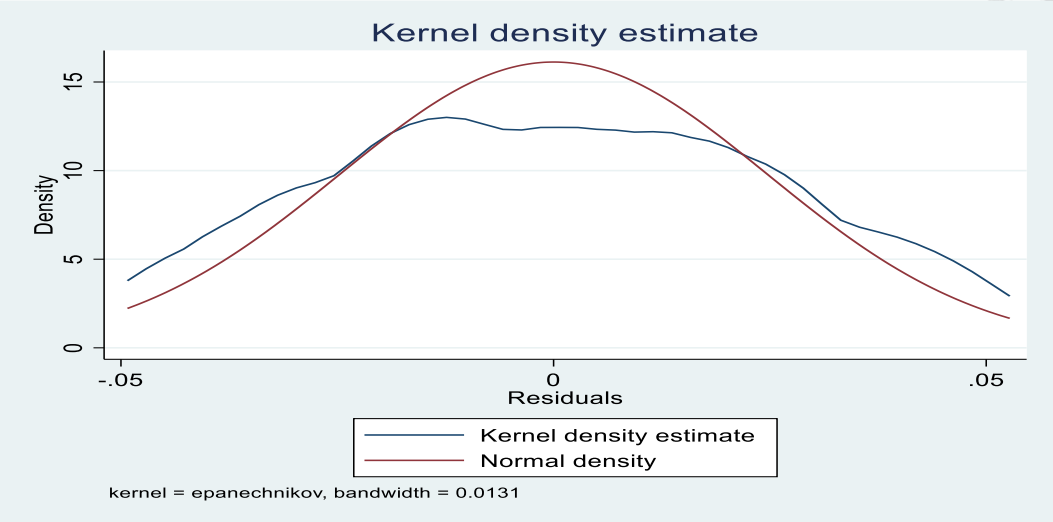

Figure 5.2: Kernel Density Estimate

Ramsey Reset Test

The p-value associated with the Fisher statistic is 0.1683, which is greater than 5%. It indicates that there is no specification error in the estimated equation. In other words, there is no omission of important variables in the specification of the model, which attests to the good quality of adjustment of the model.

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Chapter 6. Conclusions

This study aimed to investigate the determinants of government agriculture expenditure in Haiti over the period 2007- 2020. The determinants being analyzed in the study were agricultural gross domestic product, government investment in agriculture, government consumption in agriculture, government capital stock (a set of public expenditures in health, education and infrastructure), inflation rate, trade openness, natural disaster divided into hurricane and earthquake (consistent with the context of Haiti). A strong theoretical and empirical literature supported the analysis of the determinants. Since the data available for all the determinants could be only found from 2007 to 2020 (14 observations), this limited the use of stronger statistical tests. A linear multiple regression model was depicted and Ordinary Least Squares (OLS) Estimators were used. Confirmatory Unit root test ADF was also used to check the stationarity of the series. Residual Normality Test and Ramsey Reset Test were used to validate the model. The model was corrected for heteroscedasticity and autocorrelation problems.

The assumption of the study was that agricultural gross domestic product has significant impact on government agriculture expenditure at a 5% level of error in Haiti. The results showed that the assumption was confirmed. The results also showed that on average, holding everything else constant, a one percentage point increase in agricultural gross domestic product at time t-1 is predicted to increase government agriculture expenditure at time t by 1.081 percentage points. On average, holding everything else constant, a one percentage point increase in government investment in agriculture at time t-1 is associated with a 0.423 percentage points increase in government agriculture expenditure at time t. On average, holding everything else constant, a 1% increase in government consumption in agriculture at time t-1 is associated with a 0.572% increase in government agriculture expenditure at time t. holding everything else constant, a 1% increase

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in number of hurricanes at time t-1 is associated with a 0.0367% decrease in government agriculture expenditure at time t. The number of hurricanes has a deterrent effect on government agriculture spending in Haiti because the agricultural budget does not capture the expenses of environmental externalities. This result is in line with Noy and Nualsri (2010). On average, holding everything else constant, a 1% increase in earthquake occurrence at time t-1 is associated with a 0.142% increase in government agriculture expenditure at time t. The agricultural sector has been one of the key sectors expected to foster economic growth after losses endured in the earthquake. The effect of government expenditures in health, education and infrastructure as well as the effect of inflation rate and trade openness on government agriculture expenditure is not statistically significant. This means that government agriculture expenditure evolves independently of these explanatory variables.

The study's contributions are manifold. First, this study shed lights on the relationship between GAE and the literature-suggested factors. Second, it offers us a sectoral approach regarding public expenditure taken in a local and international context. Third, it reinforces the idea of building longer database (over thirty years) or elaborating quarterly reports to better assess the progress of the sector. Based on the empirical findings, our recommendations in light of this study are three-fold. First, monitor GAE in Haiti for a better evidence-based planning. Second, even if this study has emphasized the quantitative side of government agriculture expenditure, it cannot fail to mention the qualitative side of agricultural public expenditure, which fosters an integrated approach at the expense of cut-throat policies. Therefore, our second recommendation is that the Haitian Authorities take political and technical measures to reduce the gap between agricultural budgetary resources and agricultural budget expenditures, reduce gap between agricultural investment expenditures and agricultural consumption expenditures, prioritize a cross-cutting

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approach between the agriculture, health, education and infrastructure sectors, channel public agricultural expenditure towards components likely to generate major impacts such as R&D, irrigation, etc., strengthen the implementation capacity of the agricultural sector and monitor performance indicators. Third, within a broader macroeconomic framework, monitor macroeconomic aggregates that may affect GAE such as those described in this study. For the future, it is recommended to undertake a study that measures the quality of government agriculture expenditure in Haiti based on indicators of performance and other factors. It is also recommended for a future research to investigate the relationship and the effect of exchange rate and tariffs on government agriculture expenditure in Haiti.

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https://mef.gouv.ht

https://www.fao.orghttps://fr.countryeconomy.com/gouvernement/depenses/haiti

Appendices

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Appendix 1: Description of the Haitian Agriculture Sector

	Description
Agrarian Structures	- Small size of farms (1.8 ha on average); - Informal management methods and land insecurity; - Land tenancy: Ownership, renting (or subleasing), and sharecropping; - 125,000 hectares of the total 550,000 hectares of arable land are suitable for irrigation, but only 75,000 of them have been enhanced with 243 irrigation systems; -35,000 ha of arable and irrigated land are devoted to rice growing, 8,000 ha to farming bananas and a large part to maize, bean and vegetable crops; - About 85% of the country's watersheds are degraded or transformed very rapidly causing depletion or disappearance of basic factors of agricultural production and frequent flooding; - Timber exports have decreased as a result of Haiti's forest thinning. The annual removal of round wood amounts to around 1,000 kilos.
Agricultural Support Services	- Weak or non-existent extension services, insufficiently developed food supply chains, limited access to rural credit markets, a weak animal and plant national system, and inability to meet increasingly important food safety standards; - Low availability and a very limited access to agricultural inputs, such as quality seeds, fertilizers, pesticides, veterinary products, animal feed.
Production Systems and Sub-sectors	- Two-fifths of all Haitians rely on the agriculture industry, primarily small-scale subsistence farming, along with forestry and fisheries;

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	- In Haiti, two thirds of the country's impoverished live in rural areas. The welfare gap between urban and rural areas is largely due to adverse conditions for agricultural production; -35% of farms raise more than 1,000,000 pigs, 55%, 1,500,000 cattle; 65%, 2,500,000 goats and 80%, 4,000,000 poultry. Breeding in small family farms is more than 90% of production national; - In previous years, annual catches have averaged 5,000 tons; - The major food crops are rice (80 % imported), maize and sorghum; - Local production of tubers is important (750,000 MT) including 45% cassava; -10 varieties of yams produced. 100 varieties of sweet potato are cultivated; - There are more than thirty vegetables commonly produced in Haiti. Nearly 150 species and fruit varieties are cultivated (Mangoes, banana, avocado, coconut, breadfruit and citrus fruits); - Incorporated almost exclusively mangoes over the period 1985-95, fruit exports extended to avocado, tamarind, passion fruit, and cashew; - There would be more than 200,000 families who would be involved in coffee production in the country. The average area per family farm would be globally at the level of 0.50 ha; - Cocoa production is ensured by small planters, but they do not ensure the marketing of their product on international markets which entails the intervention of several intermediaries in the chain of this product; -Over 50% of the world's vetiver oil is exported from Haiti (an essential oil used in high-end perfumes);

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	-Due to dropping pricing and ferocious foreign competition, Haiti has reduced the amount of sugarcane it produces, a typically significant cash crop.

Appendix 2: MPCE, MEF, MARNDR: Mission and Responsibilities

Ministry of Planning and External Cooperation of Haiti	**Ministry of Economy and Finance of Haiti**	**Ministry of Agriculture, Natural Resources and Rural Development of Haiti**
The Ministry of Planning and External Cooperation (MPCE) has the main mission to ensure the management of the national development through: • Elaboration of overall strategies for socio-economic development and land use planning; • Elaboration of territorial development strategies; • Coordination of sectoral and	The Ministry of Economy and Finance has the fundamental mission of formulating and implementing the economic and financial policy of the state. The Ministry of Economy and Finance has the following responsibilities: • Determine the tax policy of the state, ensure the collection of taxes and duties, manage the property of the state.	The Ministry of Agriculture, Natural Resources and Rural Development is responsible for "defining the Haitian government's policy in the areas of agriculture, livestock, renewable natural resources and rural development" through: • Setting of the Government's objectives in terms of agricultural policy, livestock and management of renewable natural resources. • Implementation of the human, material and

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regional/departmental/ local strategies; • Preparation, management and coordination of public investment; • Mobilization, allocation and coordination of foreign investment resources; • Monitoring and Evaluation at the global level of strategies, investments and the use of Official Development Assistance (ODA) resources intended for investment and Non-Governmental Organizations (NGOs).	• Coordinate the preparation of the general budget of the Republic and ensure its execution; • Ensure cash management; • Judge the appropriateness of state expenditure; • Establish, with the assistance of the Central Bank, the monetary policy of the country and supervise its execution.	financial resources necessary to achieve these objectives. • Promotion of positive changes in the rural environment through the increase of the main productions, farmer training, the transfer of appropriate technologies, the search for promising niches and markets favorable to producers, the promotion of agricultural entrepreneurship, the search for value added by promoting product processing techniques, creating agricultural and non-agricultural jobs in rural areas.

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DSNCRP'S Objectives (2007-2010) for Agricultural Sector - Agriculture and Rural Development (Haiti)

Overall Objective	Promote modern agriculture while generating income and protecting the environment to provide food security for all people and to raise the standard of life for farmers.
Specific Objective 1	Reinforce the agricultural sector institutions
Specific Objective 2	Promote improved land management and sustainable agriculture
Specific Objective 3	Boost agriculture output
Specific Objective 4	Improve rural essential agricultural infrastructure
Specific Objective 5	Promote aquaculture and fishing
Specific Objective 6	Encourage the growth of agro-food sectors
Specific Objective 7	Promote a new marketing approach
Specific Objective 8	Set up infrastructure for agricultural output assistance

Haiti's Strategic Development Plan (PSDH) 2012-2030 - Programs and Sub-Programs for fiscal, budget, monetary and agricultural policies

Programs	**Sub-Programs**
Establish active governance for accelerated and balanced economic growth	Make the choice of openness and partnership
	Guiding fiscal and tax policies
	Guiding monetary policy and the action of the financial system

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	Support private investment
Modernize and Boost Agriculture and Livestock	Supervise agricultural and livestock practices
	Facilitate access to agricultural equipment and inputs
	Build and rehabilitate irrigation systems
	Set up a storage chain for agricultural inputs and products
	Set up a network of slaughterhouses and a cold chain for livestock products
Modernize and Boost Fisheries	Supervise fishing practices
	Facilitate access to fishing equipment and inputs
	Install fish aggregating devices
	Develop hill lakes
	Set up fish farms
	Set up aquaculture farms
	Set up a cold chain for fish products

Challenges and Vision of the Policy for Agricultural Development 2010-2025

Challenges	**Vision**

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Reducing food dependency from a perspective of sovereignty food (search for maximum satisfaction of national food demand).	Modern, agro-ecological agriculture based on the effectiveness and efficiency of farms families and the promotion of agricultural enterprises through the involvement of the private sector.
Creating employment opportunities in rural areas to curb the exodus towards cities.	Productive and competitive agriculture on the local market and on the international market, able to ensure food security for the population.
Increasing the contribution of the agricultural sector in foreign currency.	Able to provide decent income to its assets.
Reducing environmental vulnerability.	Concerned with the preservation of the environment and natural resources.
	Generating surpluses for the operation of agri-food companies.

Appendix 3: FAO's Classification (2015)

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Box 1 – MAFAP classification of public expenditures in support of the food and agricultural sector[9]

1. Agriculture-specific expenditure – monetary transfers that are specific to the agricultural sector, i.e. agriculture is the only, or principal, beneficiary of a given expenditure measure

1.1 Payments to agents in the food and agriculture sector – monetary transfers to **individual** agents in the food and agriculture sector

1.1.1 Payments to producers – monetary transfers to individual agricultural producers (farmers)

A. Production subsidies based on outputs – monetary transfers to agricultural producers that are based on current output of a specific agricultural commodity

B. Input subsidies – monetary transfers to agricultural producers that are based on on-farm use of inputs:

B1 - Variable inputs (seeds, fertiliser, energy, credit, other) **–** monetary transfers reducing the on-farm cost of a specific variable input or a mix of variable inputs

B2 - Capital (machinery and equipment, on-farm irrigation, other basic on-farm infrastructure) **–** monetary transfers reducing the on-farm investment cost of farm buildings, equipment, plantations, irrigation, drainage and soil improvements

B3 - On-farm services (pest and disease control/veterinary services, on-farm training, technical assistance, extension etc., other) **–** monetary transfers reducing the cost of technical assistance and training provided to individual farmers

C. Income support – monetary transfers to agricultural producers based on their level of income

D. Other payments to producers – monetary transfers to agricultural producers individually for which there is insufficient information to allocate them into the above listed categories

1.1.2 Payments to consumers – monetary transfers to final consumers of agricultural commodities individually in the form of:

E. Food aid – monetary transfers to final consumers to reduce the cost of food

F. Cash transfers – monetary transfers to final consumers to increase their food consumption expenditure

G. School feeding programmes – monetary transfers to final consumers to provide free or reduced-cost food in schools

H. Other payments to consumers – monetary transfers to final consumers individually for which there is insufficient information to allocate them into the above listed categories

1.1.3 Payments to input suppliers – monetary transfers to agricultural input suppliers individually

1.1.4 Payments to processors – monetary transfers to agricultural commodities processors individually

1.1.5 Payments to traders – monetary transfers to agricultural traders individually

1.1.6 Payments to transporters – monetary transfers to agricultural commodities transporters individually

1.2 General support to the food and agriculture sector– public expenditures generating monetary transfers to agents of the agro-food sector **collectively**

I. Agricultural research – public expenditures financing research activities improving agricultural production

J. Technical assistance – public expenditures financing technical assistance for agricultural sector agents collectively

K. Training – public expenditures financing agricultural training

L. Extension/technology transfer – public expenditures financing provision of extension services

M. Inspection (veterinary/plant) **–** public expenditures financing control of quality and safety of food, agricultural inputs and the environment

N. Agricultural infrastructure– public expenditures financing off-farm collective infrastructure

N1. Feeder roads – public expenditures financing feeder roads

N2. Off-farm irrigation – public expenditures financing off-farm irrigation

N3. Other off-farm infrastructure – public expenditures financing agricultural infrastructure that are not feeder roads or off-farm irrigation

O. Storage/public stockholding – public expenditures financing public storage of agro-food products

P. Marketing – public expenditures financing assistance in marketing of food and agriculture products

Q. Other general support to the food and agriculture sector – other transfers to the agro-food agents collectively for which there is insufficient information to allocate them into above listed categories

2. Agriculture-supportive expenditure – public expenditures that are not specific to agriculture, but which have a strong influence on agricultural sector development

R. Rural education – public expenditures on education in rural areas

S. Rural health – public expenditures on health services in rural areas

T. Rural infrastructure – public expenditures on rural infrastructure

T1. Rural roads – public expenditures financing rural roads

T2. Rural water and sanitation – public expenditures financing rural water and sanitation

T3. Rural energy – public expenditures financing rural energy

T4. Other rural infrastructure – public expenditures financing rural infrastructure that are not rural roads, rural water and sanitation, rural energy and other rural infrastructure

U. Other support to the rural sector – other public expenditures on rural areas benefiting agricultural sector development for which there is insufficient information to allocate them into above listed categories

Total expenditure in support of the food and agriculture sector (excluding administrative costs) (policy transfers, PEAPT): sum of agriculture-specific and agriculture-supportive expenditure (1+2)

Identifiable administrative costs for the food and agriculture sector: administrative costs include costs of formulation, implementation and evaluation of agricultural policies

Total expenditure in support of the food and agriculture sector (including administrative costs) (PEA): sum of agriculture-specific expenditure, agriculture supportive expenditure and identifiable administrative costs for the food and agriculture sector (1+2+identifiable administrative costs for the food and agriculture sector).

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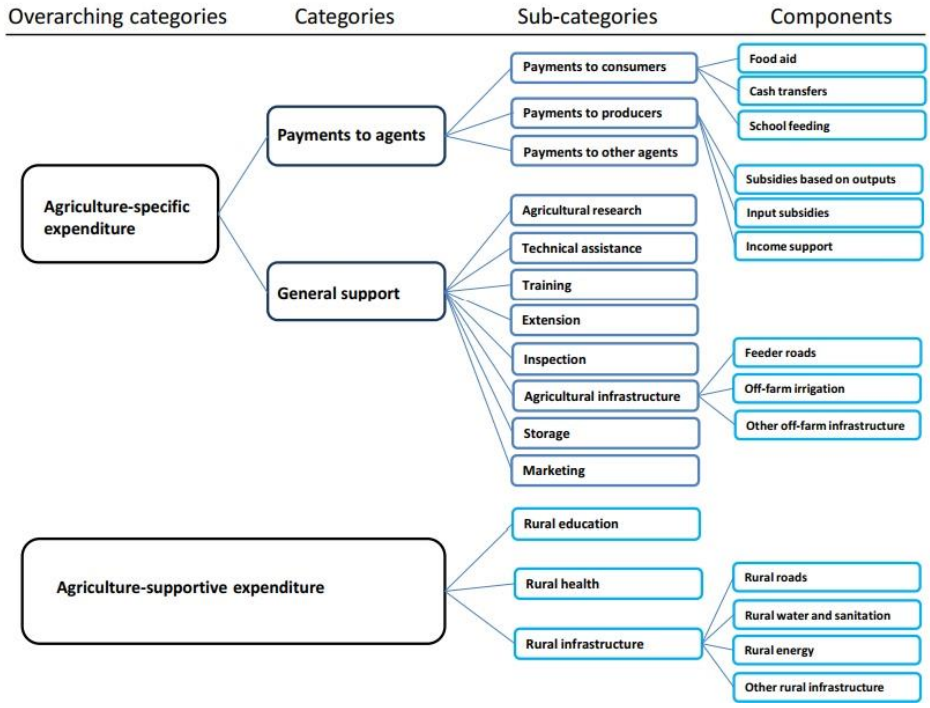
Figure 1 – Schematic view of MAFAP public expenditure categories



Appendix 4: OECD's Classification (2014)

OECD Code	Objectives
31110	Agricultural policy and management administration
31120	Agricultural development
31130	Cropland resources
31140	Water resources for agricultural use
31150	Products for agricultural use
31161	Agricultural production
31162	Industrial production of crops/crops intended for export
31163	Cattle

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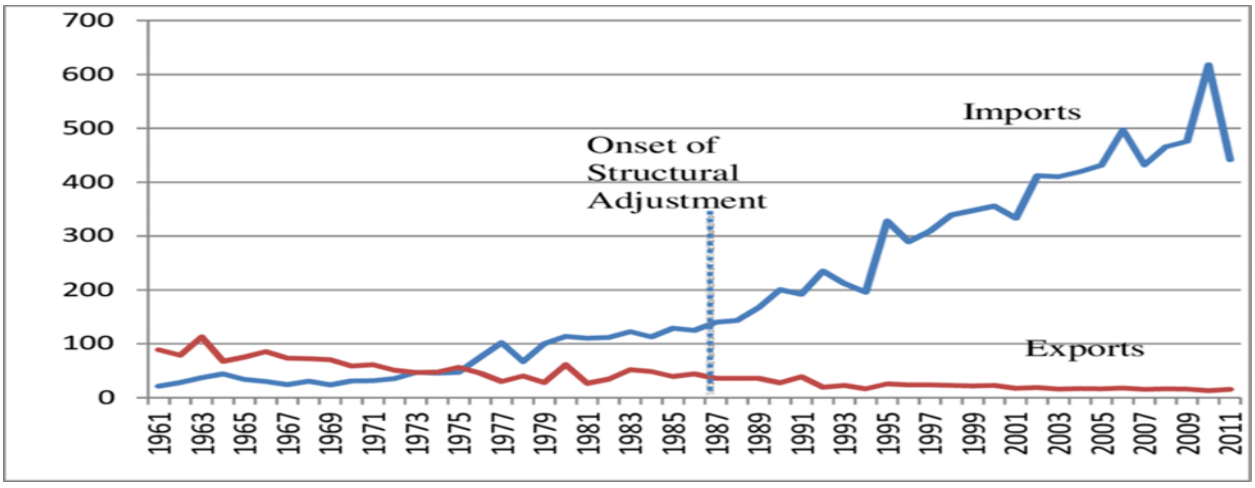
31164	Land reform
31165	Agricultural development alternative
31166	Agricultural extension
31181	Education and training in the agricultural sector
31182	Agricultural research
31191	Agricultural services
31192	Protection of plants and harvests, locust control
31193	Agricultural financial services
31194	Agricultural cooperatives
31195	Veterinary services (livestock)
52010	Food Safety and Food Aid Program
32161	Agribusiness
32162	Forest industries

Source: Summary from Giordano (2016)

Appendix 5: Haiti's Total Agricultural Product Trade by Value (US$000,000 Base Price) 1961-2011



Source: Research Gate

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