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Essays in public food procurement: the case of PNAE in Brazil

Ensaios em compras públicas de alimentos: o caso do PNAE no Brasil

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Tese apresentada ao Programa de Pós-Graduação em Administração do Departamento de Administração da Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo, como requisito parcial para a obtenção do título de Doutor em Ciências.

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RESUMO

Nos países em desenvolvimento, os pequenos produtores rurais enfrentam altos custos de transação para acessar os mercados de alimentos. Para mitigar esse problema, muitos países promovem a inclusão desses produtores em compras governamentais. Desde 2009, uma lei federal exige que as escolas públicas no Brasil usem pelo menos 30% de seus orçamentos de compras de alimentos provenientes de recursos do Fundo Nacional de Desenvolvimento da Educação para comprar de agricultores familiares. Apesar disso, muitos municípios ainda não compram quase nada dos agricultores familiares enquanto outros estão fortemente envolvidos nesse programa. Esta tese foca em entender os motivos do cumprimento discrepante dessa política pública. É composta por três capítulos. No primeiro, realizo análise bibliométrica reviso artigos acadêmicos qualitativamente. Identifiquei alguns fatores positivos e negativos para o cumprimento da regra dos 30% e os dividi em características de oferta (produção de agricultores familiares), características de demanda (governança e gestão da educação) e contexto local (como PIB per capita). Esses fatores são testados empiricamente no capítulo 2, com dados populacionais secundários do FNDE e do IBGE. Realizei regressões de mínimos quadrados ordinários com efeitos fixos por regiões geográficas (mesorregiões e estados). Descobri que as características de governança e oferta de produtos dos agricultores familiares são os principais fatores que podem ajudar ou dificultar o sucesso deste programa. No capítulo 3, investiguei se municípios que elegeram prefeito do mesmo partido (PT) que criou a regra dos 30% do PNAE estão mais propensos a cumpri-la. Verifiquei que prefeitos podem ou não incentivar a implementação do PNAE e isso depende do alinhamento partidário. Esta tese apresenta um conjunto novo de evidências empíricas relacionadas ao PNAE. Primeiro, a oferta em si pode não ser um problema para a implementação do PNAE, no entanto, alguns detalhes em torno dela, como organização dos pequenos produtores, podem atrapalhar os municípios a adquirirem mais dos agricultores familiares. Segundo, forneço uma explicação alternativa para os incentivos políticos de implementação de política pública: o alinhamento político.

Palavras-chave: Políticas públicas. Governança. Variável instrumental. PT. Município.

ABSTRACT

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In developing countries, smallholders face high transactions costs for accessing food markets. To mitigate this problem, many countries promote the inclusion of on smallholder's products in public markets. Since 2009, a federal law requires public schools in Brazil to use at least 30% of their food budgets received from National Education Development Fund (FNDE, acronym in Portuguese) to procure from family farmers. Despite this, many municipalities still buy almost nothing from family farmers, while others are heavily involved in this program. This thesis focuses on understanding the reasons for the differences in compliance with this public policy. It consists of three chapters. In the first one, I perform a bibliometric analysis and review academic articles qualitatively. I identified some positive and negative factors for complying with the 30% rule and divided them into supply features (family farmers production), demand features (governance and education management) and local context (such as GDP per capita). These factors are empirically tested in chapter 2, with secondary population data from FNDE and Brazilian Geography and Statistics Institute (IBGE in Portuguese). I performed ordinary least squares regressions with fixed effects by geographic regions (mesoregions and states). I found that governance characteristics and smallholder's products supply are the main drives that can help or hinder this program success. In chapter 3, I investigated whether municipalities that elected mayor from the same party (PT) that created the PNAE are more likely to comply with the 30% rule. I found that mayors may or may not encourage the implementation of the PNAE and this depends on party alignment. This thesis presents a new set of empirical evidence related to the PNAE. First, supply itself may not be an issue for PNAE implementation; however, some details around it, like price and access and smallholder's organization may be in the way for municipalities to procure more from family farmers. Second, I provide an alternative explanation for the political incentives of public policy implementation: political alignment.

Keywords: Public policy. Governance. Instrumental variable. PT. Municipalities.

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SUMMARY

1 GENERAL INTRODUCTION

The Brazilian government delivers 40 million meals a day to feed students in public schools, which is almost 20% of all Brazilian population, at the total amount of over 760 million euros in 2020 (Conselho de Monitoramento e Avaliação de Políticas Públicas, 2020). This public policy has been one of the most important actions to fight hunger in Brazil, which is a critical issue since the pandemic. Penssan (2021) revealed that 55.2% of Brazilian households were experiencing food insecurity (FI) and 9.0% were facing hunger. There are one million malnourished children and adolescents below 18 years old in the country (UOL, 2022).

In Brazil, public school feeding is regulated by the law n. 11,947, from 2009, stating that at least 30% of the whole amount of money handed from the federal government to each municipality must be used to buy food from family farmers[1]. Every year, all municipalities are compelled to submit their food procurement invoices to be approved by the School Feeding Council (SFC), thus allowing the federal government to take those documents to be considered in its invoice. The available data indicates different achievements on this goal countrywide, in average 28.24% of smallholders' products procurement over total food procurement with a standard deviation of 21.05% in 2017 (FNDE, 2016).

More than 600 municipalities (around 10% of the total number of municipalities) bought almost no food from family farmers. This is surprising because from the time of collection of our data, 2015 to 2017, the law on school food procurement was already 5 years old. Most municipalities buy between 20% and 40% of food products coming from family farmers. Nevertheless, few municipalities were procuring almost 100% of their school food products from smallholders. 3,110 municipalities procure less than 30% from family farmers, which means they do not accomplish the law minimum goal, and other 2,460 meet the requested target. How can we explain this heterogeneous implementation? What are the main factors for the achievement of the policy target?

The municipality that does not accomplish the minimum goal risks being penalized[2]. There are some justifications that municipalities may claim for non-compliance with the law, they are especially related to the low or uncertain supply of the family farmer's products. As a

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[1]According to the Brazilian law (n. 11,326), a farmer is considered a family farmer if they do not hold, in any way, an area greater than four fiscal modules (which varies by location, e.g. the Amazon region has larger fiscal modules than the southern region of Brazil); predominantly use the labor force of the family itself in the economic activities of its establishment or enterprise; have income predominantly originated from activities linked to the farm; direct their establishment or enterprise with their family.

[2]The penalizations alternate between not receiving money on the following period, and being obliged to return the money to the federal government

result, the penalization is applied only in rare cases: when the municipality is not accountable for purchases, or does not institute a School Feeding Council, or does not provide food of any kind in schools (Bonduki, 2017).

The purpose of this research is to investigate the factors related to the territorial inequality in a public policy output.

To better understand such subject, the general question is divided into others:

a) Why does the same rule lead to different results in National School Feeding Program within the same country?

b) Are the municipalities that elected mayors belonging to the same party that created the National School Feeding Program 30% set aside rule more likely to meet (or even exceed) the target?

1.1 JUSTIFICATION

The question of this research is relevant for theory because while previous studies focused on the general effect of policies and suggested that they are homogenous outcomes within nations, I propose that the effect of these policies largely depend on governance, public management structure, supply availability and political party alignment. I investigate the reasons for the heterogeneity of public policy performance. I propose firstly to analyze PNAE (acronym for National School Feeding Program in Portuguese) focusing on variables of governance, public management, and family farmer's products supply. Secondly, I focus on the alignment of the political parties of the municipalities with the party that designed this public policy.

The research sheds light on the role and the importance of implementing entities and how governance structures are architected. The incorporation of the coordination structure aspects is crucial to better comprehend why some public policies generally do not achieve the expected outputs.

Empirically, the question of this study is relevant for some reasons such as the social impact, education and the near-universal reach of school feeding. The first reason is related to the social impact, for the recognition of food public procurement at schools is directly linked to at least three Sustainable Development Goals, created by the United Nations: Zero Hunger, Good Health and Well-Being and Quality Education (see United Nations, 2019).

Regarding education, many research have already shown how a good nutrition for school-age children is positively related to a better school performance and a better learning

(Sorhaindo, & Feinstein, 2006). Although we cannot state that family farmer's products surpass the nutritional value of the traditional agriculture products, this and other public policies show an interest on students getting well-fed. "School feeding programs can help to get children into school and help to keep them there, increasing enrollment and reducing absenteeism, and once the children are in the classroom, these programs can contribute to their learning, through avoiding hunger and enhancing cognitive abilities" (Drake et al, 2016 p.viii).

In Brazil, the social impact produced by inclusive school food public procurement affects not only students, but the family farm producers. "Family farmer agriculture is fundamental for Brazil's development. There are approximately 4.4 million family farmers, which is 84% of all Brazilian farmers" (Brazilian Agriculture Ministry, 2018). And the analyzed law incentives public procurement, specifically, from this kind of agriculture.

The second reason is that school feeding is near-universal, happening in almost every country in the world with a comprehensive reach of approximately 368 million children benefiting from it (Drake et al, 2016). To be exact, in Brazil, in 2016, 5,570 municipalities and 154,060 schools participated on the analyzed program, which generated R$ 3,421,487,528.00 on food procurement.

My expected contribution is a better understanding on the factors promoting or hindering the successful implementation of public policy related to school food procurement. This has a relevance for the welfare as it is related to education, health and a large economic budget pertaining to children, teachers, and family farmer producers.

1.2 STRUCTURE

This dissertation has three chapters written as research papers. The first chapter is a literature review on food public procurement in Brazil, presenting what academics have been publishing on the subject and what factors were deemed crucial predecessors for the failure or success of the Brazilian public policy[3].

On the second chapter, I do a quantitative analysis on all Brazilian municipalities. The main idea consists of getting a larger-scale perspective than previous qualitative studies on the subject to investigate what factors are important for implementing the National School Feeding

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[3]A failure will be established if the municipality is using less than 30% of the money forwarded by the federal government to school feeding to buy family farmers' products and the success will be established if the municipality uses at least 30% of the money to buy family farmers' products.

Program. On the third chapter, I test if a specific factor (party alignment) has an impact on this public policy implementation, using an instrumental variable approach.

Table 1.1 provides a summary of the chapters with intended objectives, methodology and results and performed activities.

Table 1.1 - Dissertation Structure

Article	1st	2nd	3rd
Title	Public Food Procurement Policy Factors in Brazil: a literature review	School Feeding Program and Public Food Procurement from Smallholder Farmers: Evidence from Brazil	Mayor's party alignment and public policy execution: evidence from Brazil
Objective	To investigate what factors are related to differences in the implementation of public food procurement policy	To identify the determinants of the proportion of smallholder's products in the public-school food procurement	To investigate if having a mayor from the same party that created the set aside rule in school feeding (PT) makes a municipality more likely to implement this policy
Methodology	Literature Review	OLS regression with fixed effects	Probit regression with instrumental variable
Results	Factors found in literature were categorized into supply features (family farmers production), demand features (governance and education management) and local context (such as GDP per capita) that could influence both supply and demand.	Governance and smallholder's product supply are the main drives that can help or hinder this program success. Supply itself may not be an issue for PNAE implementation, however, some details around it, like price and access and smallholder's organization may be in the way for municipalities to procure more from family farmers.	We found that electing a PT mayor increases the chances of reaching the 30% procurement target. We provide an alternative explanation for political drivers of a public policy implementation that is political alignment.

Source: author

2. PUBLIC FOOD PROCUREMENT POLICY FACTORS IN BRAZIL: A LITERATURE REVIEW

ABSTRACT

The purpose of this research is to investigate what factors are related to differences in the implementation of public food procurement policy (PNAE in Portuguese) by Brazilian municipalities. Relying on a literature review methodology, we search for the word PNAE in two of the most important Brazilian research databases. We identified and analyzed 25 articles on this issue. We, then, created a taxonomy of the reasons for these differences. The results showed thirteen positive and negative factors, grouped into: i. governance, ii. education management, that are on the demand side; iii. smallholder's supply, that is on the supply side; and iv. local context that may influence both demand and supply. Positive factor examples are community participation and family producer's proximity to schools. Negative factor examples are bureaucracy, infrastructure problems and resistance to change. The contribution of this research is a clearer understanding on what factors can help the successful implementation of public policy related to school food procurement. It has a social relevance for welfare as it is related to education, health and a large economic budget pertaining to children, teachers and family farmer producers.

Keywords: PNAE. CAE. Education. Public policy. Governance.

2.1 INTRODUCTION

The Brazilian school food program is acknowledged as one of the most important instruments to fight hunger worldwide (Swesson, 2021), as it ensures students all ages in public schools have access to food – nearly 40 million people. This program is directly linked to at least three Sustainable Development Goals, created by the United Nations: Zero Hunger, Good Health and Well-Being, and Quality Education (see United Nations, 2019). In 2020, 5,570 municipalities and 154,060 schools participated on the analyzed program, which generated the total amount of over 760 million euros in 2020 (Conselho de Monitoramento e Avaliação de Políticas Públicas, 2020).

The school feeding in Brazil was named National School Food Program (PNAE in Portuguese) the late 1970s and has become more smallholders inclusive over time, following

an emerging trend of placing greater emphasis on the role for the community and the smallholder farmers in food procurement policies (Drake et al., 2016). Hence, in 2009 it added an agriculture concern to its goals, with law n. 11,947 requiring that at least 30% of the whole budget handed from the Federal Government to each municipality must be used to buy food coming from family farming producers.

In PNAE, National Education Development Fund (FNDE, acronym in Portuguese), a federal agent, passes on money to the executing entities (that can be Departments of Education of the States, Federal District and the Municipalities) to procure food school. FNDE also monitors the program. The money is transferred annually, the amount varies from R$0.36 to R$2.00 a day for student.

It is worth mentioning that the social impact provided by such an inclusive public school food procurement policy is not only on students, but also on family farming or smallholders producers; from whom the above-mentioned law specifically encourages public procurement. After all, "[f]amily farmer agriculture is fundamental for Brazil's development. There are approximately 4.4 million family farmers, which is 84% of all Brazilian farmers" (Brazilian Agriculture Ministry, 2018).

In this paper, we seek to understand why, despite the relevance of said policy and it being over 10 years old, it is still not fully complied with by the totality of Brazilian municipalities – 5,570 integrating the PNAE program. While many previous studies have focused on the reasons municipalities fail to comply with this law, the vast majority of these tend to show a set of arguments that are conventionally called "laundry list", without discussing how such factors may be intertwined with each other (Conselho de Monitoramento e Avaliação de Políticas Públicas, 2020).

Our purpose, in turn, is to critically synthetize these previous works and to extract what they support as factors positively and negatively influencing the procurement from family farmers. To this end, we perform a literature review and create a taxonomy of theoretical arguments to show how they relate to each other. Thus, we carry out our research in two of the most important Brazilian research databases, SciELO and SPELL, searching for the word "PNAE" either in abstract, title or keywords of papers published at any time frame. We create a taxonomy of the motivations for the compliance to this policy related to local context, governance structures and other factors.

This chapter is organized as follows. Section 2 explores how school food is managed worldwide, section 3 demonstrates the historical context and the institutional setting underlying

the implementation of PNAE; section 4 presents our methodology. Section 5 discusses the results, followed by a conclusion in section 6.

2.2   SCHOOL FOOD IN THE WORLD

Public procurement has been used worldwide to achieve social objectives since the 19th century. As the government has a large demand for products and services, it has the power to introduce market policies and incentive new behaviors (Stefani et al. 2017).

School food public procurement potentially benefits both sides of the market, the demand, and indirect consumers, who are the students; and the suppliers, that can be a specific group or a social minority (Stefani et al, 2017). For the suppliers, an advantage of systematically selling for the government is reducing the risk demand uncertainty. For the consumers, some indirect advantages are incentives for food production directed to domestic demand instead of commodities to export, and therefore, greater food security (Sumberg and Sabates-Wheeler, 2011).

The global investment on public school food procurement is in the order of US$75 billion a year; however, this investment does not seem to achieve the same output worldwide. On poorest countries, there are less coverage and quality on the public policies related to it (Drake et al, 2016).

The demand focus behind some of these programs considers there is small farmers latent producer's capacity just waiting to be requested, therefore, more demand would easily lead to more economic transactions. Nevertheless, it is not always the case, resources are scarce and even though there are consumers interested in buying, suppliers sometimes are unable to produce or deliver products to meet the required demand, i.e., there are market failures (Sumberg and Sabates-Wheeler, 2011). Hence, in some context, the family farmers would need capacity instruction, technology investment and other manners of support, that poorest countries government may be incapable to provide.

There is a possible incompatibility of objectives pertaining school food policies. On one hand, there is the interest in buying affordable food, so that the students have access to it; on the other hand, there is the need to ensure economic sustainability for farmers. This antagonism was clearly observed in the 1990s, when the European Union (EU) defined that members states should adopt its lower prices policy to buy products and services in general, which hampered the role of social and environmental concerns. In the following decade, after the Directive

2004/18/EC, several states started to address public food procurement towards local and organic foods (Stefani et al, 2017).

Overall, as we see from the 2000s, the food policy became more centralized on social and sustainability themes. We have noted this tendency observing the literature on the subject. A public food procurement literature review on scientific paper in 2017 (Stefani et al) identified 66 out of 77 papers from U.S. and Europe, probably their English written limitation excluded most developing countries research. The following databases were searched: Web of Science, CAB Abstract, Scopus, Emerald Insight, and Sociological Abstract.

The American literature contains a great share of management studies, focusing mostly on themes such as policy types ("farm to school" and, nutrition and health initiatives) and the food supply chains, probably due to a long tradition of these programs. At the same time, the Farm to School Program that linked schools to local agriculture and helped schools cope with financial limitations on food budgets started in the United States. With this program, schools could opt to buy food based on geographical preference, instead of just cheaper products (Stefani et al, 2017).

Drake et al (2016) compared fourteen developing countries on case studies: Botswana, Brazil, Cape Verde, Chile, Côte d'Ivoire, Ecuador, Ghana, India, Kenya, Mali, Mexico, Namibia, Nigeria, and South Africa. These countries were purposely selected as case studies because they exhibit how diverse and how innovative feeding school programs can be. Their analysis considered design and implementation, policy and legal frameworks, institutional arrangements, funding and budgeting, and community participation.

For design and implementation, the specific concern was which subjects each program were related: agriculture, education or health and nutrition. Almost all programs were related to education and only Ghana and Mali were related to all topics. The targeting approach could be universal to all students; individual, especially for low-income students; and geographic to certain regions (see Table 2.1).

Table 2.1 - 14 case studies design and implementation

	Strategic Focus			Targeting Approach		
	Agriculture	Education	Health and nutrition	Universal	Individual	Geographic
Botswana		x		x		
Brazil	x	x		x		
Cape Verde		x		x		
Chile		x	x		x	
Côte d'Ivoire	x	x				x
Ecuador		x		x		
Ghana	x	x				x
India		x	x	x		
Kenya (HGSM program)		x				x
Kenya (NMK program)	x					x
Mali	x	x	x			x
Mexico			x		x	x
Namibia		x		x		
Nigeria		x		x		
South Africa		x				x
Total	5	13	4	7	2	7

Source: Drake et al (2016, p. xxxix)

Regarding policy and legal framework for the authors "it is important to have a clear policy in place to govern implementation. Whilst sound regulations certainly do not guarantee implementation, they establish a visible mandate to be realized and set standards for service delivery across the different objectives." (Drake et al, 2016 p. 27). However, strict and static laws can stand in the way to these programs' evolution. These programs usually have a fluid and dynamic nature and change as their implementation and experience provide lessons and their managers learn (Drake et al, 2016).

Accordingly, there is a delicate balance between imposing targets and restrictions by law, as it occurs in the Brazilian program, to make sure implementation happens, and leaving room for innovation and adaptation. A solution for such a problem could be creating goals that progress over time and making targets that varies in line with some context characteristics.

Like that challenge, there are others related to school food procurement. "Providing food to children in school, though a simple and widely accepted idea, in practice, is a complex intervention that involves a range of stakeholders operating at various levels across different sectors" (Drake et al, 2016, p. iii). To overcome those barriers, there are adequate institutional

arrangements that vary across countries, however, they should consider what coordination need between different levels, like national and subnational, and the interaction among local agriculture and food nutritional quality (Drake et al, 2016).

Coordination can be overseen by the community. The community can also be one of the stakeholders responsible for check and balance for the school food process. Community can participate in different supply chain stages. Drake at al (2016) found diverse kinds of participation in their 14 countries research. Accountability and monitoring were generally deficient in the eleven countries, Chile, Ecuador, and Brazil being exceptions.

The conclusion for this report is that there is no 'one size fits all' model because school food is a complex task that arises in different levels and requires various stakeholders. Drake et al (2016, p. ix) point out "The most sustainable and government-owned programs are those that are more than the sum of their parts: designed and implemented together by the education, health and agriculture sectors." The Brazilian National School Food Program (PNAE, in Portuguese) can be considered as a program of this type, as it will is detailed below.

2.3 SCHOOL FOOD IN BRAZIL: PNAE'S LITERATURE REVIEW

2.3.1 Historical Context

The government concern with public school food started in 1930s decade in Brazil with President Getúlio Vargas. It was first associated with a health issue (Balestrin et al, 2016), but it became an Education Ministry responsibility in 1955 based on the National School Lunch Program developed in the United States of America (Cunha et al, 2017). In 1979, the school food policy was officially named National School Food Program (PNAE, in Portuguese) (Schwartzman et al, 2017).

At that time, smallholders' farmers have been excluded from rural public policies that prioritized monoculture and large estates properties (Souza-Esquerdo and Bergamasco, 2015). It was only around 1990, after civil society and family agriculture groups had pressured that idea to link family farming to public purchase finally gained political support (Schwartzman et al, 2017).

In 1994, it became possible for local public managers like mayors and education secretaries to privilege short circuits and to encourage local production and commerce as the Brazilian federal law n. 8,913 decentralized the school food process. This law also stated that

nutritionists should create the menus, prioritizing staple foods that respects the local food culture and tradition (Schwartzman et al, 2017 and Balestrin et al, 2016).

However, there are barriers for smallholders and family farmers producers to sell to the government even with law incentives. An obstacle in Brazil is the federal law n. 8,666 from 1993, that requires competitive bidding for public procurement, the winner being the cheapest supplier. Small enterprises and farmers are rarely able to offer the lowest prices. To overcome this, in 2003, the federal government created the Food Procurement Program (PAA, in Portuguese). That was the first strategy to avoid competitive bidding related to food procurement (Schwartzman et al, 2017).

In 2009, with the federal law n. 11,947 federal government required that at least 30% of the money transferred from it to the municipalities for the school food should be used to buy family farmers' products. To do that, municipalities were allowed to use the Public Call mechanism, that consists of municipalities offering to buy from family farmers who are willing to sell their products for the region mean prices. If more than one supplier wants to sell, the municipalities prioritize local producers, and social minorities. There should be a wide Public Call disclosure and the municipalities must make apparent the time and place of delivery, the quantity, and quality standard information so that family farmers can access public procurement opportunities (Schwartzman et al, 2017).

Regarding education, previous research has already shown how a good nutrition for school-age children is positively related to a better school performance and a better learning (Sorhaindo, & Feinstein, 2006). "School food programs can help to get children into school and help to keep them there, increasing enrollment and reducing absenteeism, and once the children are in the classroom, these programs can contribute to their learning, through avoiding hunger and enhancing cognitive abilities" (Drake et al, 2016 p.viii).

2.3.2 PNAE's Structure and Characteristics

Governance centralization is about the provision of a uniform order (for instance, national regulations and laws). To the opposite, decentralization provides diversity in the governance of social interactions. Each frame has strength and weaknesses depending on the characteristic of the environment they occur.

According to Brousseau and Raynaud (2006), in a population of finite and heterogeneous agents, "the more general the order, the more it must deal with heterogeneous coordination needs." (p. 12). The same authors also emphasize that "centralization provides agents with (i)

scale and scope effects, (ii) learning and specialization benefits, and (iii) means to reduce collective welfare losses by boosting consistency between local rules, and internalization of externalities, and the creation of positive network effects due to the use of common rules." (p.15). But also, the following disadvantages: "static maladaptation (increasing heterogeneity of preferences), dynamic maladaptation (reduced renegotiability), cumulative information asymmetries, enforcement requirements (increasing incentives to free ride), private capture (greater incentives to distort collective governance) (p.32, 2006).

PNAE is a complex program with a diverse stakeholders' structure. Table 2.2 provides a simplified representation of the institutional frame PNAE with special emphasis on the entities and their responsibilities:

Table 2.2 - PNAE structure

Kind	Actor	Specific organization	Responsibility
Operational	Federal government	National Education Development Fund (FNDE in Portuguese)	Defining the program rules, providing complementary financial assistance, standardization, coordination, monitoring and supervision of program implementation, as well as evaluating their effectiveness
	Executing Entities	Departments of Education of the States, Federal District and the Municipalities	Developing all conditions for the PNAE to be executed in accordance with the law.
	Executing Unit	Non-profit privately owned, civil society legal entity that may be instituted at the initiative of the school, the community or both. Executing Units may be also referred to as "School Cashier", "Parent-Teacher Association" or 'Parent-Teacher Circle".	Educational community representation
	School Food Council (CAE, in Portuguese)		Social control over the PNAE, monitoring the purchase of products, the quality of the food offered to students, the hygiene and sanitary conditions in which food is handled, distribution and consumption, financial execution and the task of evaluating the accountability of the Executing Unit and issuing the Concluding Opinion document.
Supporters	Court of accounts (Tribunais de Conta in Portuguese)		Oversee accountability
	Federal Prosecutor (Ministério Público in Portuguese)		In partnership with FNDE, receives and investigates PNAE's mismanagement reports.
	Departments of Health and Agriculture of the States, Federal District and the Municipalities		Sanitary inspection, attesting the quality of the products used in the food offered and for articulating the production of family agriculture with the PNAE.
	Federal and Regional Councils of Nutritionists		Oversee the performance of nutritionists

Source: author based on FNDE (2019)

The municipality that does not applies the 30% law has a possibility of being penalized[4]. There are some justifications that municipalities may claim for non-compliance with the law, they are especially related to the low or uncertain supply of the family farmer's products. As a result, the penalization is applied only in rare cases: when the municipality is not accountable for purchases, or does not institute a School Food Council, or does not provide food of any kind in schools (Bonduki, 2017).

There are three coordination options to implement PNAE according to FNDE. In the traditional model, municipality centralized model, town hall buys the food products, and they are responsible for cooking and distributing for all schools in the municipality. Some advantages of this strategy are no need for stock in the schools and greater purchase bargain power, due to scale. Some disadvantages are needed for greater stock management specially for expiration date losses and need for stock space in the secretaries (Santos et al, 2016).

The second option is the decentralized model, when each school is responsible for their own feeding process. The positive aspect is more autonomy to decide the menu and make it more personalized to the school taste and needs and the negative is the lack of a specialized team to manage this process (Santos et al, 2016). The third option is the centralized model, in which the States are directly responsible for school food, through Department of Education of the States or Federal District.

According to the literature, there are two other models: semi-centralized in which raw food products are bought by each school, and more industrialized food products are bought by the education secretary; and the outsourced model, where the education secretaries buy the food products and a contracted enterprise prepares and delivers meals (Santos et al, 2016). The outsource model is not foreseen by the updated PNAE guide available on its website, information about it is reached only by primary data collection directly with municipalities.

Machado et al (2018) have found that the traditional model is most frequent than decentralized, mixed or outsourced for the units that buy at least 30% from family farmers. The centralized model is probably the most effective to link school food to local agriculture, that is to successfully implement PNAE's 30% goal.

Another fundamental element for this local agriculture policy is the nutritionist support. Based on the federal law nº.11,947 and the Resolution n. 26 from 2013, nutritionists must do the following activities: diagnosis of the students' nutritional status; planning, elaboration,

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4 The penalizations alternate between not receiving money on the following period, and being obliged to return the money to the federal government

monitoring and evaluation of the school food menu; human resources training; sanitary hygiene quality control; coordination and realization of food and nutritional education actions and others (Corrêa et al, 2017).

Bonduki (2017) found that the most successful PNAE implementation municipality cluster was the one with a population around 20,000 to 100,000 inhabitants. These municipalities are privileged compared to bigger cities for their low logistic complexity and usually their low distance to family farmers; and at the same time, they are privileged compared to smaller cities because their bureaucracies are more established and efficient.

Bureaucracy enacts as a barrier, for its tiresome sequence of activities and authorizations needed for the school food process. The chronological order of each stage, as reported by Hirata et al. (2017), is: 1) appointment of a special committee for family agriculture procurement (CECAF); 2) identification of family farmers and local producers; 3) establishment of the menu; 4) basic project; 5) prices quotation; 6) formalization of the process; 7) public announcement; 8) budget/ authorization; 9) legal analysis; 10) publication of the public call; 11) receipt of the proposed sales; 12) public session of judgment; 13) publication of the judgement; 14) receiving samples; 15) homologation; 16) disclosure of the waiver of bidding System of Electronic Disclosure of Purchases and Procurements (SIDEC, in Portuguese) and Integrated System of Management of General Services (SUASG, in Portuguese); 17) note of commitment; 18) issue of the contract.

Abreu (2014) identified other challenges in PNAE's execution, especially in small municipalities. Beyond them, there is heterogeneity in Brazilian geographic regions. There is a well-known heterogeneity between Brazilian municipalities, their population varies from 815 to 20 million inhabitants or 10% of the country population (Bonduki, 2017).

Table 2.3 shows a case where a municipality can locally complement the transferred financial resources from the federal government to school food. Once the funds from different sources are integrated, it is hard to separate them and to know exactly where it came from. Therefore, it is only possible to analyze the amounts.

This municipality uses part of its own money to obey the federal government rule so to continue to have access to its budget, which stand-to-reason especially if family farm products are more expensive. Apart from that, the municipality may not be interested on buying this kind of products, as it almost reaches the minimal percentage required by law regarding FNDE money, and but acquire only 12,1% from family farm products, considering all the financial resources available for school food

Table 2.3 - Financial resources used for school food procurement in a municipality

Financial resources used for school food procurement	
Amount handed by FNDE	34,5%
Municipality complementary amount for school food procurement	65,5%
Total amount used for school food procurement	100%
Amount used for buying family farmers' products, considering only the amount handed by FNDE	29,5%
Amount used for family farmers' products buying, considering the total amount used for school food procurement	12,1%
Amount used for buying family farmers products, considering only the municipality complementary amount for school food procurement	2,9%

Source: Soares et al. (2018).

Soares et al (2018) also show that there are three kinds of food used for school food according to FNDE health concerns: recommended, restricted and prohibited products. Family farm products provided only the recommended kind of food.

2.4 METHODOLOGY

To reach the goal of identifying which PNAE's factors of success and failures are addressed by the literature, we searched for it in Brazilian research databases, SciELO and SPELL, looking for the word "PNAE" either in abstract, title or key words in any time[5].

We read all articles and collect the following information: title, whether it is a case study or geographic limited, (if yes) specific region analyzed, authors, year, journal, research database it was found, keywords, abstract, research question or objective, theory used, methodology, results, conclusions and determinants of result.

We found 37 articles, of which 12 were excluded from the final analysis because they were duplicated in both research databases, or they were written before the federal law n.11,947 from 2009, or they were not specifically about PNAE, or they did not address the family farm agriculture or procurement subjects. Thus, only 25 articles will be analyzed in the following topics.

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5 There are many theses and dissertations about this subject as Bonduki (2017) and Abreu (2014), who are cited in this chapter. This literature review focused on journal published articles only for they are expected to have gone through a peer review to certify their quality.

2.5 RESULTS AND DISCUSSION

For the articles search, there was no time limitations, however, as one of the requirements was that they approached the federal law n. 11,947 from 2009, and it takes some years for an article to be published, the first year with an analyzed article published was 2015. From there, it grows until reaches a peak in 2017, then falls for more than a half and grows again. It may tell that PNAE as a research object has reached a limit when associated with specific other subjects, besides more recently other ideas are appearing.

Figure 2.1: Number of articles by year
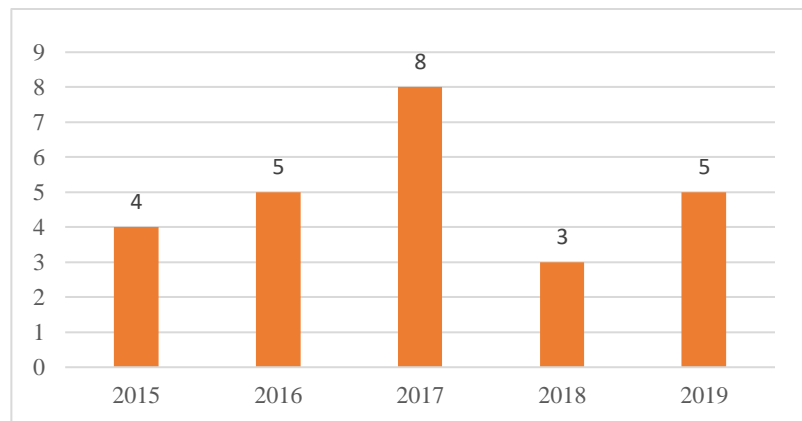
Source: research data.

For the methodology, in most of the articles, 60% used the qualitative approach with interviews and case studies. Two used only documental data collection, which was possible because PNAE is nationally wide documented. One of the articles analyzed previous regulatory standards that led to the regulation of the program management structure (federal law n. 11,947).

Figure 2.2: Number of articles by methodology
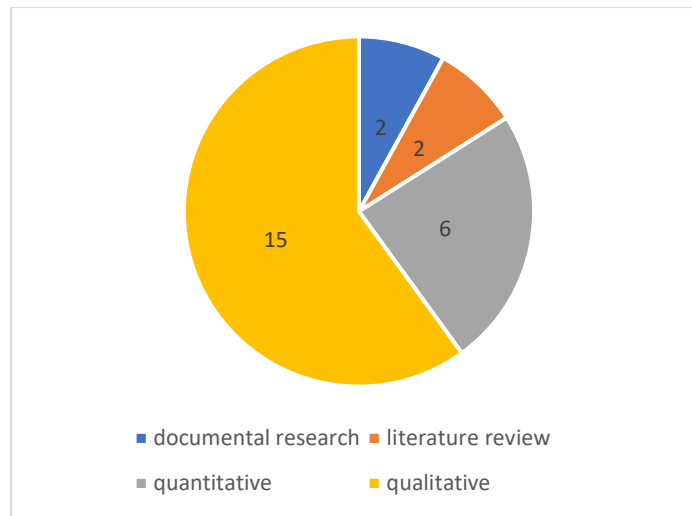
Source: research data.

17 out of 25 articles focused in a specific geographic area, representing more than 75% of its total. The most researched region is the Southeast, which is also the most populated one. There was no specific article about the West Center region, also there was just one about the North and it is combined with the Northeast. The West Center and North regions are the least populated ones. The region specificity is in line with the qualitative approach, the most common one, as shown in table 2.4.

Table 2.4 - Number of Articles by region

Region	Location	Number of articles
North and Northeast regions	BA	1
	PE	1
	North and Northeast regions	1
	Total	3
Southeast region	ES	1
	MG	4
	SP	2
	PR	2
	Total	9
South region	South region	1
	RS	4
	SC	2
	Total	7

Source: research data.

School food program is an interdisciplinary subject, linked to nutrition, education, rural development, management, and others. Therefore, journals from different themes publish papers about it, focusing on various aspects. The most common journal theme is health[6], which is probably due to the fundamental role nutritionists play in this program.

Figure 2.3: Number of Articles by Journal subject
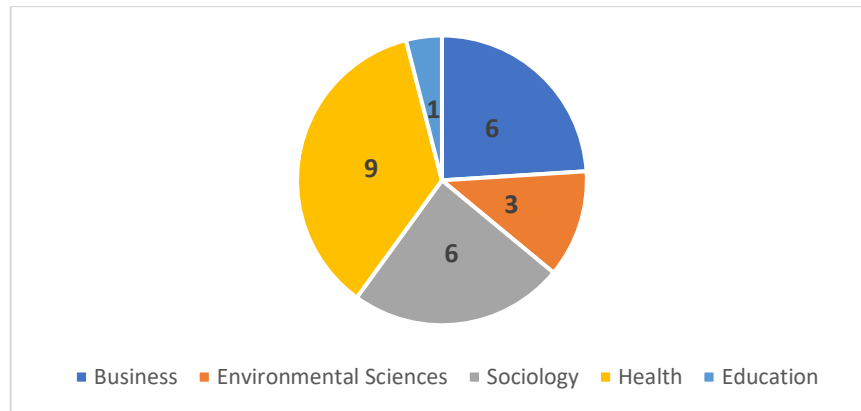
Source: research data

In 15 articles out of total, or 60%, it is identified at least one aspect that would promote or hinder family farm products procurement. They are divided into: i. governance, that considers autonomy and centralization or decentralization structure such as: municipal centralized management (Melo et al, 2016) and its partnerships and inter-sectoral coordination between the parts responsible for implementing PNAE, like townhall, SFC, departments of agriculture and education in the municipalities (cited in seven articles); ii. education management, such as decentralized management[7] (Melo et al, 2016); iii. smallholder's supply, including close or abundant family farm products (Elias et al, 2019); and iv. local context like small scale municipality (Machado et al, 2018). All these factors are associated with more family farm products procurement according to the literature.

For the factors concerning less smallholders products procurement are also the ones related to education management like institutional arrangement and resistance to change (Elias

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6This classification was based on the journal title and which knowledge area was evaluated with the highest score on CAPES (Higher Education Improvement Coordination) assessment.

[7] In the centralized model, the States are directly responsible for school food program for all the public schools in all levels (preschool, elementary, middle school and high school) in the State, through Department of Education of the States or Federal District. The State level thus plays the role of the executing entity. In the decentralized model, each school is responsible for its own catering process, and become *de facto* the executing entity. There is an intermediate level of centralization in which town hall is responsible for the various activities making up school catering for all the public school in the municipality.

et al, 2019; Mossmann et al, 2017) or social, economic, and geographical local context related ones, such as low family farmer's infrastructure, the most mentioned negative factor; and bureaucracy, cited in six articles.

The resistance to change can be related to a fear public manager might have. Even though there are legal alternatives to replace the traditional bidding mechanism that hinders family farm products procurement, public managers are afraid of administrative and judicial sanctions for having used these alternatives. It probably happens because innovative public procurement approaches that prioritize family farmers, like the Public Call, are not as well-known and institutionalized as the long-established ones. This problem probably happens because the rules are not clear enough.

Low infrastructure seems to characterize family farmers (Sodré et al, 2016; Souza-Esquerdo, 2015; Schwartzman, 2017; Pedraza et al, 2018; Vilela et al, 2019; Mossmann et al, 2017; Melo et al, 2016) as agriculture public policies in Brazil historically prioritize large farmers. A consequence of this can be low quality, variety and bad appearance or high cost of family farm products, a factor cited by three articles (Oliveira at al., 2017; Vilela et al, 2019; Mossmann et al, 2017). Bureaucracy problems are also very present at school food, as it is an 18 activities process (Hirata et al, 2017).

To overcome bureaucracy and inertia sometimes present in public management, a wide set of rural development public policies must be in place. Conselho de Monitoramento e Avaliação de Políticas Públicas (2020) has found that even in municipalities that accomplish very low family farmers procurement percentage, PNAE 30% rule is seen as legit, which indicates there is no formal resistance for executing this policy by public managers.

Table 2.5 show all factors identified in the literature.

Table 2.5 - Positive and Negative Factors in the purchase food from family farm

Positive Factors		
	Factor	**Who cited it**
Governance	Actors' partnership and inter-sectoral coordination	Schwartzman, 2017; Corrêa et al, 2017; Pedraza et al, 2018; Lopes et al, 2019; Cunha et al, 2017; Elias et al, 2019; Mossmann et al, 2017
	Program institutionalization and community participation	Melo et al, 2016
Education management	Municipal centralized management	Melo et al, 2016
	Nutritionist role	Schwartzman, 2017; Santos et al, 2016; Lopes et al, 2019; Machado et al, 2018
Smallholder's supply	Close or abundant family farm products	Elias et al, 2019
Local context	Small scale municipality	Machado et al, 2018

Negative Factors		
	Factor	**Who cited it**
Education management	Institutional arrangement and resistance to change	Elias et al, 2019; Mossmann et al, 2017
	Outsource	Machado et al, 2018
	Bureaucracy	Souza-Esquerdo, 2015; Schwartzman, 2017; Pedraza et al, 2018; Vilela et al, 2019; Mossmann et al, 2017; Cruz e Assis, 2019
Smallholder's supply	Large scale agriculture tradition	Machado et al, 2018
	Low family farmers infrastructure	Sodré et al, 2016; Souza-Esquerdo, 2015; Schwartzman, 2017; Pedraza et al, 2018; Vilela et al, 2019; Mossmann et al, 2017; Melo et al, 2016
	Low quality, variety and bad appearance or high cost of family farm products	Oliveira at al., 2017; Vilela et al, 2019; Mossmann et al, 2017
	Not an interesting selling for family farmers	Souza-Esquerdo, 2015; Schwartzman, 2017; Triches and Silvestri, 2018

Source: research data

The factors identified in the literature can be divided into supply and demand and local context. Supply is smallholder's supply, demand is the government side, who procure foodstuff and its supervision (education management and governance). Local context may affect both demand and supply in diverse manners.

Figure 2.4: Diagram of theoretical arguments
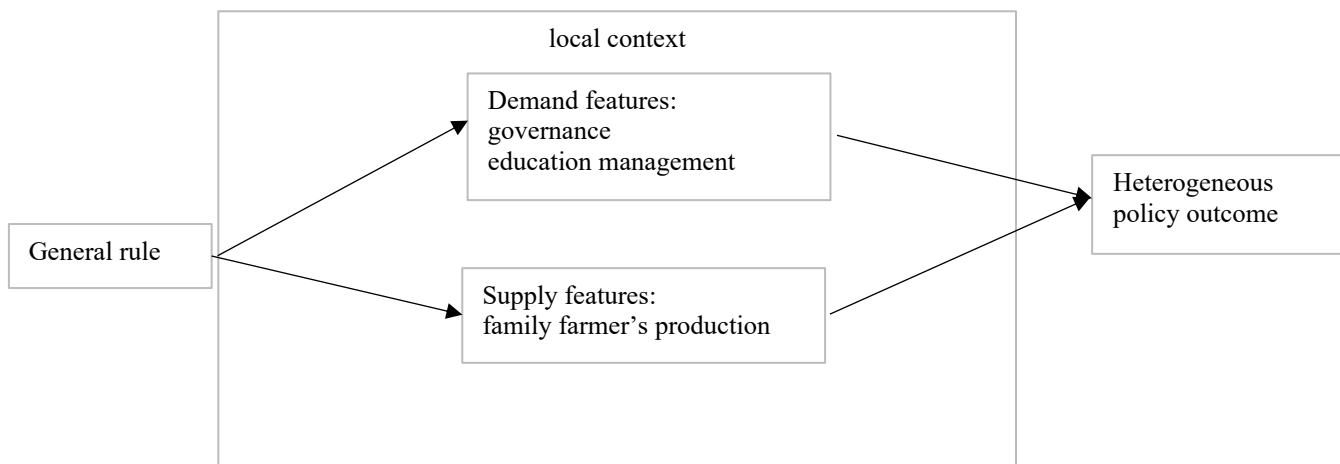
Source: research data

More efficient and well organized (in cooperatives for instance) supplier may not be enough for this 30% PNAE rule to implemented. It is fundamental to understand what happens in public education management and governance side and look for more effective strategies,

because part of explanation why this program is not largely implemented can be found in those areas.

2.6 CONCLUSION

This article aimed to characterize public school food procurement policies in Brazil, based on a literature review and to investigate positive and negative factors influencing its implementation at the local level. There was a tendency in food procurement of increasing complexity due to social and environmental concerns, like the purchase of food from family farmers, local producers and organic products. In Brazil in particular, regulations require the acquisition of 30% of products from family farmers.

Thirteen positive and negative factors were found on what helps or hinders the 30% PNAE's procurement rule implementation. They were divided into governance, education management, smallholder's supply, or local context. In the Brazilian case, the main factors that hinder compliance with the legislation are bureaucracy, infrastructure problems and resistance to change (new forms of procurement execution). On the other hand, the positive factors cited were decentralized procurement and family producer's proximity.

A limitation for this research is the use of only the initials PNAE as a word search and having looked solely for peer-reviewed papers, excluding thesis or dissertations. For future research we suggest empirically analyzing the factors found in this paper by means of qualitative and quantitative methodologies.

The contribution for this research is a clearer understanding on what factors can help the successful implementation of public policy related to school food procurement. This has a social relevance for the welfare as it is related to education, health and a large economic budget pertaining to children, teachers and family farmer producer.

3 SCHOOL FOOD PROGRAM AND PUBLIC FOOD PROCUREMENT FROM SMALLHOLDER FARMERS: EVIDENCE FROM BRAZIL

ABSTRACT

In developing countries, smallholders face high transactions costs for accessing food markets. To mitigate this problem, many countries and international organizations promote inclusion on smallholder's products in public markets (Kelly and Swensson, 2021). Brazilian government uses its purchasing power to link smallholder farmers to public school food procurement. Since 2009, public schools must dedicate at least 30 percent of their food procurement budgets to purchase food from smallholder farmers known as family farmers. Despite being a countrywide regulation, many municipalities still buy almost nothing while others are heavily involved in this program (FNDE, 2020). The purpose of this research is to identify the determinants of the proportion of smallholder's products in the public-school food procurement. We specifically analyzed factors related to supply, such as close or abundant family farm products (Elias et al, 2019) and others related to demand, like how education management is structured and how active governance is. The data we rely on comes from FNDE, a federal agency under the Ministry of Education, and Brazilian Geography and Statistics Institute (IBGE in Portuguese). Both databases provide information for the entire population of Brazilian municipalities (5,570 municipalities). We ran OLS regressions with fixed effects for geographical regions to control for local characteristics we do not have information about. We found that governance characteristics and smallholder's product supply are the main drives that can help or hinder this program success. Regarding food items supply indicates that supply itself may not be an issue for PNAE implementation, however, some details around it, like price and access and smallholder's organization may be in the way for municipalities to procure more from family farmers.

Keywords: Brazil. Governance. Public food procurement. Public policy. School food program. Smallholder farms.

3.1 INTRODUCTION

Public procurement has been used to achieve social objectives since the 19th century. As the government has a large demand for products and services, it has the power to create market opportunities and incentivize new behaviors (Stefani et al, 2017). The global investment specifically on public school food procurement is in the order of US$75 billion a year, however this investment does not seem to achieve the same output worldwide. On poorest countries, these public policies generally combine education concerns with agriculture and health (Drake et al, 2016). Their goals can be to improve school enrollment and learning outcomes, promote local economic development in developing countries and more broadly sustainable food systems in developed countries.

In developing countries, smallholders face numerous impediments that prevent them from participating in large food markets such as national public markets organized by the State to procure food for the institutional catering sector, like inadequate provision of physical (i.e., road, electricity, telecommunication) and institutional infrastructure (i.e., effective legal mechanisms to enforce contracts) (Gelo et al, 2020). To help overcome some of those barriers, the federal State in Brazil uses its purchasing power to link these farmers to school food market, benefiting smallholders with incentives to compete with bigger farmers and pupils with possibly more nutritional meals (Pye-Smith, 2014). More specifically, since 2009, public schools in municipalities must dedicate at least 30% of their food procurement budgets to purchase food from "family farmers"[8] that are smallholders, we use these two names interchangeably to refer to this specific kind of farmers. International organizations such as the Food and Agriculture Organization of the United Nations consider the Brazilian school food program as a model for other developing countries (Miranda, 2018; Kelly and Swensson, 2017).

However, survey data shows that the percentage of family farmers products in school food procurement varies with many municipalities buying almost nothing to almost everything from smallholder farmers (FNDE, 2020). Part of the explanation may come from the fact that, until very recently, the implementation of this law lacks coercive measures. Municipalities whose food procurement was below the 30 percent threshold did not face any kinds of financial

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[8] According to the Brazilian law (n. 11,326), a farmer is considered a family farmer if he or she: does not hold, in any way, an area greater than 4 (four) fiscal modules (that depending on the municipality a fiscal module varies from 50,000 to 1,100,000 square meters) predominantly uses the labor force of the family itself in the economic activities of its establishment or enterprise; have income predominantly originated from activities linked to the farm; direct his or hers establishment or enterprise with his or hers family.

consequences. Therefore, if that was the only driver, most if not all municipalities should be below the requested percentage. Empirical evidence shows that a significant proportion of municipalities use more than 30% of their budget to procure food from family farmers (FNDE, 2020) suggesting that factors beyond the lack of law enforcement are also part of the story. It is, thus, important to identify the factors that promote the successful implementation of public policy related to school food procurement in a developing country.

The goal of this paper is to identify the determinants of the proportion of family farm products in the food procurement of public schools in Brazil. To do so, we rely on an original database collected by Brazilian Geography and Statistics Institute (IBGE) and National Education Development Fund (FNDE). The database covers the food procurement for all the 5,570 Brazilian municipalities (covering 154,060 public schools) from 2014 to 2017, the most updated data available.

We also rely on a literature review discussed in chapter 2 to identify explanatory variables. We complement the literature review with anecdotical evidence gathered during interviews with policy makers involved in the management of the school food program. We then performed a quantitative analysis using cross section ordinary least squares (OLS) and fixed effects.

The paper is organized as follows. Section two presents the institutional context of school food program in Brazil. Section three we show the factors concerning the amount of family farmers products in school food procurement in Brazil, the literature both in Brazil and internationally. Section four presents the data and the variables we rely on. Section five shows our methods. Section six presents our results and describe various robustness checks as well as some research limitations. The conclusion contains policy implications as well as research suggestions.

3.2 INSTITUTIONAL SETTING

Brazil is a federal State with three government layers: the federal level, the state level (26 states plus a Federal District) and the municipal level (made of 5,570 municipalities). According to the Brazilian Constitution, each level of government is responsible for certain public educational provision. The Federal level is responsible for higher education like universities, states are primarily responsible for high school and middle school education and municipalities primarily are responsible for elementary school and pre-kindergarten. Both States and

municipalities can be responsible for elementary education (Brazil, 1988). The focus of our analysis will be on elementary school at the municipal level.

The federal level plays a role of planning, coordination and regulation of social policies in the country, while states and more specifically municipalities became responsible for the management and implementation of such policies (Bichir, Simoni & Pereira, 2019). It also collects most of the taxes in the country and redistribute part of these financial resources to the lower levels to help them provide public services (Arretche, 2002). For most municipalities, there is a strong dependence on federal transfers because a large part of the state and municipal budget comes from it. For 81.98% of Brazilian municipalities, transfers from federal and state levels accounted for more than 75% of total municipal budget in 2016. This dependency ratio was less than 50% in only 1.81% of them (Ministério da Economia, 2017). This is particularly the case for rural and sparsely populated municipalities with low additional tax collection on their own capacity as most municipal taxes in Brazil are related to urban occupation such as the ones linked to cars and services of any kind (like private health, tourism and entertainment). Therefore, there is a high probability of municipalities responding to financial incentives derived from federal programs.

One of the policies dedicated to the public educational sector is known as the national school food program (PNAE in Portuguese). Since 2009, this program requires that, at least 30% of the resources passed on by the federal government for school food to the municipalities and states public schools should be used to procure foodstuffs from family agriculture (federal law number n. 11,947).[9]

The federal entity who manages PNAE and transfers money to lower administrative levels is the National Education Development Fund (FNDE in Portuguese) a structure part of the Ministry of Education. The amount of money transferred from FNDE to municipalities is based on the number of students enrolled in the previous year. It is a fixed amount per student in the whole country[10]. Another fundamental actor for PNAE is called "executing entity", it is responsible for the overall operation of the program at the local level, and this includes receiving the funds, creating the menu, publishing procurement calls, signing contracts, delivering daily meals and nutritional education. States, municipalities and even individual primary schools can play the role of executing entity. Municipalities are traditionally the executing entity for secondary and elementary schools and pre-kindergarten. States are traditionally the executing

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[9] This law only applies to public school as private schools do not receive public money for school food.
[10] With exceptions to minorities who are 'quilombolas', those of African descent, and indigenous communities. These minorities receive more money than traditional students.

entity for secondary and high schools. Federal schools are the executing entity for themselves. However, if a municipality and the State agree, municipality can become responsible for school food management of schools under states' responsibility (usually high schools) that are in its municipal area, receiving a specific amount of money for it.

Similarly, for large municipalities with many public schools (like São Paulo), it can be unfeasible to centralize the management of the school food program at the municipal level, so schools would prefer to do it on their own. According to FNDE, there are three options to implement PNAE which differ in the centralization of the program implementation between the various administrative layers and who play the role of executing entity. In the centralized model, the States are directly responsible for school food program for all the public schools in all levels (elementary, primary, secondary and high school) in the State, through Department of Education of the states or Federal District. The State level thus plays the role of the executing entity. In the decentralized model, each school is responsible for its own catering process, and become *de facto* the executing entity. There is an intermediate level of centralization in which town hall is responsible for the various activities making up school catering for all the public school in the municipality.

The positive aspect of a decentralized system is a greater autonomy to tailor the decisions to the pupils' heterogeneous needs. The negative side is the lack of a specialized team to manage this process (Santos et al, 2016). The benefits of the intermediate level of implementation are a reduction of storage in individual schools and greater buying and bargaining power, possibly facing better price due to scale (especially for large municipalities). Some disadvantages regards to the centralized model are need for larger store space, the need to carefully manage food stocks to avoid losses due to constraints on expiration date (Santos et al, 2016) and a higher sensitivity to external supply shocks. For instance, in São Paulo state, out of 645 municipalities, 18.6% use the centralized model.[11]

The last fundamental actor for PNAE is known as School Food Councils (CAE in Portuguese). These councils are responsible for monitoring school food programs at the state and municipal levels. Besides ensuring wise use of financial resources, CAEs encourage the efficient delivery of the program (Kelly and Swensson, 2017). The School Food Council (SFC) is a collegial body serving as a forum for decision making and advisory nature, it makes recommendations for the actors who is implementing the program. It is made of at least 7 full

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[11] Unfortunately, we do not have the relative proportion of each option (centralization, decentralization, intermediate) for the whole sample of municipalities. In exception, São Paulo state collets and makes this available upon request.

members: one political representative (the mayor or its secretaries in municipal SFCs), two members representing education workers and students, two members representing civil society and two members representing parents.

SFCs have the main function of ensuring the achievement of quality school meals, through the inspection of public resources transferred by the National Education Development Fund (FNDE), which complements the resources of the States, Federal District and municipalities, for the execution of the PNAE program. Therefore, for some municipalities, the amount available locally to procure school food is higher than the amount transferred through the program (FNDE, 2020). The following figure summarizes the interplay between the various players of the PNAE program.

Figure 3.1. School food program management structure
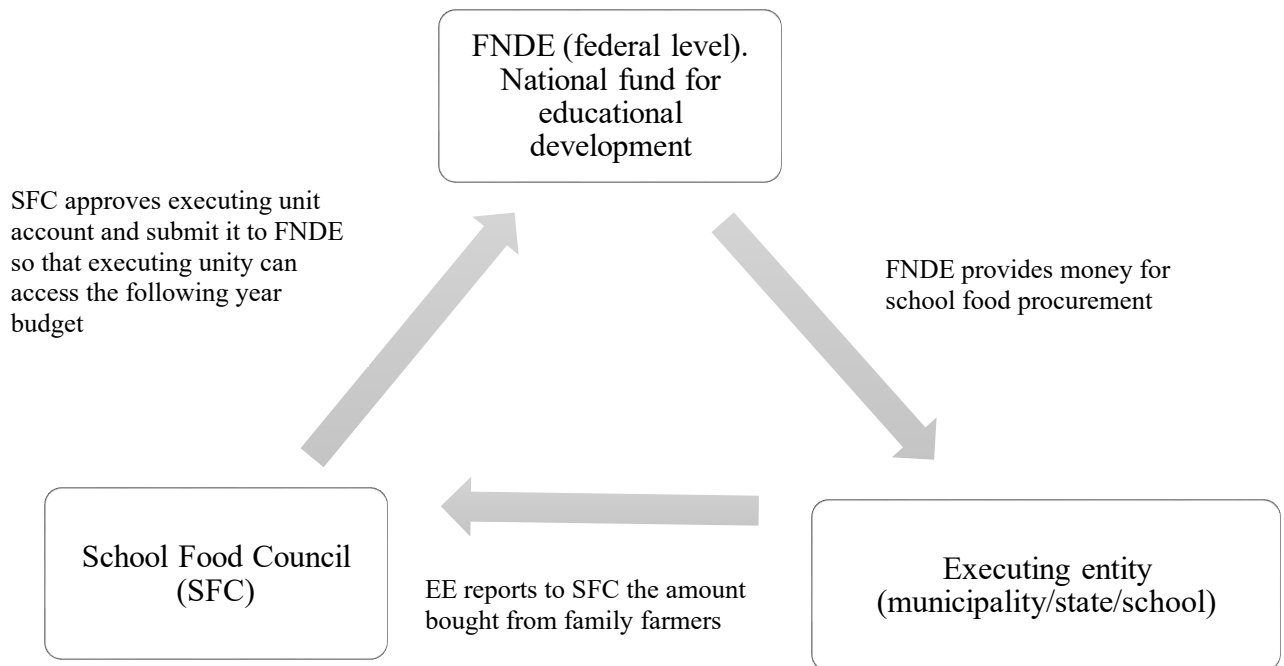
Source: Authors

Every year, all municipalities and states submit their food procurement invoices to be approved by the SFC, thus allowing the federal government to consider those documents as their invoice. SFCs exist only in municipalities and states, not in schools. SFC has the power to disapprove the accounts the municipality provide, thus making them redo it before sending to FNDE or even hindering this process, which can lead to the municipality not receiving the funds on the next term. FNDE is authorized to suspend transfers of PNAE to executing units if they fail to constitute the respective SFC (School Food Council) or fail to present the book accounts

of the resources previously received for the execution of the PNAE or to commit irregularities in the execution of the PNAE. Note, however, that the failure to reach the 30% target goal is not a requirement for the executing entities to keep receiving money from the federal government[12]. There are some justifications that municipalities may claim for non-compliance with the law, they are especially related to the low or uncertain supply of the family farmer's products. As a result, the penalization is applied only in rare cases: when the municipality is not accountable for purchases or does not institute a School Food Council or does not provide food of any kind in schools (Bonduki, 2017).

3.3 THE FACTORS CONCERNING THE AMOUNT OF FAMILY FARMERS' PRODUCTS IN SCHOOL FOOD PROCUREMENT IN BRAZIL

Public procurement is an instrument to achieve various economic, social, and environmental objectives (Morgan and Sonnino, 2008). Because of its purchasing power, the public sector is often considered as a catalyst able to improve food system's sustainability by influencing behaviors in both production and consumption sides of the food markets (Stefani et al, 2017). School food program and related food public procurement policies may, however, have different purposes depending on the socioeconomic context in which they are implemented.

In Europe, for instance, the European Union introduced in 2004 the "Green Public Procurement" strategy to encourage public bodies to use their purchasing power to shape, or at least influence, production and consumption patterns in order to reduce diet-related health problems and provide environmental benefits (European Commission, 2016). Some member states go even further by directly promoting sustainable procurement patterns through national law. For instance, in France a law set specific targets on food purchase in public schools (law n. 2018-938, called Egalim law). By 2022, the food procured must contain at least 50% of products certified by a public label (such as PDO/PGI, "Label Rouge" certifying higher products' quality) with at least 20% of organic products. In Italy, initiatives from the government also push public school food procurement towards the provision of organic and

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[12] In May 2020, FNDE released the normative number 6 that says "*The percentage not executed in accordance with the provision in the caput will be assessed when rendering accounts and the corresponding amount must be returned*." This may be a fundamental difference on enforcement, as until before this resolution, returning money to FNDE was not foreseen by law. FNDE is already giving support to the executing units on how this will be implemented. Our data, however, cover a period below this change in the enforcement of the school program.

quality food (Filippini and al., 2018). In the United States, the Federal level as well as some States promote "Farm to School" programs whose main task is to foster local food procurement (Botkins and Roe, 2018). More broadly, in developed countries, the emphasis is mostly put on the impact of food diets on human health (like growing obesity) and environment protection.

With regards to developing countries, the societal challenges are probably different. Alleviation of poverty and access to at least one decent meal per day for kids are more prominent goals in these countries than in developed ones. In Brazil, there are one million malnourished children and adolescents below 18 years old (UOL, 2022). PENSSAN (2021) revealed that 55.2% of Brazilian households were experiencing food insecurity and 9.0% were facing hunger.

In developing countries, Drake et al (2016) compared fourteen case studies. These countries were purposely selected because they exhibit a diversity of innovative school food programs. Their analysis considered several factors such as design and implementation, policy and legal frameworks, institutional arrangements, funding and budgeting, and community participation.

As we saw in Chapter 2, in the Brazilian academic literature, the research about school food come from different fields, like health, education, and social sciences. This literature helped us to survey some of the factors promoting or hindering food procurement with smallholder's products.

Many of the existing literature in Brazil identified factors that are, however, very subjective and hard to quantify such as actors' partnership and intersectoral coordination (Schwartzman, 2017; Corrêa et al, 2017; Pedraza et al, 2018; Lopes et al, 2019; Cunha et al, 2017; Elias et al, 2019; Mossmann et al, 2017), community participation (Melo et al, 2016) or resistance to change (Elias et al., 2019; Mossmann et al., 2017).

However, other factors are more easily transformed into quantitative variables. Some are related to supply, such as local availability of family farmers' products (Elias et al, 2019) or low family farmers infrastructure (Sodré et al, 2016; Souza-Esquerdo, 2015; Schwartzman, 2017; Pedraza et al, 2018; Vilela et al, 2019; Mossmann et al, 2017; Melo et al, 2016). Others are related to education public management, like using municipality centralized management model that are positively related to more smallholder's products procurement according to Melo et al, 2016. And finally, some factors should be used as control variables like municipality population size negatively related to more smallholders' products procurement according to Machado et al, 2018.

3.4 DATA DESCRIPTION

Our database is made of the entire population of Brazilian municipalities (5,570 observations). Even though the data we use are free and easily accessible on the internet, we are not aware of any previous researchers that created and analyzed a database merging different kind of data as we did in a countrywide manner.

The data we rely on come from various sources. The independent variables regarding school, students, amounts of money transferred and school food procurement are from the FNDE annual census which collect data from their programs such as PNAE. The dependent variable is also from FNDE but come from a different database[13]. Every year all municipalities and states are required to provide information and documents to confirm how they had used the money transferred from FNDE to procure school food. If they provide incorrect or false information, they can be sued by public authorities. For this reason, it is a very reliable data.

The other main source of data is the Brazilian Geography and Statistics Institute (IBGE in Portuguese). Specifically, their database called Basic Municipal Information Survey 2014 edition (Pesquisa de Informações Básicas Municipais), a census run every year in all 5,570 Brazilian municipalities. The questions relevant for this research are on governance and education management information (specifically data on the variables number of SFC meetings, SFC parity, SFC year of creation, access information law, education budget responsibility under education organ, HR/population, and education management centralization in state level).

The other database used from IBGE is Censo Agro 2006 edition[14] that is the main and most complete statistical research on structure and production agriculture in Brazil. The merging ID for the databases are the five digits code IBGE created and it is adopted by many other research institutes in Brazil. Our sample size used in the regressions is 4,768 observations.

3.5 METHODS

We wanted to investigate the determinants of the proportion of family farmers' products in public school food procurement. Given the structure of our database, we use cross section

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[13] Publicly available here: https://www.fnde.gov.br/index.php/programas/pnae/pnae-consultas/pnae-dados-da-agricultura-familiar

[14] There is a new edition on this census for the year 2017. However, we did not use it so that our regressors are observed before their outcome variable. Censo Agro 2006 is publicly available here: https://sidra.ibge.gov.br/pesquisa/censo-agropecuario/censo-agropecuario-2006/segunda-apuracao

ordinary least square regressions. Our main specification for the empirical model is the following:

$$y_i = \beta_0 + \beta_{1\ governance_i} + \beta_{2\ education\ public\ management\ i} +$$
$$\beta_{3\ smallholder's\ products\ supply_i} + \beta_{4\ control\ i} + a_i + \varepsilon_i$$

Where y_i is the average percentage of smallholder's farmers product procurement over total food product procurement for a municipality between 2015 and 2017; $governance_i$ is a vector of the variables related to governance characteristics; *education public management$_i$* is a vector of the variables related to education public management variables; *smallholder's products supply$_i$* is a vector of the variables related to smallholder's products supply; $control_i$ is control variables (GDP/capita and population density, for instance); a_i are state fixed effects; and ε_i *is the error term*. We describe each variable later in the article. Given heterogenous biological and social and economic context of Brazil, we expect to mitigate these influences through the introduction of state and mesoregions fixed effects.

Addressing concerns about endogeneity is warranted if we suspect that some explanatory variables are correlated with the error term (i.e., an omitted variable bias). Examples of omitted variables in this context could be low or insufficient human resources to manage school food and school infrastructure for food storage (Sodré & Salamoni, 2016). The availability of logistic infrastructure may impact food prices because if the producer has a high delivery cost, he or she will have to take it into account when reformulating final prices, hence making these products less interesting for procurement. However, since we control for state and mesoregion fixed effects, which acts as a proxy for local specificities, this source of bias is potentially mitigated. Mesoregions were created by IBGE based on social characteristics, geography, and spatial articulation. There are smaller than states and there are no mesoregions across more than one state. In Brazil there are 133 mesoregions.

Furthermore, it is possible that some unobserved subjective determinants of school food program described in the literature are also correlated to some regressors of our model such as actor's partnership, intersectoral coordination and nutritionist, and mayor willingness to execute the program. For instance, if the nutritionist who created the menu is too specific about the kind of vegetables she or he requests and if it is out of family farmers offer, it can harm family farmer's products procurement (Schwartzman, et al, 2017). We do not have information on this as we have chosen a quantitative and wide approach instead of a limited and qualitative one where we could access this knowledge.

Another source of bias could come from the presence of reverse causality. This would be the case if, for instance, smallholder farmers started to produce more in response to school food demand. Such bias would overestimate the effects of supply on our dependent variable. However, we did not suspect this bias to be a major issue in our analysis because our supply variables were measured before (around 10 years earlier) our measurements of food product procurement.

Finally, we are not concerned by multicollinearity issues. Indeed, the independent variable are not highly correlated together as you can see in table A1 in the appendix. We used Stata software for the econometric analysis.

3.5.1 Dependent variable

Our dependent variable relies on the proportion of family farmer's products bought by a given municipality. This information is available annually in the FNDE database from 2011 to 2017. Although official, we observe that some municipalities lack this information or even provide dubious data[15]. Such cases made us to be cautious and exclude that municipalities in the empirical analyses.

Specifically, we used the average of the years 2015 to 2017 as dependent variable in our model. We did so to control for potential harvest variations on the period. Harvests vary from a year to another, especially for family farmers who usually do not have the technology to mitigate climate hazards such as fertilizers. So, in a bad harvest year, there would be much less smallholder farmers product procurement than in a good one. Moreover, controlling for state fixed effects in our regressions, we potentially alleviated the effect of climate hazards affecting harvests.

3.5.2 Independent variables

Botkins and Roe (2018) analyzed the determinants of school districts' Food to School (FTS) participation in the United States. This program promotes national or more localized agricultural systems through school food programs. In their research, they distinguish supply side factors from community characteristics and school district characteristics. Adapting their

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[15] For instance, some municipalities presented information stating that more than 100% of their food procurement are from family farmers, which is an unrealistic percentage.

framework, we distinguish for each municipality four groups of determinants explaining family farms procurement: governance indicators, type of education management, characteristics of family farm supply, and municipality characteristics (controls).

3.5.2.1 Governance of school food procurement

To address governance at the municipality level, we rely on three broad aspects established by the UN Statistical Commission in 2015 (Praia Group on Governance Statistics, 2020): non-discrimination and equality, participation, and openness. IBGE already adopted them as a guide in their studies. The proxy for participation is the number of School Food Council meetings in the last 12 months. We expected this variable to have a positive association with more family farm procurement as a more participative group of stakeholders would be more organized to pressure the authorities on applying PNAE law. According to Evangelista (2010), SFC is formally created just so that the municipality have access to the federal money, but lack the resources to develop their activities. Having more meetings can also be a proxy of how active SFC is.

The proxy for non-discrimination and equality we use from our database is SFC parity. This is a dummy variable that takes the value 1 when there is at least one representative for each stakeholder recommended by a federal law in SFC and zero otherwise. We expected this variable to have a positive association with more family farm procurement as a more diverse group of stakeholders could represent different actors such as students and family farmers, and they would be more concerned with this issue and willing to pressure the authorities on applying the 30% minimum law. In their qualitative analysis, Melo et al. (2018) stressed the importance of program institutionalization defined as how established the process of doing a certain activity is and how sustainable over time it remains, how it will continue to happen even if people do change it. We proxied this factor by which year SFC was created. Older SFC would be more able to supervise PNAE. We thus expected this variable to have a positive association with more family farm procurement.

For openness, the proxy we rely on is the information access law in the municipality, it is a dummy variable. In Brazil, thanks to a federal law, any citizen can ask for federal public information like budget or spending. Some municipalities also have similar laws through which citizens can access family farm procurement that year for example. This variable presents value 1 if the municipality has some information access law and 0 otherwise. We expected this variable to have a positive association with more family farm procurement as citizens who can

be better informed of how public management happens in their municipality would be more able to make pressure on it.

3.5.2.2 Education management

Education public management refers to how education is managed in each municipality considering civil servants who work on it and School Food Council features, that help us understand how each municipality deals with school food. In this group of determinants, we distinguished several characteristics suggested by previous literature and interviewed specialists. These features are: specificity, quality and outsourcing. Specificity means school food is managed by an education organ, like a secretary. The proxy for specificity is a dummy variable that takes the value 1 when the education budget is under education organ responsibility, 0 otherwise. It was originally a categorical variable whose possibilities were mayor, education organ and other. If education budget is under education organ responsibility, it probably means it is not treated in a general way as it would be if under mayor or others responsibility. This variable is possibly positively related to more family farm procurement as with a more specific management it would be easier to control and use education budget as requested by the federal law.

For education public management quality proxy, we used human resources in education management by population, as with more human resources, we assume public policies implementation would be more effective. So, we expect this variable to have a positive association with more family farm procurement.

The third variable for the education public management is outsourcing activities. Outsourcing, in this case, is when the municipality hires a private company to work on any part of school food activities, like buying food products, producing, or delivering meals. Machado et al (2018) found outsourcing to be a negative factor for more family farm procurement. According to the authors, in outsourced school food management, the decision-making role of food purchase is assigned to private companies, and they do not necessarily prioritize procuring food from family farmers, which may indicate the need for greater control, regulation and support for such management modalities. Outsourcing is a dummy variable for the management mode of schools' canteen in each municipality. It takes the value 1 if one of the activities related to school food such as purchasing, cooking, or delivering meals is outsourced to a private company, 0 otherwise.

Improvement of school food is a yes or no question posed in 2014 in Basic Municipal Information Survey database. It asks if there was an improvement that year. We considered it to be a proxy for political motivation towards public schools, which is a positive factor for more family farm procurement according to Souza-Esquerdo et al (2014) and Lopes et al (2019). Education budget law existence is a dummy variable taking the value of 1 if there is a municipal law specifying how education budget should be spent, and 0 otherwise. This would be positively related to more smallholder's product procurement as there would be more concern about education budget including school food budget.

3.5.2.3 Supply characteristics

Another relevant set of variables are related to smallholders' food supply availability, capturing how much products are available and close for the municipality to procure. The variables are the percentage of smallholder's establishments over total agricultural establishments, the percentage of smallholder's agriculture production over total agricultural production and rural population over total population. All these variables are in municipal scale.

According to Schwartzman et al (2017) more supply has a positive association with more family farm procurement, so we expect all these variables to be positively related to more family farmer's products bought. There could be a concern regarding these variables as more procurement in last years may be an incentive to increase supply. However, we avoided this issue by using supply variables from 2006 years before our dependent variables.

3.5.2.4 Control variables

Finally, we control for sociodemographic and economic municipality characteristics. First, GDP per capita in average from years 2015 to 2017 captures much information, like how much tax money might be available for implementing public policies, how educated is the population, how developed is the economy in that municipality. This control is particularly important because the municipalities are required to complement with their own financial resources the school food budget they receive from federal government. This would facilitate smallholder's products procurement as they are usually more expensive than traditional products. We expect this variable to have a positive association with more family farm

procurement. We also used GDP per capita in average square root to check if there was an optimum value to maximize family farmers procurement percentage.

Then, we control for population density in average from 2015 to 2017, which is a proxy for school geographical dispersion. A higher density is possibly associated with less dispersion which possibly means less costly transportation for family farm products, which would make it easier to buy them. On the other hand, higher density population can be also related to a more urban municipalities, where the access to smallholders would be more difficult. The sense of association between this variable and family farm procurement is thus unclear.

Number of schools in 2016 refers to the number of public schools in each municipality. Problems with logistic and transportation are a negative factor for more family farmers products procurement according to Vilela (2018) and Triches and al (2018). We expect this variable to be negatively related to smallholders' farmers product procurement as with more schools there would be higher transportation delivery cost. This variable could be highly correlated with other control variables, such as GDP per capita and population density. We tested it. We used 2016 data because they are the most updated FNDE provides. Table 3.1 summarizes how independent variables are related to more family farm products procurement.

Table 3.1 - Independent variables description

Factor	Variable	Description	Expected relation with dependent variable	Measuring units
		Independent variables		
		Factors related to demand		
		Governance		
Governance	Number of SFC meetings	How many meetings did SFC take in 2013?	Positive	count
	SFC parity	Does SFC follow representatives' proportion?	Positive	dummy
	SFC year of creation	When SFC was created?	Negative	year
	Access to information law	If there is a municipality law that helps citizens and press to access public management information	Positive	dummy
		Education management		
Education management	Education budget responsibility under education organ	Education budget is under educational organ responsibility	positive	dummy
	HR/population	Proportion of education civil servants minus teachers on population	Positive	proportion
	Outsourcing food processing activities in 2014	Outsourcing food processing activities in 2014	Negative	dummy
	Improvement of school food	The municipality adopts targeted actions regarding improvement of school food	Positive	dummy
	Education budget law existence	If there are the allocation values for education provided by law	Positive	dummy
		Factors related to supply		
Smallholder's supply	% family rural establishments/total establishments 2006	Proportion of family farms quantity on total farms	Positive	percentage
	% family farming production in 2006	Proportion of family farms of agriculture production on total farms	Positive	percentage
	% rural pop. 2010	Proportion of rural population on total population	Positive	percentage

Control variables				
Control variables	GDP per capita	GDP per capita mean from 2015 to 2017 in thousands	Positive	1000 reais (Brazilian currency)/ population
	GDP per capita square root	GDP per capita mean from 2015 to 2017 in thousands	Negative	1000 reais (Brazilian currency)/ population
	Population density	Population mean from 2015 to 2017/ municipality area	Positive	population/km^2
	Number of schools	How many are in each municipality?	Negative	quantity

Source: authors

3.6   RESULTS AND DISCUSSIONS

3.6.1 Descriptive analysis

Graph 3.1 depicts how smallholder's products procurement is distributed through municipalities. The first striking result is the fact that more than 600 municipalities (around 10% of the number of municipalities) bought almost no food from family farmers. This is surprising because from the time of collection of our data, the law on school food procurement was already 5 years old. Most municipalities buy between 20% and 40% of food products coming from family farmers. Nevertheless, few municipalities were procuring almost 100% of their school food products from smallholders. 3,110 municipalities procure less than 30% from family farmers, which means they do not accomplish the law minimum goal, and other 2,460 meet the requested target.

Graph 3.1: Repartition of the share of family farms products in municipal food procurement
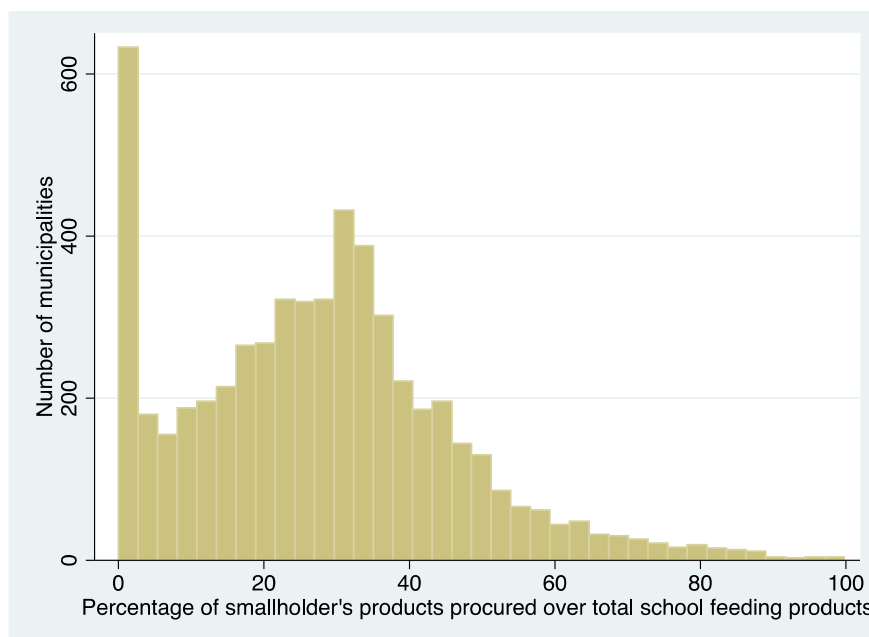
Source: research data

Table 3.2 represents the mean percentage of family farm procurement by region (see annex A2 for a map of Brazilian regions, in the map, North region is in green, Northeast region is in brown, Midwest is in red, Southeast is in yellow, and South in purple).

Table 3.2 - Characteristics by Region

Region name	North	Northeast	Southeast	South	Midwest
Number of states	7	9	4	3	4
Number of municipalities	450	1794	1668	1191	467
% of family farm procured for public schools (average from year 2015 to 2017)	20.87595 (15.501)	22.41709 (13.716)	27.31123 (17.122)	42.21258 (17.453)	19.46106 (16.659)
Family farm establishments percentage mean (number of family farms over number of total farms)	81.86042 (12.768)	86.34057 (10.9)	69.83855 (15.544)	82.73298 (11.763)	63.73462 (17.061)
Family farm production mean (in value terms of money)	69.46599 (30.867)	69.94845 (26.85)	37.846 (28.357)	58.10735 (29.973)	28.42965 (28.743)

Source: research data

Because of its geographical size, Brazil is a very heterogeneous country. Cultural and geographical factors differ significantly across the country, and this may affect our dependent variable in many ways. For instance, North is the largest region in geographic area and it has the lowest number of municipalities, which means that municipalities there are larger and smallholders may have to deal with longer distances to deliver their product, demanding higher costs. Due to Amazon Forest location, part of its land is protected by law and cannot be used for agriculture production. Northeast region is where Portuguese colonization started in Brazil. It has the largest percentage of family farms establishments over total agriculture establishments and the largest percentage of family farm's production over total production. Despite the supply availability, the proportion of family farms' products in school food procurement remains relatively low.

Southeast region contributes to the largest share of Brazil's GDP, it has the most developed economic activities, and the largest Brazilian metropoles (São Paulo and Rio de Janeiro)[16]. In 2016, it had the worst family farm products procurement percentage mean, around 18% (IPEA, 2019). South region is the region with the lowest social inequalities in Brazil. It is the only region whose family farm products procurement percentage mean in 2016 was greater than 30% (IPEA, 2019). Midwest is known by its large conventional agriculture livestock farms and has the lowest percentage of family farms establishments; these two facts are possibly correlated. All in all, this suggests a strong heterogeneity between regions, but probably also within at the states level. To control for this heterogeneity, we will introduce regions and states fixed effects in our empirical analysis.

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[16] São Paulo has a population of more than 46,649 million people and Rio de Janeiro has a population of more than 6,775 million people.

In Table 3.3 we show some descriptive statistics for the whole sample of municipalities. The first striking result is the fact that, even eight years after the implementation of the law on school food procurement, the mean of the family farm products procured is still below the legal target. The number of SFC meetings is around six, which means they meet every two months in average. More than 90% of SFC follow the stakeholder composition required by law. The mean year of SFC creation is 2001, three years after its creation was required by law, but eight years before the 30% rule creation. Less than 20% of the municipalities have an access to information law, which is not required by a federal rule and may indicate that it is hard for citizens to get informed about how public policies are implemented.

Regarding education management, we see that for almost half of the sample, education budget responsibility is under education organ and not under the mayor's office or other organ responsibility. There is around 0.02 education civil servant per habitant. Around 5% of the municipalities outsourced at least some activity in school food in 2014. More than 94% of the sample claimed they improved school food in the previous year, but they were not required to provide evidence on this. More than 83% had a law regulating education budget spendings, which possibly makes education management more specific in line with the education budget responsibility under education organ variable.

Regarding food items supply, the mean for percentage family rural establishments over total establishments and the percentage of family farming production over total agriculture production indicates that supply itself may not be an issue for PNAE implementation, as the majority of establishments and production is from family farmers and it is a proportion much higher than the 30% required by law. However, some details around it, like price and access may be in the way for municipalities to procure more from family farmers. Rural population was around 36% that is expected considering Brazilian population heavily migrated to the cities in the middle of the last century.

Most control variable exhibit an important standard deviation showing large differences between municipalities. Some municipalities have GDP per capita values close to high income countries and for other, closer to low-income countries. Population density is also very heterogenous. There are municipalities very sparsely populated with nature mostly preserved and other with high people concentration, like São Paulo. For number of schools, there is a high standard deviation and it is around three times the value of the mean. There are around 27 schools in each municipality.

Table 3.3 - Descriptive Statistics whole sample

Variable	Type	Obs.	Mean	Std. Dev.
Dependent variable				
Family farmer's products procurement percentage	Percentage	5,416	27.073	18.056
Independent variable **Factors related to demand**				
Governance				
Number of SFC meetings	Count	5,273	6.696	4.856
SFC parity	Dummy (1 if yes)	5,312	0.908	0.289
SFC year of creation	Dummy (1 if yes)	5,235	2001.848	5.598
Access information law	Dummy (1 if yes)	5,160	0.196	0.397
Education management				
Education budget responsibility under education organ	Dummy (1 if yes)	5,444	0.487	0.500
HR/population	Continuous and positive values only	5,091	0.018	0.009
Outsourcing school catering food processing activities in 2014	Dummy (1 if yes)	5,339	0.055	0.227
Improvement of school food	Dummy (1 if yes)	5,444	0.943	0.368
Education budget law existence	Dummy (1 if yes)	5,570	0.837	0.369
Factors related to supply				
% family rural establishments / total establishments 2006	Percentage	5,548	78.460	15.53441
% family farming production	Percentage	5,505	54.638	32.27713
% rural pop 2010	Percentage	5,439	36.437	22.01789
Control variables				
GDP per capita	Continuous and positive values only	5,160	20,733.42	18,818.00
GDP per capita square root	Continuous and positive values only	5,160	4,267.00	1,591.00
Population density	Continuous and positive values only	5,160	99.384	436.280
Number of schools	Continuous and positive values only	5,444	27.977	74.702

Source: research data

Table 3.4 compares the subsample of municipalities complying with the law (30% or more of food procured coming from family farms) with the subsample that did not comply. Considering the governance factors, half of the variables differs significantly between the two subsamples. SFC parity is significant and has a surprising result as complying subsample has a less democratic SFC. For the transparency aspect represented by access information law variable, the result is expected as the complying subsample show a higher value on this variable.

For education management variables, all variables were significantly different between the two samples. Education budget responsibility under education organ had higher values for complying sample as we expected. Surprisingly the municipalities that did not comply with the law have more HR in education for population proportion. Improvement of school food and education budget law existence are higher for the complying subsample as we expected.

For all three supply variables, there are higher values for the complying sample as expected by literature. Finally, for control variables, all variables are significantly different between the two subsamples. GDP per capita and GDP per capita square root are higher for subsample complying with the law. Population density in the not complying subsample was higher than for complying sample. The complying sample had less schools than the other sample in average.

Table 3.4 - Descriptive Statistics comparing non-complying and complying subsamples

Variable	"Not complying" sample			"Complying" sample			diff = mean(C) - mean(NC)
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	
Number of SFC meetings	2942	6.682	4.409	2305	6.687	5.364	0.040
SFC parity	2971	0.919	0.274	2315	0.894	0.308	-3.042***
SFC year of creation	2914	2001.876	5.506	2297	2001.821	5.615	-0.357
Access to information law	2828	0.161	0.367	2332	0.239	0.427	7.123***
Education budget responsibility under education organ	3050	0.431	0.495	2366	0.559	0.497	9.368***
HR/population	2783	0.019	0.010	2308	0.016	0.008	-9.247***
Outsourcing food processing activities in 2014	2959	0.067	0.249	2357	0.039	0.193	-4.483***
Improvement of school food	3041	0.934	0.248	2357	0.957	0.204	3.617***
Education budget law existence	3050	0.825	0.380	2366	0.855	0.353	2.911***
% family rural establishments	3050	77.060	16.689	2366	80.179	13.857	7.338***
% family farmer production	3019	53.421	33.397	2354	56.097	30.978	3.0075***
% rural pop 2010	3014	0.361	0.215	2352	0.368	0.220	1.176
GDP per capita 2015	2828	18.580	18.476	2332	23.345	18.901	9.125***
GDP per capita 2015 squared	2828	4.022	1.551	2332	4.563	1.588	12.347***
Population density	2828	111.664	503.176	2332	84.491	337.342	-2.2275**
Number of schools	3050	30.137	92.643	2366	24.495	38.754	-2.779**

Source: research data

3.6.2 Multivariate regressions

In this section, we present results from our empirical strategy shown in table 3.5. All estimations included the average of the family farm procurement as the dependent variable with fixed effects. In model 1, we used state fixed effects. In model 2 we used mesoregion fixed effects.

In model 1, variable number of SFC meetings was significant as we expected because more meetings would be a proxy for a more participative SFC. At first, we suspected more meetings could be related to less family farm procurement as too many meetings could be related to a more bureaucratic environment harming procurement from family farmers, or there

would be an optimal number of SFC meetings, we tested it and did not find evidence on this. SFC parity and year of creation, proxies for nondiscrimination and equality and program institutionalization were not significant. Possibly, these characteristics are important, but they were not captured by quantitative variables or the available data on them (from 2014) is too far from the dependent variable data (from 2015 to 2017) to have an effect. Access to information law is also not significant. Possibly being able to access information was not enough encouragement for citizens to do it. Therefore, only one out of the four governance variables were significant.

Education budget responsibility under education organ is significant and has a positive coefficient, as expected. HR/population was also significant, but had opposite signal to the one we expected, as less civil servants for education by population would lead to more family farm procurement. One could suspect of collinearity problems with other variables, but this was not the case as shown in Table A1 on the Appendix. We do not have a convincing explanation for this result. We could however conjecture that the negative relation is explained by the fact that having more human resources working in public education management may create a more complex environment that can create difficulties for this public policy to be implemented.

Outsourcing food processing activities was significant at 10% confidence interval, corroborating with Machado et al (2018). Education budget law existence was significant and positive confirming our idea that a more specific education management would lead to more family farmers products procurement. Therefore, four out of five education management variables were significant at 5% confidence level.

All family farm supply variables, expect percentage of rural population, were significant with a positive signal in regressions with state fixed effects, in accordance with Botkins and Roe (2018), Elias et al (2019) and Machado et al (2018). This emphasizes how important access to family farm supply is for executing this program, even though it seems not to be enough to apply this policy.

For control variables, GDP per capita has a negative signal and GDP per capita square root has a positive signal indicating a nonlinear relation between family farm procurement and GDP per capita. The turning point is 23,590.00 which means that until R$ 23.590,00 less money leads to more family farmers products procurement percentage and after this point, there is a positive association between family farmers products procurement percentage and GDP per capita. Population density was significant and had a negative sign, but it did not correlate with other independent variables, especially the ones on family farm supply group as we expected.

This is in line with the results by Machado et al (2018) for whom small scale municipalities would benefit from this characteristic to procure more smallholder's products as public management is less complex in small municipalities, so public policies are more easily implemented. Number of schools is not significant. The R^2 for model 1 is 29.2% and adjusted R^2 for is 28,6%.

In model 2, with mesoregion fixed effects, all demand variables (governance and education management) remained similar in terms of significance and signal. For the family farm supply variables, only percentage of family rural establishments over total establishments is significant in this model. The control variables also keep the same significance and signals as the previous model.

Table 3.5 - Regressions using family farm percentage as dependent variable

	State fixed effects	Mesoregion fixed effects
Mean family farm procurement percentage	Model 1	Model 2
Factors related to demand		
Governance		
Number of SFC meetings	0.0993**	0.0936**
	(0.0477)	(0.0474)
SFC parity	0.545	0.451
	(0.768)	(0.758)
SFC year of creation	0.0287	0.0270
	(0.0402)	(0.0397)
Access to information law	0.352	0.168
	(0.601)	(0.598)
Education management		
Education budget responsibility under education organ	1.565***	1.474***
	(0.481)	(0.477)
HR/population	-124.8***	-91.44***
	(28.32)	(28.21)
Outsourcing food processing activities in 2014	-1.943*	-1.920*
	(1.031)	(1.023)
Improvement of school food	1.333	0.792
	(0.986)	(0.977)
Education budget law existence	1.146*	1.247**
	(0.614)	(0.610)
Factors related to supply		
% family rural establishments / total establishments	0.109***	0.0559**
	(0.0227)	(0.0241)
% family farming production	0.0240**	0.0102
	(0.0101)	(0.0104)

% rural pop. 2010	2.123	0.944
	(1.339)	(1.364)
Control variables		
GDP per capita 2015	-0.123***	-0.119**
	(0.0466)	(0.0477)
GDP per capita 2015 squared	2.607***	2.429***
	(0.638)	(0.667)
Population density	-0.00248**	-0.00273**
	(0.00103)	(0.00108)
Number of schools		
	0.00353	0.00555
	(0.00394)	(0.00390)
State fixed effects	yes	no
Mesoregion fixed effects	no	yes
Constant	-48.03	-38.25
	(80.73)	(79.62)
Obs.	4,768	4,768
R squared	0.292	0.342
Adjusted R-squared	0.286	0.322

Source: research data

3.6.3 Robustness checks Alternative specifications

Our main concerns in our models are about endogeneity as stressed in Section 3.5 (methods). Our robustness check relied on two strategies: regressing each of three dependent variables years alone and using the dependent variable as a dummy of complying and not complying with the law.

3.6.3.1 Each year of dependent variable

The number of observations, mean and standard deviation in each year of the dependent are similar between one another, as shown above in table 3.6:

Table 3.6 - Each year of dependent variable statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Perc 2015	5399	26.73853	20.83472	0	99.9986
Perc 2016	5187	27.02147	20.82613	0	100
Perc 2017	5381	28.24489	21.0551	0	99.70377
Mean family farm procurement percentage	5416	27.07252	18.05612	0	99.74908

Source: research data

The regressions for this topic are on Tables A2 and A3 of the Appendix. For these regressions we take the percentage of family farmers products procurement of each year as the dependent variable. Considering the governance variables, only number of SFC meetings was significant. For the education management dimension, education budget responsibility under education organ and HR/population, were significant for all years. Outsourcing food processing activities, improvement of school food, and education budget law existence were significant for at least one year.

Regarding the supply factors, percentage of family farm rural establishment over total rural establishments was significant and positive for all years, percentage of rural population was significant for 2016 and 2017 data and rural population significant and positive for 2017 data.

Control variables GDP per capita square root was the only variable significant in all years. GDP per capita and population density also significant for the years 2015 and 2017. Number of schools was not significant. The regression with the highest R^2 (30.9%) is the one for the year 2017 with mesoregions fixed effect.

3.6.3.2 Dependent variable as dummy

In these regressions, we used family farmers product percentage as dummy and not as continuous variables. We found that some mesoregions predicted failure perfectly. They are Tefé (Amazonas federal unit), Boa Vista (Roraima federal unit), Oiapoque - Porto Grande (Amapá federal unit), Parnaíba (Piauí federal unit), São Raimundo Nonato (Piauí federal unit) and Corrente - Bom Jesus (Piauí federal unit). Half of them is in the North region; Boa Vista is the capital of the federal unit it is located. And the other half is in the Northeast region all in the same federal unit, Piauí.

For the logistic regression using the dependent variable family farm products procurement percentage ad dummy, the only significant variable in governance dimension was the number of SFC meetings, just like the regression for the average percentage as dependent variable.

For education management, HR/population is different than the regression for the average percentage as dependent variable for the mesoregion models. It is not significant in the mesoregion fixed effects here. All other variables in education management are similar to what we show in Table 3.5.

For supply variables, there was no difference in significance and signals in these regressions when compared to the ones that uses family farmers' products procurement percentage as continuous. The following table 3.7 summarizes what was discussed in these paragraphs.

Table 3.7 - Regressions using complying and not complying with the law as dummy dependent variable

	State fixed effects	Meso fixed effects
	Model 1	Model 2
	Factors related to demand	
	Governance	
Number of SFC meetings	0.0127*	0.0126*
	(0.00694)	(0.00719)
SFC parity	-0.0907	-0.0995
	(0.115)	(0.119)
SFC year of creation	0.00257	0.00262
	(0.00598)	(0.00621)
Access information law	0.0806	0.0931
	(0.0901)	(0.0942)
	Education management	
Education budget responsibility under education organ		
	0.285***	0.290***
	(0.0713)	(0.0742)
HR/population	-10.11**	-7.266
	(4.235)	(4.430)
Outsourcing food processing activities in 2014	-0.310**	-0.315**
	(0.155)	(0.160)
Improvement of school food	0.266*	0.227
	(0.150)	(0.157)
	0.177*	0.202**

Education budget law existence	(0.0911)	(0.0951)
Factors related to supply		
% family rural establishment	0.0114***	0.00435
	(0.00341)	(0.00377)
% family farming production	0.00337**	0.00158
	(0.00150)	(0.00163)
% rural pop 2010	0.171	0.0815
	(0.204)	(0.218)
Control variables		
GDP/capita	-0.0198***	-0.0206***
	(0.00674)	(0.00727)
GDP/capita square root	0.381***	0.388***
	(0.0929)	(0.102)
Population density	-0.000361**	-0.000410**
	(0.000176)	(0.000194)
Number of schools	0.000153	0.000458
	(0.000762)	(0.000779)
State fixed effects	yes	no
Meso region FE	no	yes
Constant	-7.920	-7.156
	(11.99)	(12.46)
Obs.	4,768	4,685
	LR chi2(41) = 1076.18	LR chi2(141) = 1201.91
	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000
	Pseudo R2 = 0.1635	Pseudo R2 = 0.1855

Source: research data

In table 3.8 we compare the models using family farmers products procurement as a percentage to the models using it as a dummy of complying with the law (reaching 30% or more) or not (less than 30%).

Table 3.8 - Comparison of which variables were significant in regression with dependent variables as continuous and as dummy

	Dependent variables as continuous		Dependent variables as dummy	
	State fixed effects	Meso fixed effects	State fixed effects	Meso fixed effects
	Model 1	Model 2	Model 1	Model 2
Factors related to demand				
Governance				
Number of SFC meetings	+	+	+	+
SFC parity	N.S.	N.S.	N.S.	N.S.
SFC year of creation	N.S.	N.S.	N.S.	N.S.
Access to information law	N.S.	N.S.	N.S.	N.S.
Education management				
Education budget responsibility under education organ	+	+	+	+
HR/population	-	-	-	N.S.
Outsourcing food processing activities in 2014	-	-	-	-
Improvement of school food	N.S.	N.S.	+	N.S.
Education budget law existence	+	+	+	+
Factors related to supply				
% family rural establishments / total establishments 2006	+	+	+	N.S.
% family farming production	+	N.S.	+	N.S.
% rural pop. 2010	N.S.	N.S.	N.S.	N.S.
Control variables				
GDP per capita	-	-	-	-
GDP per capita square root	+	+	+	+
Population density	-	-	-	-
Number of schools	N.S.	N.S.	N.S.	N.S.

Source: research data

Notes: $+$ represents a positive and a statistically significant impact; $-$ represents a negative and a statistically significant impact; N.S. represents a statistically not significant impact.

3.7 CONCLUDING REMARKS

In this research, we used a quantitative approach to the problem of inequalities in school food implementation to explore potential drivers of this heterogeneity. Our analysis illuminates that governance, education management, demand side and supply factors are associated with smallholder's products procurement in Brazilian school food program.

As School food program is socially and culturally influenced by the geographic region it is implemented on, it was a challenge to quantify the factors that relates to its diverse output. Many aspects are intrinsically qualitative like the nutritionist and mayors or public managers willingness to promote this public policy or how organized family farmers are in a municipality. For other aspects there is no country wide data available on it.

This research contribution relies mostly on the kind of data we used and on methodology. While most previous studies on the PNAE program relied on qualitative evidence to identify the factors promoting or limiting the ability to meet the 30% target, we chose to rely on a quantitative methodology taking advantage of the fact that we had information on the proportion of family farmers production in the school food procurement for the whole population of Brazilian municipalities.

There seems to be more and less adequate structure to implement PNAE that should be incentivized country wide, such as more active governance resources. Interestingly, not all SFC (a democratic and formally powerful governance asset) characteristics were found to be highly significantly related to the outcome. Possibly members of SFC are not aware of how to use its power. Regarding smallholder's supply, there should be more support for them so that municipalities can access more easily their production. There are already in Brazil policies and organizations with this focus that help with technical support and financial access.

Another recommendation for public policies managers is to consider each municipality smallholder's supply and governance context. Thus, they acknowledge the diversity we found in the country and specify stimulating goals for the ones who are already able to overcome the 30% federal rule target and special attention and feasible goals for the ones who are still below the initial target.

A limitation of this research is that we do not have some qualitative data available countrywide. Part of the explanation of why school food public policy works or does not work is related to subjective and qualitative aspects according to previous literature. Another limitation is that the most updated data available for the dependent variable is from 2017.

For future research, we recommend studying the relationship between this school food program and smallholders' revenue and performance measures of the family farmers to investigate if where there is more smallholder's products procurement, they experience higher revenue.

4 MAYOR'S PARTY ALIGNMENT AND PUBLIC POLICY EXECUTION: EVIDENCE FROM BRAZIL

ABSTRACT

The procurement of food schools in Brazil meals is directly linked to smallholders sells, as at least 30% of the school feeding budget must be used to buy products from them. National School Feeding Program (PNAE in Portuguese) is associated to the left-wing party, PT, that created it. The implementation of this policy is highly heterogenous, and many municipalities do not accomplish the 30% goal. Considering this context, we investigated if having a PT mayor makes a municipality more likely to implement this policy. We argued that there is space for mayors to incentive or not PNAE's implementation and it depends on party alignment. We use temperature on election day as instrumental variable to test it. We found that electing a PT mayor increases the chances of reaching the 30% procurement target by 4.2%. We provided an alternative explanation for political drivers of a public policy implementation that is political alignment.

Keywords: school feeding, instrumental variable, PNAE, PT, municipalities.

4.1 INTRODUCTION

The Brazilian government delivers 40 million meals a day to feed students in elementary public schools, which is almost 20% of all Brazilian population, at the total amount of over 760 million euros in 2021 (Conselho de Monitoramento e Avaliação de Políticas Públicas, 2021). The procurement of these meals comes, at least in part, from smallholders. According to the federal regulations composing the National School Feeding Program (PNAE, in Portuguese), 30% of the school feeding budget transferred from federal to the other levels must be used specifically to procure from these farmers.

This National School Feeding Program, sat up in 2009 by the president Lula government, a left-wing politician, is acknowledged by FAO as a pioneering and well succeeded case, as it is rare for a school feeding program to reach every student enrolled in public schools, not only minorities or small groups (Kelly and Swensson, 2017). Nonetheless, as the 30% set aside rule is not strictly enforced at the local level, there might be room for political use. Since local mayors have discretions over the implementation of this policy at the local level its execution or success tends to vary. Indeed, even though it is a countrywide public policy, the percentage

of food products coming from smallholders varies from zero to almost one hundred per cent, depending on the municipality at stake (at the local level) (FNDE, 2017).

Some municipalities seem to have more difficulties than others on reaching the targeted percentage possibly due to little or no structured family farmers' product supply. As there is weak enforcement, municipalities have discretion to implement it on the local level. Beyond effective difficulties to implement the PNAE program, political motivation at the local level can also play a role. This context creates a suitable environment to investigate the following research question: Are the municipalities that elected mayors belonging to the same party that created the National School Feeding Program 30% set aside rule more likely to meet (or even exceed) the target?

Grisa et al (2020) researched whether having a PT (Workers' Party) mayor is related to procuring more from family farmers. Their quantitative study was restricted to two states in the south of Brazil, and they have not found conclusive results. Bezerra and Gondinho (2021) found that if voters find out mismanagement or corruption in school feeding, they do not reelect the mayor, however their research does not account for the 30% PNAE's procurement rule. We are not aware of previous studies looking at a causal relation between political affilation at the local level and PNAE implementation. We predict PT mayors would implement this public policy more than mayors from other parties.

We use high temperature as an instrumental variable. We argue that left-wing voters are more harmed by bad weather conditions on election day. And they would be more absent than other voters because of their low-income conditions and their restrictions to access voting places (like bad transportation). In municipalities where the temperature was too hot, we believe there were less chances of PT being elected. In 2022 elections because of this concern, public authorities offered free public transport to make people more willing to vote in all capitals and 13 states in Brazil (G1, 2022).

Bad weather is believed to possibly influence election results because of turnouts (The Washington Post, 2020; U.S. News, 2016); however, there is not much evidence of it (Gomez, 2007). We tested and confirmed this idea. Our tests and regression show that electing a mayor from the same party that created PNAE's 30% rule increases up to 5.7% the likelihood of meeting the 30% target.

This research question is empirically relevant for two reasons, the first is related to the social impact of this policy. "Family farmer[17] agriculture is fundamental for Brazilian development. There are approximately 4.4 million family farmers, corresponding to 84% of all Brazilian farmers" (Brazilian Agriculture Ministry, 2018). Said policy encourages public procurement specifically from this agriculture type. The second reason is that this policy has a national and comprehensive reach. This is clearly relevant for welfare, as it is related to education, health and a large economic budget with respect to children, teachers and family farmer producers.

It is also relevant for theory, because we provide an alternative explanation for political drivers of a public policy implementation. Previous literature usually tests enforcement (Arretche & Marques, 2007) and reelection as motivations for it (Bezerra & Gondinho, 2021; Fernandes & Almeida, 2019). We test another incentive that is political alignment.

Our main contribution relies on the kind of data and methodology. We collected secondary data for all 5,570 municipalities in Brazil. We provide a new way of empirically accessing the relations on party alignment and public policy execution using instrumental variables for causal inference.

The paper is organized as follows: section two presents the theoretical framework; section three we show the institutional context of school feeding program. On section four we describe the politics in Brazil focusing in PNAE data we used. Section five shows the methodology, and we explain the variables. Section six presents our results. The conclusion on section seven contains policy implications as well as research suggestions.

4.2   THEORETICAL FRAMEWORK

PNAE's 30% rule is public procurement mechanism functioning as a market, with demand and supply sides. The supply side actors are the family farmers, who produce food to be sold to the government. The demand actors are the public agents who have some autonomy to decide how to procure foodstuff to be distributed in schools. We believe this autonomy leaves space for mayors to incentive or not PNAE's implementation.

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[17]According to the Brazilian law (n° 11,326), a farmer is considered a family farmer if he or she: does not hold, in any way, an area greater than 4 (four) fiscal modules (that depending on the municipality a fiscal module varies from 50,000 to 1,100,000 square meters) predominantly use the labor force of the family itself in the economic activities of its establishment or enterprise; have income predominantly originated from activities linked to the farm; direct his or hers establishment or enterprise with his or hers family.

Therefore, we divided the theoretical framework that guided our research on how ideology party can affect a policy implementation (1.2.1) and if temperature is a driver for electing a mayor possibly more aligned with PNAE's ideology (1.2.2). We used previous literature to investigate whether the local government affiliated to the same party as the federal affect the implementation of a specific public policy.

4.2.1 Party Ideology and Party Alignment and Public Policy Implementation

Our argument is that even though PNAE's 30% rule is nationwide public policy, there are institutions that can hinder or encourage its implementation, and these are influenced by the ideology of the party in power. Voters determine which party is in power in democracies. Parties knowing this could take actions to win votes in the next election, hence voters would get their preferred outcome independently of which party is in power (Lind, 2020). In this section, we should evidence on the opposite, that party ideology and party alignment matter for public policy implementation, especially when there is not enough enforcement.

Based on the idea of policy-seeking party (Strom, 1990), parties search for power to create and implement public policies. Previous literature shows empirical evidence on this idea that we also test in a specific context. We first present broader research on different countries with distinct public policies and then focus on Brazil and PNAE policy.

One of the policies in which party ideology is important is carbon dioxide emissions mitigation. Empirical research comparing government ideology in different countries has found that left-wing governments are associated with less environmental pollution among the least polluted countries. Among the median and most polluting countries, government ideology does not have significant influences on carbon dioxide emissions (Chang, Wen, Dong and Hao, 2018). It might indicate that party ideology is more important once other fundamental resources are already in place to implement a public policy. Consequently, it is important to consider contextual factors such as agriculture added value to GDP when investigating PNAE's 30% rule accomplishment.

More recently, Toshkov, Carrol and Yesilkagit (2022) have found that there are differences in public policies implementation due to party ideology. They studied COVID-19 prevention in Europe. Economically left-wing parties are traditionally more committed to social values and protecting weaker groups, consequently, they are expected to take earlier actions in COVID prevention. However, traditional/authoritarian/nationalist features, which are values

more associated with the right-wing are also predicted to take precautions faster in the pandemic as such parties believe in the authority of the state to manage society and are not globalization supporters in general. The authors discovered that more right-wing and authoritarian governments responded faster to the pandemic and this feature was more important than government structure and having a separate ministry for health.

In Brazil, common sense says the ideology of the party matters, as new incumbent usually discontinues the public policies in place to start new ones (Campo, Ladeira & Rodrigues, 2017) possibly because he or she wants to establish new policies to be remembered and reelected. This can be due to a new ideology in place. Changing policies and implementing new ones is not necessarily harmful to public management. It is expected that in a democracy, there will be alternation of power and changes will occur (Campo, Ladeira & Rodrigues, 2017). Opposition parties to a government even use electoral dissatisfaction with politicians in power to win votes.

In PNAE's case, as it is a public policy ruled by a federal law, formally there is not much space for deciding not to implement it anymore. But, as enforcement is weak and it is not easy to implement this policy, mayors can make decisions that leads or not to accomplishing the 30% procurement rule.

In research about specific party ideology and policy implementation in local level, Silva and Baia (2018) indicated an association between the party affiliation of mayors and the decision of municipalities to participate in *Mais Médicos para o Brasil* ("More Doctors for Brazil" in Portuguese) program. *Mais Médicos para o Brasil* was created when PT (Workers' Party) was in federal government in 2013. The objective of the program was to address the shortage of doctors in the countryside and on the outskirts of large cities by bringing foreigner doctors to take these positions.

At first, important stakeholders such as doctors' associations and unions were against it because doctors trained in other countries would be working in Brazil without the due revalidation of the diploma according to the existing rules. It soon became a political matter. Municipalities governed by parties that supported the federal government took part in this program more than those against the federal government. However, financial positive incentives (more budget to spend on health) from the federal government to the municipalities to implement it made it popular also with parties against the federal government (Silva and Baia, 2018). This kind of incentives are not part of PNAE program. In this study, the authors did not consider local differences, such as the proportion of doctors by population. This data could influence how important this public policy is perceived by voters and how willingly the mayor would be to implement it.

Party alignment can affect intergovernmental budget transfer specially when mayor is from the same party as the executive power leader, but not when they are just in the same coalition (Meireles, 2019). In Brazil, part of the financial transfers of nonessential spending is negotiated through agreements, that are proposed by municipalities and evaluated by the federal bureaucracy. Using regression discontinuity design (RDD) for close elections, Meireles (2019) found that mayors aligned with the federal government send 0.4 standard deviation more proposals than the ones that the ones that are not aligned.

4.2.1.1 Voter turnout

We analyzed voter turnout literature because we rely on temperature as an instrumental variable for electing a PT mayor and if he or she is implementing the 30% PNAE rule. Popular wisdom says bad weather on election days may change election results (The Washington Post, 2020; U.S. News, 2016). Gomez, Hansford and Krause (2007) tested and confirmed it for the U.S. presidential elections from 1960 to 2000. These authors look specifically into rain data. We use temperature instead of rain because when elections happen in Brazil (the month of October) it does not rain much and it turned out not to be a good instrument, while temperature can be quite higher than usual.

In democracies with compulsory voting and universal enforcement with the same punishment for the whole population, we expect not a high asymmetry between different demographic groups (Nicolau, 2022). In Brazil, we have mandatory elections since 1932. Voting is a right and an obligation and there is a strong voting culture. In 2022, almost 80% of the population voted (UOL, 2022).

However, punishment for not voting in Brazil seems to affect more relatively wealthy. If a person is in the city where he or she is supposed to vote and does not do it, he or she cannot get passport or an ID document, earn salary from a public job or enroll in a public job selection, sell to the government, get a loan from a governmental financial institution, enroll in a public educational establishment, obtain any document from diplomatic offices (TSE, 2022).

Left-wing voters in generally, such as PT (Workers' Party acronym in Portuguese) voters are less likely to vote in bad weather conditions days. The classical explanation is that prospective left-wing voters have higher costs of turnout and lower intrinsic utility from voting, and hence only vote if stimulated by external conditions we explain why in the following

paragraphs. The empirical evidence on this founds mixed results (Lind, 2020). We found no empirical research specifically on this in Brazil.

The rational choice model highlights the costs of voting: such R = PB - C, where R stands for the net rewards from voting; P is the probability that one's participation will be decisive; B is the individual's utility benefits if participation is successful (e.g., the preferred candidate wins); and C is the costs of participation. Since P is a function of the size of the electorate, the individual's contribution to political action is minute when the electorate is large (Gomez, Hansford and Krause, 2007).

The utility benefit of electing a specific politician may be higher for the poor as they possibly depend more on public policies. However, "the need to concentrate on their personal material welfare does not foster a strong civic orientation within these individuals, thus making them both less interested in politics and less efficacious" (Gomez et al, 2007, p. 651). So, their perceived benefit (B in the equation) would be lower. And their cost would be higher than for the rich for two reasons: the cost of not voting is lower for the poor in Brazil as the enforcement does not really have an impact on them; and the cost of voting is higher for them in a very hot election day as they have less resources to avoid bad weather discomfort than the rich, using a private car with air conditioning, for instance.

PT voters are generally poorer, less educated and have less access to information when compared to other party voters (Gimenes, Furriel, Borba and Ribeiro, 2016; Souza, 2019). When asked if they would vote if it was not compulsory in Brazil, most people who answer "no" are female, black and have not finished high school (Nicolau, 2022; Aguiar, 2018), these characteristics are also more frequent in lower income people.

Poor people usually live far from city centers and are more dependent on public transport. A very hot election day would harm them more than rich people who are traditionally right-wing voters. In large cities in Brazil, there is an unequal distribution of public transport infrastructure (Pereira, Schwanen, and Wessel, 2019).

Low-income people were more harmed than the rich in this process, making it more difficult for them to access jobs and schools (Pereira et al, 2019). Many of the polling places in Brazil are schools. If the polling place is in a walkable distance from the voter's house it is also more disconformable for poor people than for the rich, as rich people would have other alternatives like using a private car for transport. This is particularly important in a country where voting is always done in person, and there is no mailing vote. The election happens in only one day. Furthermore, the temperature is the same for all the citizens of a city.

For this and other reasons presented in this section, we argue that temperature is a good instrumental variable, and it is fundamental for voter turnout. Poor people would vote less in disconformable temperature locations, not only because of their low social economic status, but because of a very hot temperature in a tropical country can make people less willing to vote.

4.3 INSTITUTIONAL SETTING

4.3.1   National School Feeding Program

Brazil is a federal State with three government layers: the federal level, the state level (26 states plus a Federal District) and the municipal level (5,570 municipalities). According to the Brazilian Constitution, each level of government is responsible for certain public educational provision (Brazil, 1988). In the rest of the paper, the focus of our analysis will be on elementary school at the municipal level.

The federal level collects most of the taxes in the country and redistribute part of these financial resources to the lower levels to help them provide public services (Arretche, 2002). For most municipalities, there is a strong dependence on federal transfers because a large part of the state and municipal budget comes from these federal transfers. For 81.98% of Brazilian municipalities, transfers from federal and state levels accounted for more than 75% of total municipal budget in 2016. This dependency ratio was less than 50% in only 1.81% of them (Ministério da Economia, 2017).

One of the public services influenced by intergovernmental transfers is the national school feeding program. Since 2009, this program requires that, at least 30% of the resources passed on by the federal government for school feeding to the municipalities and states public schools should be used to procure foodstuffs from familial agriculture (federal law number nº 11,947)[18].

The federal entity who manages PNAE and transfers money to lower administrative levels is the National Education Development Fund (FNDE, in Portuguese) a structure part of the Ministry of Education. The amount of money transferred from FNDE to municipalities is based on the number of students enrolled in the previous year. It is a fixed amount per student in the whole country[19]. Another fundamental actor for PNAE is called "executing entity". It is responsible for the overall operation of the program at the local level, and this includes receiving

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[18] This law only applies to public school as private schools do not receive public money for school feeding
[19] With exceptions to minorities who are 'quilombolas', those of African descent, and indigenous communities. These minorities receive more money than traditional students.

the funds, creating the menu, publishing procurement calls, signing contracts, delivering daily meals and nutritional education. States, municipalities, and even individual primary schools can play the role of executing entity. Municipalities are traditionally the executing entity for kindergarten and elementary schools and pre-kindergarten.

The last fundamental actor for PNAE is known as School Feeding Councils (SFC, or CAE in Portuguese). These councils are responsible for monitoring school feeding programs at the state and municipal levels. Besides ensuring wise use of financial resources, SFCs encourage the efficient delivery of the program (Kelly and Swensson, 2017). It is a collegial body serving as a forum for decision making and advisory nature, it makes recommendations for the actors who are implementing the program. It is made of at least 7 full members: one political representative (the mayor or its secretaries), two members representing education workers and students, two members representing civil society and two members representing parents. Every year, all municipalities and states submit their food procurement invoices to be approved by the SFC, thus allowing municipalities and states to send these documents to federal government. SFC has the power to disapprove the accounts the municipality provide, thus making them redo it before sending to FNDE or even hindering this process which can lead to the municipality not receiving the funds on the next term.

FNDE is authorized to suspend transfers of PNAE to executing units if they fail to constitute the respective SFC or fail to present the book accounts of the resources previously received for the execution of the PNAE or to commit irregularities in the execution of the PNAE. Note, however, that the failure to reach the 30% target goal is not a requirement for the executing entities to keep receiving money from the federal government[20]. There are some justifications that municipalities may claim for non-compliance with the law, they are especially related to the low or uncertain supply of the family farmer's products (Bonduki, 2017).

4.3.2 Municipal Elections

Municipalities in Brazil are governed by a mayor (*prefeito*) together with a council of local legislators (*Câmara de Vereadores*), Municipal election happens every four years. The last one was in 2020. In these elections, voters choose a mayor and a local legislator

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[20] In May 2020, FNDE released the normative number 6 that says "The percentage not executed in accordance with the provision in the caput will be assessed when rendering accounts and the corresponding amount must be returned." This may be a fundamental difference on enforcement, as until before this resolution, returning money to FNDE was not foreseen by law. FNDE is already giving support to the executing units on how this will be implemented. Our data, however, covered a period below this change in the enforcement of the school program.

independently. A voter can choose a mayor and a local legislator from opposite political parties. Detailed electoral rules are outlined in Law n. 4737/65 and Law n. 9504/1997.

There is universal suffrage and direct vote. In municipalities whose population is below 200,000 inhabitants there is just one round. The candidate who wins more votes is elected even if he or she does not make 50% or more in the counting of votes. In the municipalities above 200,000 inhabitants, if no candidate achieves an absolute majority in the first round, there is a second round with the two most voted candidates from the first round. A mayor can only be reelected once subsequently.

There are 32 political parties in Brazil (see table B1 in the appendix). In 2022, PL (president Bolsonaro's party) elected most seats in Chamber of Deputies to the following term starting in 2023: 99 out of 513. The second biggest was PT, electing 68. The parties are free to make coalitions at local context in a different manner they do in the federal level. A party that is against the president of Brazil at the federal level can make a coalition with the president's party in the municipal level and support the same candidate. In our empirical strategy, we only considered a candidate to be a PT candidate if he or she is supported exclusively from PT with no coalition. In our analysis there are only municipalities where there is no second round, which is more than 90% of the original sample of 5,570 municipalities. In Brazil, parties can make coalitions in the first round.

4.4   POLITICAL CONTEXT

The origin, expansion and consolidation of a system of public policies in Brazil stemmed from the process of reorganization of civil society, with the resumption of democracy in the mid-1980s. The end of more than two decades of military dictatorship (1964-1985), occurred with the expansion of society's discontent (for instance, high inflation) and the intensification of the movements making pressure for the democratic reopening, where "direct vote now" (Diretas Já in Portuguese) stands out (Castro & Ribeiro, 2009). This movement claimed for direct voting, which did not happen in the military dictatorship.

In 1980, the Workers' Party (PT initials in Portuguese) emerged, founded by groups opposing the dictatorial regime, such as union movements from the ABC region that concentrated the Brazilian automobile industry, intellectuals, artists, and Catholics linked to Liberation Theology. PT demanded more jobs, housing, education, health, agrarian reform, an end to hunger and other social advances. An agenda that made it one of the most important

political parties in Brazil (Hunter, 2010). The 1988 Constitution, created right after the end of the dictatorial regime, formed the basis for expanding the population's access to public goods and services. In this context, education and health were recognized as a priority and received special treatment with increased resources. The reconfiguration of the national system of social policies towards a redistributive model of social protection was inspired by the logic of the welfare policy of post-war European countries (Arretche & Marques, 2002).

4.4.1 PT and School food program

Since 1990, federal government has adopted public policy decentralization. It has required municipalities to be more responsible for its implementation. However, this responsibility has not come with more autonomy for the municipalities, and, in the following decades (Arretche, 2004) federal government imposed common policies and national standards aiming a reduction in inequalities in offers and results (Jaccoud, 2019). PNAE's 30% rule is part of this strategy as it is a federal public policy implemented by other governmental spheres and searches for inequalities reduction favoring a marginalized population, smallholders' farmers.

Also, in the 1990s PT lost the first presidential election it participated to a more libertarian candidate. Therefore, PT mobilized its members and created a document proposing alternative public policies. One on them was the idea of making municipalities responsible for school feeding in elementary school before it happened officially and prioritize local food procurement in 1991. Decentralizing school feeding would be the first step to have a more local procurement. In this same decade in 1994 and 1998, PT's party platform for federal government prioritized procuring from small business and smallholders' farmers (Grisa et al, 2020).

PT, upon assuming the presidency in 2003, received the legacy of the policies built after the end of the dictatorship. It made more interventions to reduce social inequalities than previous federal governments, making fight against hunger and poverty a priority through a series of public policies. PNAE 30% rule is an example of this, it was a federal law demanded by the president (Lula at the time), designed by the Education Minister, Fernando Haddad, who was also part of PT. Then, it was approved by the congress houses (Schottz and Schmitt, 2021).

Parties that belong to the opposition are usually less willing to implement policies associated to the party in power at the federal level (Silva and Baia, 2018). Not implementing PNAE's 30% rule does not have a financial cost for the mayor as there is no fine. It does not have a financial incentive on implementation either, which is the case for *Mais Médicos*,

described before as the amount of money received is only based on the number of students and not the achievement of the policy target. However, it can have an electoral cost of losing votes in the following election. This is usually more relevant for policies easily accessed and well-known, which does not seem to be the case of PNAE's 30% rule. The consumers (students and their parents) are generally not aware of where their food come from or if the 30% rule is implemented or not. This possibly makes them less conscious and less interested in pressuring for it.

Voters and society in general are very concerned when there is not enough school feeding being provided in public school, making headlines in big press vehicles (UOL, 2022); however, they do not seem to care or be aware of where this food comes from. Giving that the 30% rule is a historical claim from PT, we assume a mayor from this party would be more willing to implement it than mayors from other parties.

4.5 METHODOLOGY

4.5.1 Data Description

Our sample is initially composed of all 5,570 Brazilian municipalities. However, some missing values in variables of our interest reduced this number. Examples of this reduction are related to the lack of information for our main dependent variable, the procurement of family farmers' products percentage by municipalities. This data comes from the National Education Development Fund (FNDE, acronym in Portuguese). Although official, we observe that some municipalities lack this information or even provide dubious data[21]. Such cases made us to be cautious and exclude that municipalities in the empirical analyses.

Our final sample consists of 4,457 municipalities. We also exclude municipalities that elected the mayor only on the second round, as it would be unsuitable to compare them with the others that elected the mayor on the first round. This excludes big cities such as São Paulo and Rio de Janeiro. Only less than 10% of the municipalities are allowed by law to have a second round, as it is a possibility for the municipalities with 200 thousand inhabitants or more.

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[21] For instance, some municipalities presented information stating that more than 100% of their food procurement are from family farmers, which is an unrealistic percentage.

4.5.1.1 Dependent variable

Our dependent variable relies on the proportion of the school feeding budget used to procure products from family farmers over total budget of school feeding transferred from federal government to municipalities. This information is available annually in the FNDE database from 2011 to 2017. We use the annual information from 2013 to 2016, as the mayors elected in 2012 started a four-year mandate in 2013. We also used the average of the years 2013 to 2016 proportion of family farmer's products bought by a given municipality as the dependent variable in our model. We did so to control for potential harvest variations on the period. Harvests vary from a year to another, especially for family farmers who usually do not have access to the technology to mitigate climate hazards such as fertilizers.

Our independent variable of most interest is the mayor's party affiliation. This is a dummy variable identifying whether a municipality elected a PT mayor in the 2012. It takes the value of 1 only if the candidate was in a single party campaign, not in a party coalition. We chose this because we believe party alignment and ideology will be higher in this case compared to a party coalition, based on Meireles (2019). This data was collected by the Superior Electoral Court (TSE in Portuguese). Further data of mayors from other parties were also collected for other empirical exercises.

4.5.1.2 Control variables

As Brazil is a large and heterogeneous country, not controlling for local differences may possibly lead to omitted variable bias. Therefore, we use some control variables which might affect the food procurement of family farmers, such as agriculture production (log), agriculture GDP, municipality area (log), education budget management under mayor responsibility, education budget management under education organ responsibility, number of School Feeding Council (SFC) meetings, population (log), population density and SFC year of creation.

Agriculture production and agriculture GDP are proxy for supply, it has been associated with specific public procurement in food and local agriculture context by Botkins and Roe (2018). Area and population density are relevant because more density probably means less costly transportation for family farmers' products, which would make it easier to buy them. Population we can assume that small scale municipalities would benefit from their smaller size to procure more smallholder's products as public management is less complex in small municipalities, so public policies are more easily implemented (Machado et al, 2018).

Education budget management under education organ responsibility and education budget management under mayor responsibility are dummies that originally were two categories of 3 options categorical variable. The third category was "others". If the budget is under educational organ responsibility, there is probably more concern about it and a more specific management than if it is under mayor responsibility. School Feeding Council (SFC) number of meetings and year of creation are proxies for how active and institutionalized this governance actor is. The following table 4.1 summarizes the variables:

Table 4.1 - Description of the variables

Variable	Description
Dependent variable	
Complied 30% rule	Dummy variable that takes the value of 1 if the municipality procured 30% or more from family farmers and zero otherwise
First stage independent variable	
PT mayor	If elect mayor in 2012 was from PT
Instrument	
Temperature	temperature on election day
Controls	
Agriculture production (log)	Agriculture production
Agriculture GDP	Agriculture added value to GDP in 2013
Area (log)	Municipality area in log
Educ. budget under mayor resp.	Education budget is under mayor responsibility
Educ. budget under educ. organ resp.	Education budget is under educational organ responsibility
Number of SFC meetings	How many meetings did SFC do in 2014
Population (log)	Municipality population in log
Population density	Population density
SFC year of creation	When SFC was created

Source: research data

4.5.1.3 Estimation strategy

To investigate our research question, our empirical analysis appears through a probit regression which estimates the likelihood $P(y = 1 \mid x) = \phi(x_{it}'\beta)$, where ϕ represents the cumulative normal distribution (Greene, 2003):

$$P(PNAE\ target=1|x) = \phi(\beta_0 + \beta_1 PTmayor_i + \beta_2 CONTROLS_i) \qquad (1)$$

where *i* stands for each municipality. PNAE target is a dummy variable takes the value of 1 if the municipality used at least 30% of the school feeding budget to procure from family farmers, and zero otherwise. PT mayor is also a dummy variable that is 1 if the municipality elect mayor in 2012, and zero otherwise. And controls are explained in section 1.5.1.2.

To further address endogeneities, we also employed an IV (instrumental variable) approach, wherein predictions of the endogenous variable using an instrument from a first-stage regression were included in a second-stage outcome regression to minimize correlation with the error term. This action required finding an exogenous instrument that is correlated with electing a PT mayor, but did not influence the outcome variable through other mechanisms. Using the instrument, we claimed to isolate the PT mayor factor from another that could be related both to electing a PT mayor and procuring more from family farmers. We modified the Equation 1 to implement this approach:

$$y_{1i} = y_{2i}\beta + x_{1i}\gamma + u_i, \tag{2}$$

$$y_{2i} = x_{2i}\Pi_2 + v_i, \tag{3}$$

where y_{2i} represents our endogenous variable of interest, the election of a PT mayor, x_{1i} is a vector of exogenous and control variables as explained above, and x_2 represents our instrument, the temperature on the October 7th, 2012 (the day of the election), a continuous variable measured in Celsius and the error terms u and v.

We believed our instrument are plausibly exogenous because an uncomfortable weather would make people less willing to get out of their homes and vote as we discussed in section 4.2.2, especially poor people who depend more on public transport and traditionally vote for PT. We found similar results when combining temperature and air humidity data. We used temperature instead of rain because, when elections happen in Brazil, there is not much rain, and we did find it significantly predicted electing a PT mayor when we tested it. We assumed party ideology of the mayor in power influences PNAE's 30% rule implementation. And that PT voters are specially harmed by a very hot election day and would turn out less than other voters.

If we do not use an instrumental variable, we could not claim causality in our results because it would be unplausible to isolate a direct relation between electing a PT mayor and more PNAE's 30% rule implementation. There could be diverse factors affecting simultaneously election a PT mayor and procuring more from family farmers, both observed like more supply and unobserved like a subjective preference for a PT mayor.

There would be a bias in electing a PT mayor in hotter election days if the municipalities with this characteristic would be hotter in general and it correlates with electing a PT in general. Northeast region is very hot and traditionally elects PT. However, we see that electing a PT mayor in 2012 (the year we analyzed) happened not exclusively in northeast as it was very common in all Brazilian coast, see figure B1 in the appendix.

Table 4.2 shows the correlation matrix between our instrument, our treatment variable

(PT mayor) and another dummy variable identifying the election of a PSDB mayor. PSDB was the traditional rightwing party in Brazil. They took part on every second-round presidential election from redemocratization to 2018.

This correlation matrix illustrated our rationale. On one hand, there was a negative correlation between temperature on the day of the election and the election of a PT mayor. On the other hand, there was a positive correlation between temperature and the election of a PSDB mayor. Our interpretation is that in hotter days, less PT voters would go out to vote and PSDB voter would be more indifferent to weather conditions. A lower PT voters turnout than PSDB voters would be associated with more PSDB mayor candidates elected than the PT ones.

Table 4.2 - Correlation matrix of temperature and elected parties in 2012

	Temperature	PT mayor	PSDB mayor
Temperature	1		
PT mayor	-0.0728	1	
PSDB mayor	0.0275	-0.1373	1

Source: research data

The same happened in 2008 mayor elections:

Table 4.3 - Correlation matrix of temperature and elected parties in 2008

	Temperature	PT mayor	PSDB mayor
Temperature	1		
PT mayor	-0.0104	1	
PSDB mayor	0.0272	-0.1336	1

4.6 RESULTS AND DISCUSSION

Table 3 reports the descriptive statistics. In the first columns, we present the whole sample, then only the municipalities that complied with the 30% rule in average from 2013 to 2016 and then only the ones that did not comply in average from 2013 to 2016.

We saw that complying with the law was raising from 2013 to 2015 when it reached a peak. Even in 2015, the highest year for this variable, less than half of the whole sample complied with the law. There is a high standard deviation for these variables, which highlights how heterogenous implementation of this policy. PT mayor mean was higher for the complying sample than for the one that was not. Temperature mean was higher in the municipalities that do not comply with the law.

Table 4.4 - Descriptive Statistic

Variable	Whole sample			Complied 30% rule (mean from 2013 to 2016) sample			Did not comply 30% rule (mean from 2013 to 2016) sample		
	Observations	Mean	Standard Deviation	Observations	Mean	Standard Deviation	Observations	Mean	Standard Deviation
Complied 30% rule in 2013	4717	0.345	0.476	1854	0.691	0.462	2863	0.121	0.326
Complied 30% rule in 2014	4717	0.407	0.491	1854	0.809	0.394	2863	0.147	0.354
Complied 30% rule in 2015	4717	0.450	0.498	1854	0.832	0.374	2863	0.203	0.403
Complied 30% rule in 2016	4717	0.434	0.496	1854	0.796	0.403	2863	0.199	0.400
Complied 30% rule (mean from 2013 to 2016)	4717	0.393	0.488	1854	1.000	0.000	2863	0.000	0.000
PT mayor	4717	0.119	0.323	1854	0.130	0.336	2863	0.111	0.314
Temperature	4717	25.884	3.064	1854	25.168	2.766	2863	26.348	3.158
Agriculture production (log) in 2013	4649	9.814	2.402	1838	10.030	2.050	2811	9.673	2.597
Agriculture production (log) in 2014	4650	9.858	2.293	1838	10.034	1.985	2812	9.743	2.468
Agriculture production (log) in 2015	4655	9.792	2.382	1839	10.002	2.048	2816	9.655	2.568
Agriculture production (log) in 2016	4660	9.679	2.462	1840	9.918	2.106	2820	9.524	2.657
Agro GDP in 2013	4717	0.197	0.154	1854	0.212	0.160	2863	0.187	0.149
Agro GDP in 2014	4717	0.191	0.148	1854	0.207	0.153	2863	0.181	0.143
Agro GDP in 2015	4717	0.185	0.146	1854	0.200	0.152	2863	0.175	0.141
Agro GDP in 2016	4717	0.196	0.153	1854	0.212	0.159	2863	0.185	0.148
Agro GDP (mean from 2013 to 2016)	4717	0.048	0.037	1854	0.052	0.038	2863	0.045	0.036
Area (log)	4717	6.190	1.253	1854	5.993	1.132	2863	6.318	1.310
Educ. budget under mayor resp.	4717	0.342	0.474	1854	0.289	0.453	2863	0.376	0.485
Educ. budget under educ. organ resp.	4717	0.497	0.500	1854	0.564	0.496	2863	0.453	0.498
Number of SFC meetings	4578	6.725	4.968	1809	6.534	4.583	2769	6.850	5.202
Population (log) in 2013	4717	9.468	1.152	1854	9.386	1.142	2863	9.522	1.156
Population (log) in 2014	4717	9.473	1.155	1854	9.390	1.146	2863	9.527	1.158
Population (log) in 2015	4717	9.478	1.158	1854	9.394	1.149	2863	9.532	1.161

Population (log) in 2016	4717	9.482	1.161	1854	9.398	1.152	2863	9.537	1.164
Population (mean from 2013 to 2016)	4717	8.089	1.157	1854	8.006	1.147	2863	8.143	1.160
Population density 2013	4717	99.663	444.067	1854	74.921	319.782	2863	115.686	508.013
Population density 2014	4717	100.530	447.620	1854	75.545	322.203	2863	116.710	512.130
Population density 2015	4717	101.380	451.075	1854	76.148	324.570	2863	117.719	516.130
Population density 2016	4717	102.235	454.841	1854	76.739	326.890	2863	118.747	520.595
Population density (mean from 2013 to 2016)	4717	25.238	112.349	1854	18.960	80.839	2863	29.304	128.552
SFC year of creation	4548	11.356	5.419	1798	11.232	5.409	2750	11.438	5.426

Source: research data

We find that the election of a PT mayor in 2012 increases the chance of hitting the 30% PNAE target in 2013, 2014, 2015 and 2016. Here, we presented the first (2013) and the last year (2016) of the mayor mandate. The mean for the years 2013 to 2016 and the other years (2014 and 2015) are in the appendix B. We made this choice because in the first year it may be hard to already make changes and implement a policy. And in the last year, the mayor could be more motivated to implement it looking for vote in the next election. Mean of the four mandate years were important to correct for harvest fluctuations.

We now report in the first column of Table 4.5 our estimates following our probit model represented in Equation 1. The second and third columns we present the IV estimates, where the likelihood of complying with the same rule if there is PT mayor increases by 3.1%. PT party elected mayor was significant at 5% confidence interval with a positive signal as predicted in probit and it was significant at 1% in IV regression. Temperature was significant at 1% for electing a PT mayor. It shows that in the first year in power, mayor ideology party is already fundamental.

We tested the instruments using Kleibergen-Paap Wald F statistic. It is a test for weak instruments (H0: coefficients of instruments in first stage are not different from zero). We can reject the hypothesis; the instrument is different from zero.

The critical value for a weak identification test resulting in maximal 10% of bias in IV coefficients is 16.38 (Stock and Yogo, 2002). The instruments are sufficiently strong for predicting variation at the first stage (resulting in a joint Kleinberger-Paap F-statistic of 19.17).

Table 4.5 - Probit and IV regressions for procurement family farmers products percentage in 2013 as dependent variable

	Probit	IV First stage	IV Second stage
PT mayor	0.120** (0.0605)		2.965*** -0.104
Temperature		-0.00718*** -0.00164	
Agriculture production (log) in 2013	0.0175* (0.00962)	-0.00454** -0.0023	0.0231*** -0.00768
Agro GDP in 2013	0.836*** (0.179)	0.00498 -0.043	0.238 -0.159
Area (log)	-0.200*** (0.0222)	0.00752 -0.00542	-0.0707*** -0.024
Educ. budget under mayor resp.	-0.0615 (0.0604)	0.00547 -0.0136	-0.0291 -0.0458
Educ. budget under educ. organ resp.	0.223***	0.0368***	-0.0215

	Probit	First stage	Second stage
	(0.0565)	-0.0132	-0.0498
	-0.00159	-0.000306	0.00106
Number of SFC meetings	(0.00448)	-0.00121	-0.00411
	0.0304	0.0151**	-0.0530**
Population (log) in 2013	(0.0320)	-0.00756	-0.0253
	-0.000472***	0.0000172	-0.000187**
Population density in 2013	(0.000139)	-0.0000232	-0.0000928
	-0.00184	0.0000882	-0.00105
SFC year of creation	(0.00363)	-0.000916	-0.00304
	0.175	0.137*	0.215
Constant	(0.235)	-0.071	-0.182
Kleinberger-Paap F-statistic	19.17**		
Observations	4,457	4457	4457

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: research data

In Table 4.6, we show the results for the year 2016. In 2016 we have similar results to 2013 in terms of significance and signals, lack of learning can be possibly why there was not much difference between the years, among many other explanations.

Table 4.6 - Probit and IV regressions for procurement family farmers products percentage in 2016 as dependent variable

	Probit	IV	
		First stage	Second stage
PT mayor	0.151**		3.019***
	(0.0590)		(0.0825)
Temperature		-0.00723***	
		(0.00165)	
Agriculture production (log) in 2016	-0.000773	-0.00379*	0.0156**
	(0.00921)	(0.00227)	(0.00722)
Agro GDP in 2016	1.088***	-0.00711	0.277*
	(0.176)	(0.0439)	(0.161)
Area (log)	-0.225***	0.00777	-0.0682***
	(0.0211)	(0.00552)	(0.0233)
Educ. budget under mayor resp.	-0.170***	0.00514	-0.0590
	(0.0583)	(0.0136)	(0.0457)
Educ. budget under educ. organ resp.	0.153***	0.0375***	-0.0577
	(0.0547)	(0.0132)	(0.0455)
Number of SFC meetings	0.000653	-0.000269	0.00164
	(0.00454)	(0.00121)	(0.00422)
Population (log) in 2016	0.188***	0.0130*	-0.00407
	(0.0301)	(0.00768)	(0.0284)
Population density in 2016	-0.000442***	2.24e-05	-0.000173**
	(0.000104)	(2.50e-05)	(8.68e-05)
SFC year of creation	-0.00171	0.000116	-0.00106
	(0.00353)	(0.000915)	(0.00289)
Constant	-0.746***	0.149**	-0.0867
	(0.226)	(0.0731)	(0.191)

Kleinberger-Paap F-statistic	19.06 ***		
Observations	4,470	4,469	4,469

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: research data

In table 4.7 we compare the PT mayor coefficient for all for mandate years. There are very consistent results.

Table 4.7 – Coefficients of PT mayor for Probit and IV regressions on procurement family farmers products percentage in different years

Outcome Variables	Probit	IV
	0.120**	2.965***
2013	(0.0605)	-0.104
	0.113*	2.965***
2014	(0.0597)	(0.104)
	0.171***	3.005***
2015	(0.0597)	(0.0939)
	0.151**	3.019***
2016	(0.0590)	(0.0825)
	0.124**	3.038***
Mean from 2013 to 2016 years)	(0.0600)	(0.0753)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1   Source: research data

The election of a PT mayor increased the likelihood of complying with the 30% food procurement rule by 5.7% in 2016 for the probit model and by 4.2% for the IV regression. The instrument succeeded Kleibergen-Paap Wald F statistic for this year, as it did for 2013. The instruments were sufficiently strong for predicting variation at the first stage (resulting in a joint Kleinberger-Paap F-statistic of 19.06). We show this in table 4.8.

Table 4.8 - Effects of PT mayor elected on different years of the Outcome variable

Outcome Variables	Probit	IV
2013	4.20%	3.10%
2016	5.70%	4.20%

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p

Our results were aligned with Gomez et al (2007), as they found bad weather influences election outcomes. The effect of having a PT mayor on PNAE's 30% rule implementation could be explained by the mayor making efforts towards it as he or she politically identifies with this

public policy. Grisa et al (2020) analyzed the effect of mayor's political party on PNAE's 30% rule has found no conclusive effect.

We highlight the impact of having a PT mayor on accomplishing PNAE's 30% rule was not tremendous. It was possibly due to the many other factors that could also explain the failure or success on this policy, like the ones we used as control and others. Chang et al (2018) has found that for party ideology to have an impact, there must be some resources already in place. It may be the case of PNAE's 30% rule, possibly even with mayor efforts, if there is not a well-organized structure, the municipality may fail.

4.7 CONCLUSION

Our analysis illuminated the implementation of a public policy is affected by the party in power. We did so based on the party alignment idea and the recent political Brazilian context using instrumental variable as methodology.

Based on theory, we assumed party ideology would be fundamental for public policy implementation specially when there is weak enforcement, no financial incentives, and the policy outcome is not easily noticed by voters. In this scenario, one of the main incentives for implementing such policy is ideology and party alignment. We also assumed PT voters would be more harmed and less willing to vote than other voters in very hot election days.

Combining these assumptions, we used countrywide quantitative data and ran probit regressions using temperature on election day as instrumental variables. We found that in municipalities that experience hotter election days, less PT mayors are elected. And in the following years, these municipalities are 4.2% more likely to comply with PNAE's 30% rule.

One of this research contributions relied mostly on the kind of data and methodology we use. It allows us to claim causality, which is innovative in school feeding context in Brazil. Previous research did not use originally all municipalities as sample (Grisa *et al*, 2020) or did not focus on the 30% procurement rule (Bezerra & Gondinho, 2021).

Another relevant contribution was for theory. We provided an alternative explanation for political drivers of a public policy implementation. Previous literature usually tested enforcement and reelection as motivations for it. We test another incentive that is political alignment and confirmed the hypothesis that it has an impact.

A limitation of this research was that we use only one election data. We only analyzed one country. Another is that we did not have rural GDP and other data specific for family farmers in Brazil, we used data for the whole rural production, that is traditional plus family

farmers production. Another limitation was there could be an uncertainty between the influence of party alignment and winning votes. A solution to this last limitation would be to split the sample in regions to separate the channel through which mayor impacts the public implementation.

A practical recommendation for the greater success for PNAE's 30% rule implementation is more transparency in public management at the municipality level. This could create voters' pressure and make mayors more willing to execute it regardless of their party. Another recommendation is creating incentives and enforcement for the municipalities that implement this policy.

For future research, we recommend looking for this phenomenon in other public policies associated with a specific party and investigating if it is exclusive to food and agriculture context in Brazil or broader. Researching other kinds of alignments between different levels, like municipality and state could be interesting as well.

5 GENERAL CONCLUSION

In this dissertation, I addressed a challenging topic in public policy implementation: heterogenous outcomes at local levels of the same public policy. More specifically, I analyzed the empirical problem of implementation diversity in National School Feeding Program 30% set aside rule.

Initially, I looked for different possible explanations for it. I started by a literature review shown in chapter 2. As PNAE topic is interdisciplinary, I searched not only business, economy and public management journals, but also health, environmental science and others. I identified some positive and negative factors for more family farmers products procurement. I divided them into supply features (family farmers production), demand features (governance and education management) and local context (such as GDP per capita) that could influence both supply and demand.

Based on the factors I found in chapter 1, I performed a quantitative analysis to test which of them influence the family famer's products procurement. In chapter 2, I did so using an ordinary least square regression strategy with fixed effects, having as the main data base all municipalities in Brazil. I found that governance (having an active School Feeding Council), education management specificity (education budget under education organ responsibility) and supply (more family farmer production) are fundamental for the municipalities to reach the 30% procurement goal.

Even though there is abundant family farmers' products supply, it is not always easy for mayors and public agents to access it. Family farmers need to be well structured to sell for the government. They need investment in farm infrastructure and logistics, as well as access to bureaucracy to participate in the institutional market. They must be able to issue invoices, for instance, and the governance structure in the municipality, especially School Feeding Council must have the resources to supervise and encourage the 30% achievement. There seems to be more or less appropriate institutions to implement PNAE set aside rule and these could be influenced by the mayor in power. This leads us to the third chapter.

In chapter 3, we investigate if having a mayor who is part of the political party that created the 30% rule makes the municipality more like to implement it. I used temperature on election day as instrumental variable to test this idea. I found that electing a mayor from the party that created this public policy Workers' Party (PT in Portuguese) increases the chances of reaching the 30% procurement target by 4.2%. Consequently, we provided an alternative explanation for political drivers of a public policy implementation that is political alignment.

I did not find a great amount of research that analyzed PNAE considering all Brazilian municipalities. Most studies before mine were qualitatively rich, but geographically limited. Showing an objective picture of how PNAE is implemented countrywide was possible my biggest contribution. Another fundamental contribution was revealing what characteristics take place to ensure if this public policy is implemented once there is weak enforcement. These factors are participative governance, specific education management, well-structured family farmer's product supply and party alignment between mayor and the party that created this policy.

Some limitations of this research are lack of data capturing behavior and subjective context that could affect PNAE's implementation. In chapter 4, I only used one election period and I did not have information particularly on family farmers production.

An implication for policy is to consider each municipality smallholder's supply and governance context. Thus, public agents could acknowledge the diversity I found in the country and specify stimulating goals for the municipalities who are already able to overcome the 30% federal rule target and special attention and feasible goals for the ones who are still below. Different municipalities may need different kinds support to reach the same goal.

Regarding smallholder's supply, there should be more support for them so that municipalities can more easily access their production. This recommendation is in line with Swensson (2015), who advocates for development of a technical assistance and rural extension program linked to public procurement, including not only production, but also managerial and marketing aspects. There are already in Brazil policies and organizations with this focus that help with technical support and financial access. This solution would benefit family farmers directly and students indirectly with more food availability. In the other hand, it could harm traditional farmers with a more qualified competition.

For future research, I recommend studying the relationship between this school feeding program and smallholders' revenue to investigate if where there was more smallholder's products procurement, they would experience higher revenue. Also, I recommend looking for the party alignment phenomenon in other public policies associated with a specific party and investigating if it is exclusive to food and agriculture context in Brazil or broader. Researching other kinds of alignments between different levels, like municipality and state could be interesting as well.

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APPENDIX

APPENDIX A - Figure A1: Map of Brazil

Source: IBGE, 2017

Figure A2: Map of Brazilian municipalities family farmers procurement percentage performance
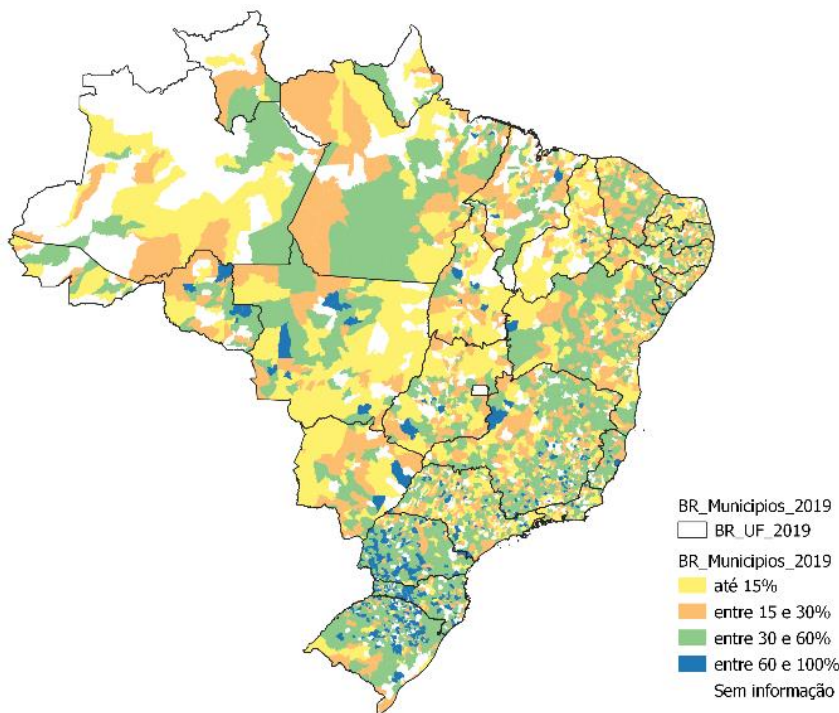
Source: Conselho de Monitoramento e Avaliação de Políticas Públicas, 2020

Table A1 - Correlation matrix

	Number of SFC meetings	SFC parity	SFC year of creation	Access information law	Education budget responsibility under education organ	HR/population	Outsourcing food processing activities in 2014
Number of SFC meetings	1						
SFC parity	-0.0106	1					
SFC year of creation	-0.018	0.0215	1				
Access information law	0.0408	-0.0372	-0.0146	1			
Education budget responsibility under education organ	0.0909	-0.0235	-0.0453	0.0619	1		
HR/population	-0.0067	0.0471	0.0364	-0.1108	-0.1015	1	
Outsourcing food processing activities in 2014	0.0754	0.0044	-0.0359	-0.0229	0.0003	-0.0057	1
Improvement of school food	-0.0021	0.0026	-0.016	0.0121	0.0457	-0.0211	0.0001
Education budget law existence	0.0528	0.0093	-0.0117	0.0344	0.0451	-0.0428	-0.002
% family rural establishments / total establishments 2006	0.01	0.0269	0.0438	-0.038	0.0077	0.1347	-0.0385
% family farming production	0.0369	0.0243	0.0305	-0.0375	0.0157	0.1697	-0.0025
% rural pop 2010	-0.0819	0.0248	0.0534	-0.0696	-0.0471	0.283	-0.0527
GDP/capita	0.0051	-0.0573	-0.0357	0.1815	0.12	-0.1481	0.043
GDP/capita square root	0.0026	-0.0724	-0.0403	0.2258	0.1479	-0.2337	0.0354
Population density	0.1724	-0.0471	-0.0453	0.0865	0.074	-0.1206	0.1383
Number of schools	0.1769	-0.0615	-0.0289	0.057	0.0687	-0.0661	0.1191

	Improvement of school food	Education budget law existence	% family rural establishments / total establishments 2006	% family farming production	% rural pop 2010	GDP/capita	GDP/capita square root
Improvement of school food	1						
Education budget law existence	0.0409	1					
% family rural establishments / total establishments 2006	-0.0245	-0.02	1				
% family farming production	-0.0397	-0.0259	0.6748	1			
% rural pop 2010	-0.0388	-0.0321	0.5077	0.4539	1		
GDP/capita	0.0424	0.0336	-0.295	-0.2977	-0.2601	1	
GDP/capita square root	0.0491	0.0464	-0.3579	-0.3781	-0.3395	0.9517	1
Population density	0.0212	0.0033	-0.0712	-0.0107	-0.2459	0.1012	0.1182
Number of schools	0.0013	0.0024	0.0154	0.0369	-0.1005	0.0362	0.039

	Population density	Number of schools
Population density	1	
Number of schools	0.5063	1

Source: research data

Table A2 - Regressions with each year of smallholder's farmers procurement percentage as dependent variable

	2015		2016		2017	
	State fixed effects Model 1	Meso fixed effects Model 2	State fixed effects Model 1	Meso fixed effects Model 2	State fixed effects Model 1	Meso fixed effects Model 2
	Factors related to demand Governance					
Number of SFC meetings	0.135**	0.116**	0.0924	0.0872	0.0919	0.0772
	(0.0586)	(0.0588)	(0.0583)	(0.0582)	(0.0576)	(0.0573)
SFC parity	1.161	0.975	0.158	-0.114	0.590	0.490
	(0.944)	(0.941)	(0.939)	(0.932)	(0.928)	(0.917)
SFC year of creation	0.0445	0.0391	0.0360	0.0377	0.0124	0.00414
	(0.0495)	(0.0492)	(0.0492)	(0.0488)	(0.0486)	(0.0480)
Access information law	0.491	0.320	-0.466	-0.654	1.145	0.839
	(0.741)	(0.741)	(0.737)	(0.735)	(0.729)	(0.723)
	Education management					
Education budget responsibility under education organ	1.253**	1.297**	1.639***	1.553***	1.486**	1.570***
	(0.593)	(0.592)	(0.589)	(0.587)	(0.583)	(0.577)
HR/population	-120.7***	-78.10**	-113.5***	-83.93**	-147.5***	-112.3***
	(34.87)	(35.01)	(34.68)	(34.70)	(34.28)	(34.14)
Outsourcing food processing activities in 2014	-3.015**	-3.050**	0.635	0.154	-2.658**	-2.865**
	(1.275)	(1.269)	(1.268)	(1.258)	(1.253)	(1.238)
Improvement of school food	2.920**	2.675**	-0.129	-0.611	0.671	0.313
	(1.212)	(1.212)	(1.206)	(1.201)	(1.192)	(1.182)
Education budget law existence	1.357*	1.551**	1.470*	1.703**	0.336	0.486
	(0.756)	(0.757)	(0.751)	(0.750)	(0.743)	(0.738)

			Factors related to supply			
% family rural establishments / total establishments 2006	0.105***	0.0457	0.107***	0.0574*	0.118***	0.0647**
	(0.0280)	(0.0299)	(0.0278)	(0.0296)	(0.0275)	(0.0291)
% family farming production	0.0202	0.00880	0.0245**	0.0103	0.0256**	0.0113
	(0.0124)	(0.0129)	(0.0124)	(0.0128)	(0.0122)	(0.0126)
% rural pop 2010	0.649	0.130	1.380	-0.295	4.643***	2.996*
	(1.647)	(1.692)	(1.638)	(1.677)	(1.619)	(1.650)
			Control variables			
GDP/capita	-0.0957*	-0.110*	-0.0358	-0.0495	-0.220***	-0.199***
	(0.0573)	(0.0591)	(0.0570)	(0.0586)	(0.0564)	(0.0577)
GDP/capita square root	2.072***	2.077**	1.816**	1.774**	3.925***	3.436***
	(0.785)	(0.828)	(0.781)	(0.821)	(0.772)	(0.807)
Population density	-0.00284**	-0.00282**	-0.00139	-0.00190	-0.00360***	-0.00348***
	(0.00127)	(0.00135)	(0.00126)	(0.00133)	(0.00124)	(0.00131)
Number of schools	0.00718	0.00938*	0.00237	0.00371	0.00139	0.00356
	(0.00484)	(0.00484)	(0.00481)	(0.00480)	(0.00475)	(0.00472)
Constant	-90.18	-69.70	-71.37	-55.02	-25.66	9.979
	(99.35)	(98.80)	-98.8	(97.94)	(97.67)	(96.33)
Obs.	4,724	4,768	4,724	4,768	4,724	4,768
R squared	0.197	0.236	0.224	0.265	0.264	0.309
Adjusted R-squared	0.190	0.2113	0.217	0.2413	0.258	0.287

Source: research data

Table A3 - Comparison of which variables were significant in each year of smallholders farmers procurement percentage as dependent variable and average of all three years as dependent variable
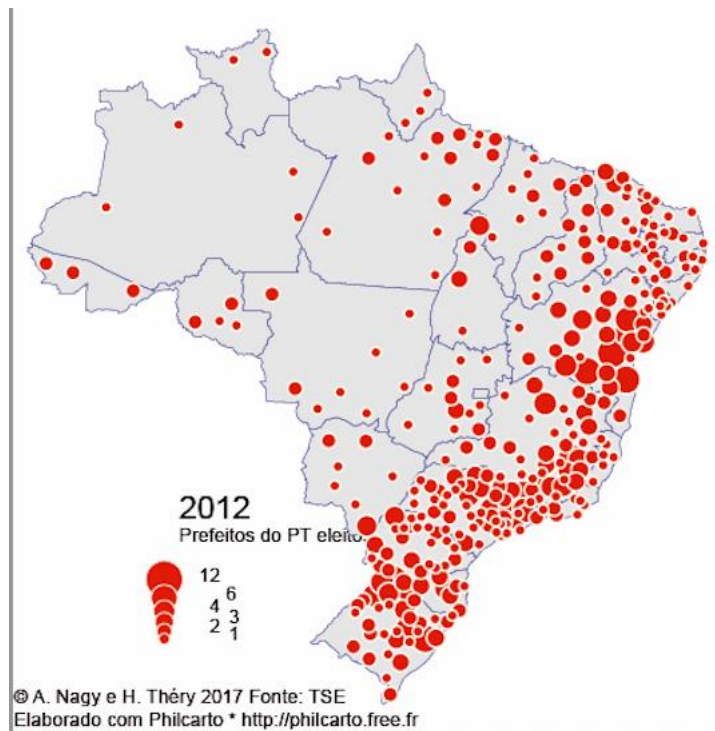
	2015		2016		2017	
	State fixed effects	Meso fixed effects	State fixed effects	Meso fixed effects	State fixed effects	Meso fixed effects
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	Factors related to demand					
	Governance					
Number of SFC meetings	+	+	N.S.	N.S.	N.S.	N.S.
SFC parity	N.S.	N.S.	N.S.	N.S.	N.S.	N.
SFC year of creation	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Access information law	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	Education management					
Education budget responsibility under education organ	+	+	+	+	+	+
HR/population	-	-	-	-	-	-
Outsourcing food processing activities in 2014	-	-	N.S.	N.S.	-	-
Improvement of school food	+	+	N.S.	N.S.	N.S.	N.S.
Education budget law existence	+	+	+	+	N.S.	N.S.
	Factors related to supply					
% family rural establishments / total establishments 2006	+	N.S.	+	+	+	+
% family farming production	N.S.	N.S.	+	N.S.	+	N.S.
% rural pop 2010	N.S.	N.S.	N.S.	N.S.	+	+
	Control variables					
GDP/capita	-	-	N.S.	N.S.	-	-
GDP/capita square root	+	+	+	+	+	+
Population density	-	-	N.S.	N.S	-	-
Number of schools	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Source: research data

Notes: $+$ represents a positive and a statistically significant impact; $-$ represents a negative and a statistically significant impact; N.S. represents a statistically insignificant impact

Appendix B

Figure B1: Map of PT mayors elected in Brazil in 2012

2012
Prefeitos do PT eleito

12
6
4 3
2 1

© A. Nagy e H. Théry 2017 Fonte: TSE
Elaborado com Philcarto * http://philcarto.free.fr

Source: Nagy and Somain (2017)

Table B1 - List of Brazilian parties

Initials	Name
MDB	Movimento Democrático Brasileiro
PTB	Partido Trabalhista Brasileiro
PDT	Partido Democrático Trabalhista
PT	Partido dos Trabalhadores
PCdoB	Partido Comunista Do Brasil
PSB	Partido Socialista Brasileiro
PSDB	Partido da Social Democracia Brasileira
AGIR	Agir
PSC	Partido Social Cristão
PMN	Partido da Mobilização Nacional
CIDADANIA	Cidadania
PV	Partido Verde
AVANTE	Avante
PP	Progressistas
PSTU	Partido Socialista dos Trabalhadores Unificado
PCB	Partido Comunista Brasileiro
PRTB	Partido Renovador Trabalhista Brasileiro
DC	Democracia Cristã
PCO	Partido da Causa Operária
PODE	Podemos
REPUBLICANOS	Republicanos
PSOL	Partido Socialismo E Liberdade
PL	Partido Liberal
PSD	Partido Social Democrático
PATRIOTA	Patriota
PROS	Partido Republicano da Ordem Social
SOLIDARIEDADE	Solidariedade
NOVO	Partido Novo
REDE	Rede Sustentabilidade
PMB	Partido da Mulher Brasileira
UP	Unidade Popular
UNIÃO	União Brasil

Source: Supreme Electoral Court

Table B2 - Correlation Matrix between Instrument and other variables

	Temperature
Temperature	**1.000**
Complied 30% rule in 2013	-0.143
Complied 30% rule in 2014	-0.136
Complied 30% rule in 2015	-0.156
Complied 30% rule in 2016	-0.191
Complied 30% rule (mean from 2013 to 2016)	-0.188
PT mayor	-0.073
Agriculture production (log) in 2013	0.064
Agriculture production (log) in 2014	0.112
Agriculture production (log) in 2015	0.094
Agriculture production (log) in 2016	0.086
Agro PIB in 2013	0.126
Agro PIB in 2014	0.118
Agro PIB in 2015	0.110
Agro PIB in 2016	0.090
Agro PIB (mean from 2013 to 2016)	0.113
Area (log)	0.297
Educ. budget under mayor resp.	0.036
Educ. budget under educ. organ resp.	-0.005
Number of SFC meetings	0.035
Population (log) in 2013	-0.073
Population (log) in 2014	-0.073
Population (log) in 2015	-0.072
Population (log) in 2016	-0.071
Population (mean from 2013 to 2016)	-0.072
Population density 2013	-0.096
Population density 2014	-0.097
Population density 2015	-0.097
Population density 2016	-0.097
Population density (mean from 2013 to 2016)	-0.097
SFC year of creation	-0.032

Table B3 - Probit and IV regressions for procurement family farmers products percentage in 2014 as dependent variable

	Probit	First stage	Second stage
PT mayor	0.113*		2.965***
	(0.0597)		(0.104)
Temperature		-0.00718***	
		(0.00164)	
Agriculture production (log) in 2014	0.0244**	-0.00454**	0.0231***
	(0.00983)	(0.00230)	(0.00768)
Agro GDP in 2014	1.073***	0.00498	0.238
	(0.183)	(0.0430)	(0.159)
Area (log)	-0.231***	0.00752	-0.0707***
	(0.0218)	(0.00542)	(0.0240)
Educ. budget under mayor resp.	0.0161	0.00547	-0.0291
	(0.0595)	(0.0136)	(0.0458)
Educ. budget under educ. organ resp.	0.264***	0.0368***	-0.0215
	(0.0559)	(0.0132)	(0.0498)
Number of SFC meetings	0.00317	-0.000306	0.00106
	(0.00404)	(0.00121)	(0.00411)
Population (log) in 2014	0.182***	0.0151**	-0.0530**
	(0.0308)	(0.00756)	(0.0253)
Population density in 2014	-0.000570***	1.72e-05	-0.000187**
	(0.000116)	(2.32e-05)	(9.28e-05)
SFC year of creation	-0.00385	8.82e-05	-0.00105
	(0.00355)	(0.000916)	(0.00304)
Constant	-1.058***	0.137*	0.215
	(0.229)	(0.0710)	(0.182)
Wald chi 2 for prrobit or Wald test for IV	191.41***	1643.65***	1643.65***
Observations	4,460	4,457	4,457

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: research data

Table B4 - Probit and IV regressions for procurement family farmers products percentage in 2015 as dependent variable

	Probit	First stage	Second stage
PT mayor	0.171***		3.005***
	(0.0597)		(0.0939)
Temperature		-0.00713***	
		(0.00165)	
Agriculture production (log) in 2015	0.0583***	-0.00331	0.0339***
	(0.00922)	(0.00214)	(0.00824)
Agro GDP in 2015	0.785***	-0.0115	0.231
	(0.180)	(0.0437)	(0.157)
Area (log)	-0.225***	0.00854	-0.0787***
	(0.0213)	(0.00553)	(0.0251)
Educ. budget under mayor resp.	-0.0369	0.00506	-0.0199
	(0.0584)	(0.0136)	(0.0452)
Educ. budget under educ. organ resp.	0.211***	0.0355***	-0.0266
	(0.0549)	(0.0132)	(0.0486)
Number of SFC meetings	0.00493	-0.000118	0.00267
	(0.00403)	(0.00120)	(0.00376)
Population (log) in 2015	0.0962***	0.0121	-0.0249
	(0.0296)	(0.00748)	(0.0258)
Population density in 2015	-0.000371***	1.71e-05	-0.000148
	(0.000113)	(2.55e-05)	(9.07e-05)
SFC year of creation	-0.000750	0.000164	-0.000906
	(0.00353)	(0.000911)	(0.00302)
Constant	-0.458**	0.146**	-0.0183
	(0.224)	(0.0718)	(0.185)
Wald chi 2 for prrobit or Wald test for IV	227.29***	52.8***	52.8***
Observations	4,466	4,466	4,466

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: research data

Table B5 - Probit and IV regressions for procurement family farmers products percentage mean from 2013 to 2016 as dependent variable

	Probit	IV	
		First stage	Second stage
PT mayor	0.124**		3.038***
	(0.0600)		(0.0753)
Temperature		-0.00706***	
		(0.00165)	
Agriculture production (log) mean from 2013 to 2016	0.0208**	-0.00460*	0.0249***
	(0.00996)	(0.00237)	(0.00767)
Agro GDP (mean from 2013 to 2016)	4.879***	0.0225	0.975
	(0.747)	(0.182)	(0.669)
Area (log)	-0.261***	0.00718	-0.0695***
	(0.0228)	(0.00551)	(0.0243)
Educ. budget under mayor resp.	-0.0693	0.00560	-0.0278
	(0.0596)	(0.0136)	(0.0442)
Educ. budget under educ. organ resp.	0.254***	0.0376***	-0.0367
	(0.0558)	(0.0132)	(0.0475)
Number of SFC meetings	-0.000971	-0.000377	0.00166
	(0.00443)	(0.00121)	(0.00404)
Population (log) (mean from 2013 to 2016)	0.159***	0.0153**	-0.0258
	(0.0325)	(0.00769)	(0.0270)
Population density (mean from 2013 to 2016)	-0.000767***	2.16e-05	-0.000235**
	(0.000157)	(2.32e-05)	(9.28e-05)
SFC year of creation	-0.00564	5.78e-05	-0.00190
	(0.00356)	(0.000915)	(0.00301)
Constant	-0.346*	0.149**	0.00378
	(0.200)	(0.0652)	(0.157)
Wald chi 2 for prrobit or Wald test for IV	235.79	67.14***	67.14***
Observations	4,485	4,485	4,485

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: research data