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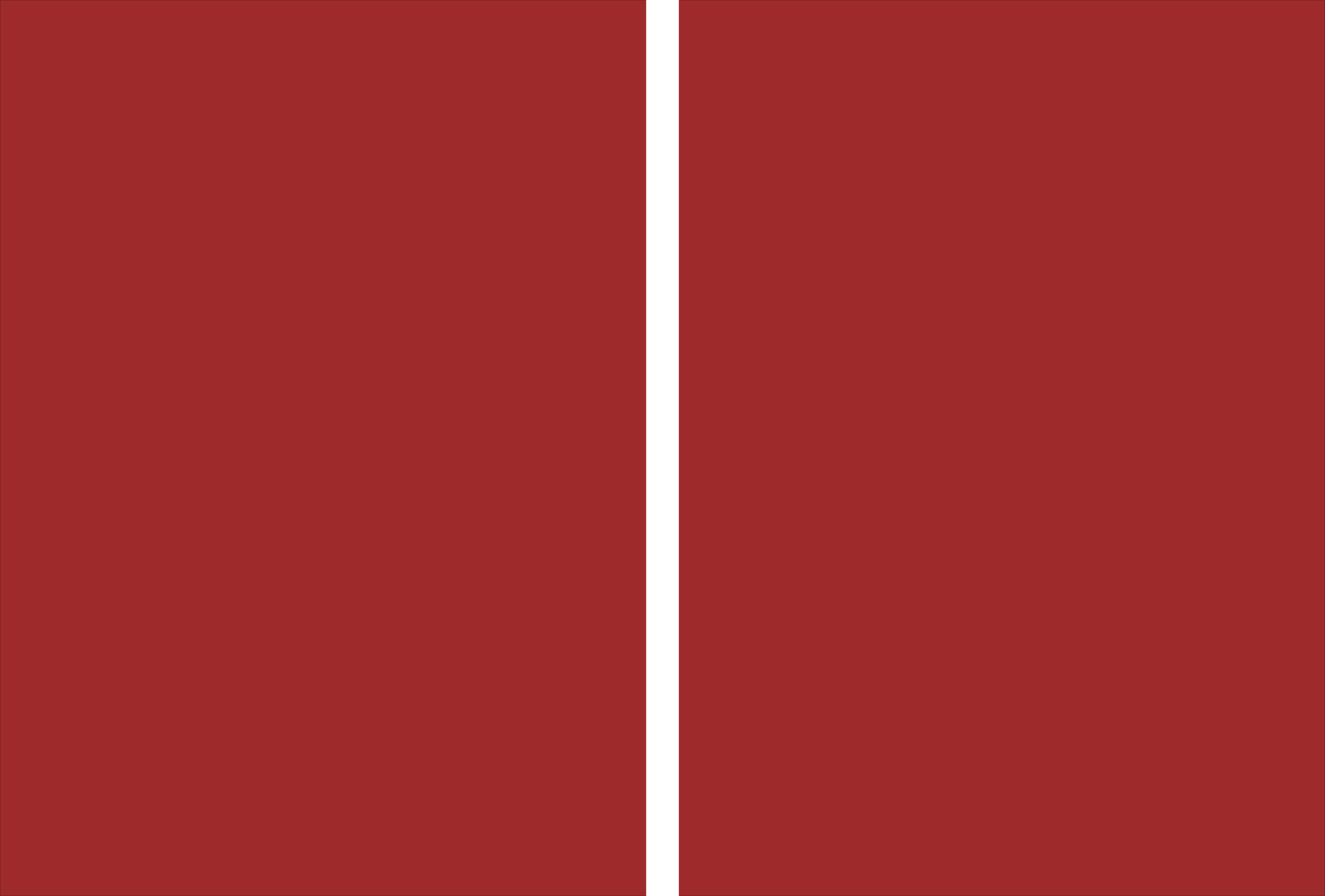
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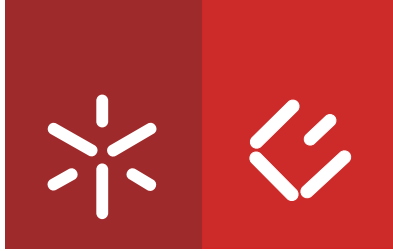
**Studies on Ecological Fiscal Transfers  
in Brazil**

Felipe Luiz Lima de Paulo **Studies on Ecological Fiscal Transfers in Brazil**

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**Universidade do Minho**

Escola de Economia e Gestão

Felipe Luiz Lima de Paulo

**Studies on Ecological Fiscal Transfers  
in Brazil**

Ph. D. Thesis in Administrative Sciences

Work developed under the supervision of  
**Doctor Pedro Jorge Sobral Camões**

February 2019

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## DECLARAÇÃO DE INTEGRIDADE

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## ABSTRACT

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This thesis focuses on the process of formulating and implementing ecological fiscal transfers (EFT) in Brazil at the state level and their consequences at the local-level decisions concerning biodiversity conservation policies. The theoretical lens is based firmly on the transaction cost-politics theory proposed by Douglass North and followed by other authors, such as Avinash Dixit, Murray Horn, David Epstein and Sharyn O'Halloran. The thesis comprises three essays which jointly advance the EFT literature providing theoretical and empirical evidence that the transaction costs can facilitate or complicate the formulation and implementation of the EFT at the state and local level. More precisely, the first essay describes and explains the process of adopting EFT across Brazilian states from 1990 to 2015. The second essay argues that the legislative branch tends to minimize the costs at the policy-making stage and the legislative branch delegates to the state agencies the role to refine EFT procedures and, accordingly, increase the costs to them. The third essay argues that an EFT schema designed at the state level affects the commitment costs of local level decisions and, due to agency costs, the time length to create PA. More broadly, the findings of this thesis provide evidence that the probability of adopting the EFT is higher in a non-electoral year, demonstrating that politicians tend to avoid conflicts during electoral years and, accordingly, to minimize the costs related to the legislative decision-making process. Also, the probability of reducing the time to adopt the EFT is lower when the state government imposes a gradual implementation of the percentage dedicated to environmental criteria to municipalities. In addition, it provides evidence of absence of technical and human resources at the environmental state agencies that can lead to agency problems, and issues related to party-ideology and political coalitions which may increase the legislative-decision making costs. The uncertainty of the EFT revenue increases the commitment costs and shape local decisions to choose the best institutional arrangement which tend not to lose their discretion so much in the moment of adopting local protected area. It also provides empirical evidence that the quality index of protected areas imposes additional costs to local governments.

*Keywords*— Policy Adoption, Protected Areas, Ecological Fiscal Transfers, Transaction Cost Theory, Brazil



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## RESUMO

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Este trabalho de tese aborda o processo de formulação e implementação das transferências fiscais ecológicas (TFE) no Brasil em nível estadual, e também suas consequências para as decisões em nível local. O enfoque teórico do trabalho foi baseado na teoria dos custos políticos de transação proposta por Douglass North e desenvolvida por outros autores, como Avinash Dixit, Murray Horn, David Epstein e Sharyn O'Halloran. O trabalho está estruturado em três ensaios, os quais contribuem para a literatura das TFE ao apresentar suporte teórico e empírico de que os custos de transação decorrentes do "jogo político" facilitam ou dificultam o processo de formulação e implementação do instrumento de política TFE (em nível estadual), e que também tais decisões influenciam políticas dos governos locais. Mais precisamente: o primeiro ensaio descreve e explica o processo de adoção das TFE entre os Estados Brasileiros nos anos 1990 à 2015; o segundo ensaio argumenta que o atraso na implementação das TFE é decorrente de ações do poder legislativo que tendem a minimizar custos de transação por meio da delegação, para as agências ambientais estaduais, de tarefas de refinamento da legislação; e o terceiro ensaio apresenta a hipótese de que as TFE implementadas em nível estadual afetam o processo de tomada de decisão de criação de áreas protegidas em nível local, aumentando ou diminuindo os custos de comprometimento e de agência. Mais amplamente, os resultados desta tese fornecem evidências de que a probabilidade de adoção das TEF é maior em um ano não eleitoral, demonstrando que os políticos tendem a minimizar os custos relacionados à decisão legislativa. Além disso, a probabilidade de reduzir o tempo de adoção das TEF é menor quando o governo estadual utiliza a estratégia de implementar gradualmente o percentual dedicado aos critérios ambientais. Além disso, este trabalho fornece evidências de que a ausência de recursos técnicos e humanos nas agências estaduais de meio ambiente podem levar a problemas de agência. Adicionalmente, questões relacionadas com a ideologia partidária e conflitos entre coalizões políticas podem aumentar os custos da tomada de decisão legislativa. Evidências empíricas também suportam a hipótese de que a incerteza do fluxo de receita das TEF aumenta os custos de comprometimento, levando os poderes locais a escolherem o melhor arranjo institucional. Esta tese também fornece evidências empíricas de que o índice de qualidade das áreas protegidas impõe custos adicionais aos governos locais.

*Palavras-chave* - Adoção de Políticas, Áreas Protegidas, Transferências Fiscais Ecológicas, Teoria dos Custos Políticos de Transação, Brasil



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## INTRODUCTION

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### 1.1 THE ISSUE AND THE RELEVANCE

Public policies for biodiversity conservation face the classical trade-off between economic growth and environmental protection (Feiock and Stream, 2001). Due to the scarcity of revenues to provide essential public services, local governments in developing and emerging countries face this trade-off even more often and intensely (Oliveira, 2002). At the international Convention on Biological Diversity (CBD), held in 1992 in Rio de Janeiro, nations agreed to promote scientific and technical cooperation, mainly to help with some problems faced by this group of countries. More specifically, Article Eighteen of the CBD (1992, p. 1) stipulates, "*special attention should be given to the development and strengthening of national capabilities, by means of human resources development and institution building*". This landmark shaped national policies for biodiversity protection around the world. Accordingly, a substantial increase in the number of protected areas (PAs) in Brazil was witnessed from 2003 to 2008 (Jenkins and Joppa, 2009).

One of the CBD traits is the role that local communities play in policies for biodiversity conservation. The CBD approach followed the concept of sustainable development to attain standards of biodiversity conservation. The recommendation was that the creation of protected areas should consider the knowledge of traditional local communities, such as in the case of indigenous land (Oliveira, 2002). Thus, biodiversity conservation policies took on another perspective to involve not only the efforts of different levels of governments but also those of the local community (Tisdell, 1995).

The decentralization of biodiversity conservation policies came under the spotlight of scholars and policymakers (Oates, 2001; Sousa et al., 2011). New policies assigned to local governments new roles in defining protected areas around the world although their benefits extend far beyond their boundaries. The policy formulation process in the legislative and executive branches began to be pressured by different interest groups, including grassroots movements. In the policy implementation process, agencies charged with developing biodiversity conservation policies at the local level also had to cope with these issues, mainly in less-developed and emerging countries.

Oliveira (2002) presents a case study of the Brazilian state of Bahia, in which state agencies had to deal with new roles, change their structures to deal with low of political support, fund protected areas, create institutional capacity, and ensure cooperation at the local level.

Depending on the policy instruments available, sub-national governments bear the costs of land use restrictions in their territories without any compensation or incentive. Therefore, private and public instruments were developed in many countries to solve problems related to lack of funding for protected areas. Payments for environmental services (PES) turn into the principal remedy to compensate local landowners for the loss of economic activity (Muradian et al., 2010; Ring and Schröter-Schlaack, 2011). Also, Ecological Fiscal Transfers (EFT) emerge as intergovernmental fiscal transfers that redistribute public revenue from central to decentralized levels of government (Ring and Barton, 2015). This economic instrument helps decentralized levels of government cover their expenditure in providing environmental public goods and services, such as creation and maintenance of protected areas.

Ring and Barton (2015, p. 438) regard EFT as *"intergovernmental fiscal transfers [that] redistribute public revenue from central to decentralized levels of government. [EFT] help lower-tier governments cover their expenditure in providing public goods and services."* There are at least three different EFT rationales for biodiversity conservation policies, as described in the literature (Ring and Barton, 2015). The first is to compensate sub-national governments' expenses (supply costs) on ecological public goods and services. The second is to compensate their opportunity costs, that is, their revenue loss due to land-use restrictions and tax revenue losses from private landowners. Lastly, it is to pay for external benefits to sub-national governments, providing external benefits outside their boundaries (spill-over effect).

According to Schröter-Schlaack et al. (2014), an EFT scheme may differ from another one through the type of transfers used: lump sum, that is, unconditional transfers, and earmarked or conditional transfers. The EFT also can be classified in four dimensions. The first involves the type of costs and benefits to be achieved. The second is the kind of indicators used in fiscal transfers (e.g., quantitative, or qualitative). The third is the scale, or *"the number of decentralized governments that can benefit from EFT"* (Schröter-Schlaack et al., 2014, p. 108). The fourth is the origin and type of financial funds allocated and the overall amount of financial resources distributed. Thus, the choice for each type of EFT scheme *"is highly dependent on the country's legal and institutional framework – not least the financial constitution"* (Ring and Barton, 2015, p. 439).

So far, the EFT were adopted in three countries: Brazil (Ring, 2008), Portugal (Santos et al., 2012) and France, although on a small scale (Schröter-Schlaack et al., 2014). However, other countries have proposed the EFT scheme, either by simulating theoretically or by introducing EFT to the political process, for example, Switzerland

(Köllner et al., 2002), Poland, Germany (Schröter-Schlaack et al., 2014), and Indonesia (Mumbunan et al., 2012). Thus, the EFT can be applied both in centralized countries (e.g., Portugal), and in federal countries (e.g., Brazil).

In Brazil, EFT constitutes part of the *Imposto Sobre Circulação de Mercadorias e Serviços* (ICMS), a type of Value Added Tax, which is collected by the state government and redistributed to municipalities. The Brazilian Federal Constitution determines that twenty-five percent of the ICMS has to be transferred to local governments, and state governments are free to decide the criteria to distribute a quarter of this amount. EFT in Brazil have several names, such as *ICMS Ecológico*, *ICMS Socioambiental*, and *ICMS Verde*. Due to their redistributive effects, in Minas Gerais, EFT are known as the *Robin Hood Law*, an allusion to the English mythical hero who used to steal from the nobility to give to the poor. Therefore, the stages of formulating, implementing and operating EFT in Brazil has *winners* and *losers* across local governments (Grieg-Gran, 2001; Jatobá, 2005; Gonçalves, 2003).

Paraná was the first state to introduce indicators related to protected areas to transfer ICMS in the early 1990s. Then, other states followed suit and adopted similar policy instruments. So far, sixteen states out of twenty-six operate an EFT scheme (see table 1).

Table 1.: EFT formulation and implementation

State	Policy Formulation	Policy Implementation
Paraná	1991	1992
São Paulo	1993	1993
Mato Grosso do Sul	1994	2001
Minas Gerais	1995	1996
Amapá	1996	1996
Rondônia	1996	2003
Rio Grande do Sul	1997	1998
Pernambuco	2000	2001
Mato Grosso	2000	2001
Tocantins	2002	2003
Acre	2004	2009
Ceará	2007	2008
Rio de Janeiro	2007	2009
Piauí	2008	2014
Goiás	2011	2014
Paraíba	2011	not yet
Pará	2012	2013

Source: compiled by author from the legislation of each state

The column of policy formulation in Table 1 represents the year of the EFT enactment, that is, when the state government published the general rules of the policy

instrument. Medeiros (2013) presents the first and the only study that describes and explains EFT enactment across states. The study raises the hypothesis that political ideology is relevant to explain the adoption of the policy instrument. However, the study did not provide a conclusive explanation concerning the time of approval of the EFT law in each state. Therefore, we intend to start filling this critical lacuna in the EFT literature. However, we assume a transaction-cost politics perspective, which assumes that the political actors are rational and seek reelections. Thus, we argue that the legislative decision-making costs and the commitment costs may explain the adoption of EFT in Brazil.

Another gap in the EFT literature is to explain the difference in the time-lag between the policy formulation and the policy implementation (see the years in the column of policy formulation and implementation in table 1). Droste et al. (2015) present a similar table in their study, although not focusing on this issue. We explored these time-lags, and we found an exciting research agenda. There are several cases of policy delays and termination concerning EFT adoption in Brazil. To study this problem, we also assume a transaction cost politics perspective, which asserts that the legislative branch tends to minimize their costs at the policy-making stage. In the implementation stage, the legislative branch delegates to the state agencies the role to refine EFT procedures and, accordingly, increases the costs to them (Horn, 1995; Epstein and O'Halloran, 1999).

At the local level, the EFT literature is relatively abundant, although mostly focusing on the analysis of the efficiency of the policy instrument. In Minas Gerais, the extensive literature points to the effectiveness of the policy instrument to incentivize the local governments to create and maintain protected areas and compensate them for doing so (Grieg-Gran, 2001; Fernandes et al., 2011). We collected data from the environmental state agency in Minas Gerais and also explored the local protected area (PA) over time (see figure 1).

The evidence depicted in figure 1 reflects the potential of the policy instrument to incentivize local governments to create more protected areas. It follows a similar pattern presented in the studies of Grieg-Gran (2001) and Fernandes et al. (2011). However, Fernandes et al. (2011) and Grieg-Gran (2001) note an interesting issue not addressed in the literature thus far. The quality index to measure the protected area was not introduced at that time, although it had been determined by the time the legislation was enacted in 1995. Fernandes et al. (2011) assigned the non-implementation of the quality index simply to an "an administrative error" of the environmental agency of the state. However, we follow a transaction-cost politics perspective in this dissertation and assume that the political actors are rational in their choices. Ring and Barton (2015, p. 442) note that the implementation of the quality index may "imply additional transaction costs related to monitoring". Therefore, we argue that an EFT schema de-

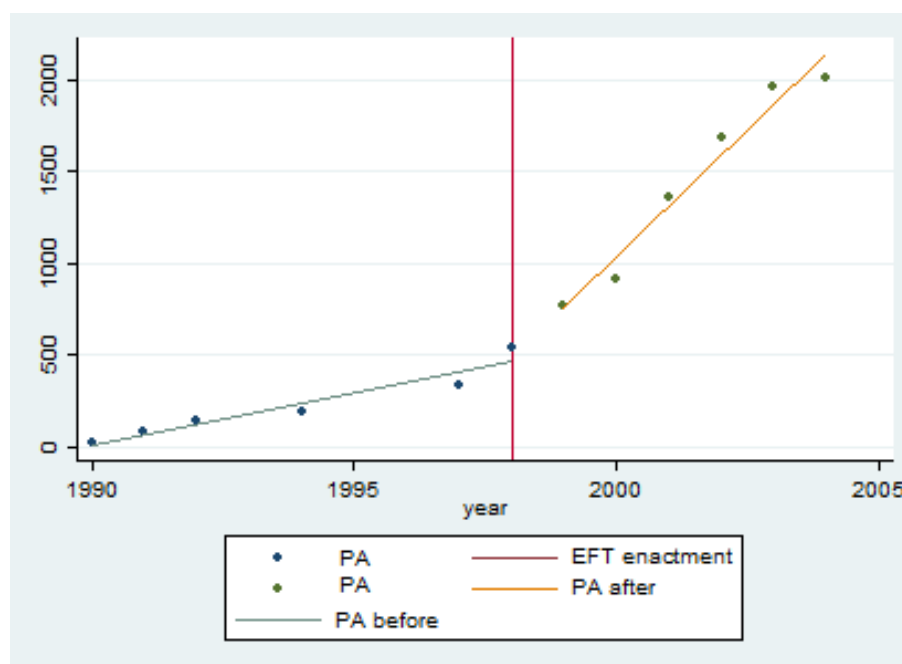


Figure 1.: Cumulative number of protected areas in the state of Minas Gerais

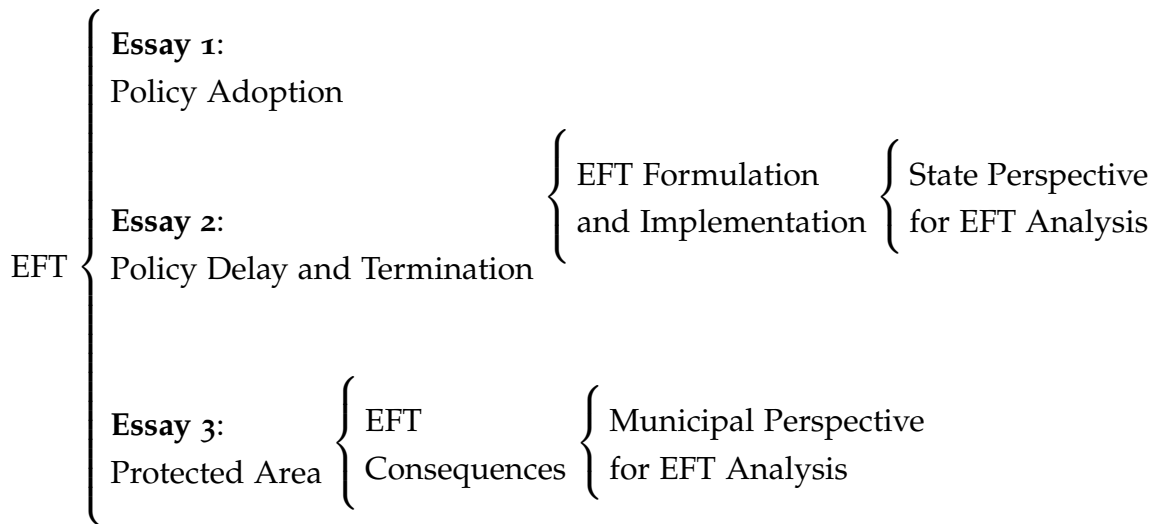
signed at the state level affects the time length to create a PA due to the increase of the agency costs at the local level.

In addition, Grieg-Gran (2001) and Fernandes et al. (2011) observed a potential decrease of the incentive component of EFT over time. Grieg-Gran (2001, p. 26) assigns the dilution of the incentive effect to the fact that *"the amount to be redistributed is fixed in terms of the percentage allocated to the ecological criterion"*. Moura (2015) analyzes the legal-institutional aspects of the EFT in each state. Although the conflicts between political actors were not addressed by her, the study suggests that the uncertainty of the EFT revenue over time increases the commitment costs to state and local governments. Therefore, we argue that an EFT schema designed at the state level also affects the commitment costs and, accordingly, the local-level decisions.

In sum, there are at least three gaps in the EFT literature that need to be addressed. The first is the need to describe the adoption of the EFT policy instrument across Brazilian states and to explain the timing to adopt them in each state based on the legislative decision-making costs and commitment costs. The second need is to explain some of the delay and termination that followed the adoption of EFT in Brazil. Third, it is necessary to check the influence of EFT on the policy-making process of adopting local protected areas by municipal governments. Therefore, this thesis intends to fill these three gaps found in the literature.

## 1.2 STRUCTURE OF THE THESIS

From the perspective of transaction-cost politics theory, this thesis comprises three essays that contribute to the literature to understand the policy process of adopting the EFT and the consequences for local level decisions, mainly concerning biodiversity conservation policies. The units of analysis of the first and second essays are the state governments, while for the third essay, they are the local governments.



The first essay describes and explains the adoption of EFT policy instrument across Brazilian states framed on the transaction-cost politics. The hypotheses are built in two types of transaction-cost, legislative decision-making costs and commitment costs, and are empirically tested through event history analysis concerning the period from 1990 to 2015. The second essay argues that the legislative branch tends to minimize their costs at the policy-making stage. At the implementation stage, the legislative branch delegates to the state agencies the role to refine EFT procedures and, accordingly, increases the costs to them. To test these arguments, it conducts an empirical strategy based on case-study analysis to describe the time-lags and the policy terminations of each state. The third essay argues that an EFT schema designed at the state level affects the commitment costs of local level decisions and, due to agency costs, the time length to create PA. The mixed research design is composed of two parts: first, a descriptive analysis detailing the evolution of EFT design in the state of Minas Gerais since the beginning until its current version; and second, an event-history analysis of municipal PA adoption from 1966 to 2013.



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## GENERAL LITERATURE REVIEW

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### 2.1 FISCAL FEDERALISM

#### 2.1.1 *Normative and Positive Perspective*

The literature on fiscal federalism addresses the role of different levels of government in positive terms and normative terms (Oates, 1999). The normative perspective focuses on how these relationships should be. It includes concerns about welfare economics and public policy. The positive branch describes how the vertical relationship between different levels of government works. The normative approach copes with the allocation and redistribution of resources in a society whereas the positive perspective represents how a government drives away from being a purely benevolent institution (Boadway and Shah, 2009; Weingast, 2014).

According to Oates's classification, there are two generations of fiscal federalism. The first generation - mostly normative - prevailed in the 1950s and the 1960s, stressing the reasons for government intervention within the framework of market failure. The second generation - mostly positive - developed around the public choice perspective in "*the view that public decision-makers are utility maximizers with their own objective functions*" (Oates, 2005, p. 355).

The normative public finance literature on fiscal federalism offers at least two rationales for government intervention regarding market failure types. "*The first is ensuring that the economy is operating on its utility possibilities frontier, that is, operating with economic efficiency*", and "*the second is ensuring that the 'best' point on society's utility possibility frontier – that is, the point that yields the highest level of social welfare – is collectively chosen*" (Boadway and Shah, 2009, p. 16).

These rationales give rise to two theorems that would become cornerstones of welfare economics literature. First is the Pareto-efficient allocation of resources where private markets can achieve the efficient allocation of resources if operating competitively, that is, "*they will yield a point on the utility possibilities frontier where it is not possible to make one person better off without making someone else worse off*". And second, in the Pareto-optimal allocation of resources, which means "*any point on society's util-*

*ity possibilities frontier*", the optimal allocation "can be achieved by the competitive market mechanism combined with a suitable redistribution of resources among households" (Boadway and Shah, 2009, p. 17). In this sense, the normative branch addresses mechanisms to cope with sources of inefficiency in the market economy. It also deals with causes of inequality in the market economy.

As a source of inefficiency in the market economy, we can highlight: 1) public goods, 2) externalities, 3) economies of scale, and 4) imperfect information, among others (unemployment resources, the absence of markets, and time inconsistency issues) (Boadway and Shah, 2009).

A public good has the characteristic of being non-rival and, in some cases, non-exclusive. For a long time, public finance literature has been considered market failure as a standard rationale for government intervention in public finance. However, governments have other expenditures beyond public goods, that is, public services and other quasi-private goods that are extremely important for consideration in recent fiscal federalism studies (Blom-Hansen et al., 2016).

Externalities arise when a production or consumption activity leads to residual or *non-planned* effects that positively or negatively influence other utility levels that are not directly involved in the transaction. These external impacts are not internalized into the price system. Traditional normative literature of public finance solves this problem by applying taxes and subsidies based on the Pigou solution (Pigou, 1929) and through regulations. However, in the 60s, with the path-breaking Coase theorem, the literature of public finance took another route when also considering the effect of the transaction costs (Coase, 1960).

As a source of inefficiency of the market economy, economies of scale deal with the traditional trade-off between decentralization and centralization of public expenditures. However, normative literature does not take into account that public decision-makers are utility maximizers with their own objective functions. Therefore, they cannot be considered as purely benevolent institutions (Boadway and Shah, 2009; Oates, 2005).

Regarding asymmetric information, public finance literature works mainly in situations where a decision taken by one side ends up affecting other sides that are not aware of all information involved in the transaction. As a consequence, the public finance literature highlights the adverse selection that arises "when participants on one side of the market differ from one another in some characteristics that are not observable to the other side" (Boadway and Shah, 2009, p. 21). In addition, the literature points out that moral hazard "refers to a situation in which one side of the market can take actions that affect the market outcome but that cannot be observed by the other side" (Boadway and Shah, 2009, p. 21). Therefore, in an institutional setting with asymmetric information, opportunistic behavior ends up arising in both private markets and the government.

However, the normative literature on public finance does not take into account the opportunistic behavior of governments.

Further, the second generation of fiscal federalism is guided by public choice theories, which consider the self-interest of bureaucrats and vote maximization of politicians (Oates, 2005; Weingast, 2014). Voting preferences and lobbying groups emerge in the research agenda of the positive branch. The recognition of the existence of these political forces significantly influenced fiscal federalism scholarship, especially regarding the determination of governmental structures as well as the search for new fiscal arrangements.

Regarding public economic efficiency, traditional welfare economics considers technical efficiency, exchange efficiency, and production efficiency as essential parts of a system that works. However, the positive branch takes into account political perspectives for efficiency measurement, especially for expenditure harmonization, tax harmonization, internal common market, local public goods and externalities, inter-jurisdictional spill-overs, horizontal fiscal externalities, vertical externalities, and fiscal inefficiency (Boadway and Shah, 2009). Below, for instance, we highlight three seminal contributions that are essential for understanding ecological fiscal transfers theoretical framework: Charles Tiebout, James Buchanan, and Mancur Olson.

Charles Tiebout presents the famous model based on the mobility of families in local units, arguing that they end up having their preferences revealed by the choice of tax package the local government adopts in the line of a famous metaphor that says they *vote with their feet* (Tiebout, 1956). Following this argument, differences in the designs of programs delivered by decentralized governments could affect migration among jurisdictions. Thus, following public choice theory, some different political decisions among decentralized governments also become important to capturing the gain or loss of competition among the jurisdictional unit. That is, *"not only does such decentralization carry with it potential economic benefits and costs, but political decisions are likely to be fundamentally different in a decentralized environment"* (Epple and Nechyba, 2004, p. 33).

Buchanan (1950) clarifies the policy implications of interstate fiscal adjustment to mitigate inter-regional disparities. In a federal system, the sub-national units have a certain autonomy regarding the political and administrative structure as well as the management of their financial resources. In this perspective, the author favors a process of decentralization. The critical point of the analysis is the discussion of fiscal imbalances among states related to the emergence of the welfare state since citizens demanded higher levels of public services. Therefore, Buchanan suggests a fiscal transfer mechanism to promote an *"equal treatment of equals"* and the *"unequal treatment to unequal people"*. (Buchanan, 1950, p. 539) asserted that *"an individual*

*should have the assurance that wherever he should desire to reside in the nation, the over-all fiscal treatment which he receives will be approximately the same”.*

The principle of fiscal equivalence is detailed in the seminal paper by [Olson \(1969\)](#). This principle argues *“that there is a need for a separate governmental institution for every collective good with a unique boundary so that there can be a match between those who receive the benefits of collective good and those who pay for it”* ([Olson, 1969](#), p. 483). It is based on three further significant assumptions. First, it is assumed that when the collective public good goes beyond local government boundaries, it ends up generating a sort of external savings for other municipalities, which in their turn produce the spill-over effect. Secondly, the given collective public good reaches only some of the citizens. It means that the provision of collective public goods in a local government would be more prejudicial for people than helpful, even if the Pareto optimality requires that the collective public good is provided ([Olson, 1969](#)). Thirdly, the boundaries of the collective public good are the same as the government territory providing it.

These analyses are examples of how public choice theories, applied in the context of fiscal federalism literature, can contribute to the determination of government structures as well as to new fiscal arrangements. Consequently, *“rational choice theories of politics explain why a decentralized system would best satisfy popular preferences in a polity containing heterogeneous individual preferences”* ([Bednar et al., 2001](#), p. 4).

### 2.1.2 Principles of Intergovernmental Transfers

Intergovernmental transfers can be adopted both in federal and non-federal zones. For example, both Brazil (a federal country) and Portugal (a non-federal country) adopted intergovernmental transfers between the upper and lower levels of government. This mechanism is applied to coordinate fiscal allocation among jurisdictions and can be useful in different situations to achieve specific goals.

[Boadway and Shah \(2009\)](#) classify intergovernmental finance instruments into two categories: 1) general purpose, which is unconditional and aims to enhance inter-jurisdictional equity and preserve local autonomy; and 2) specific purpose, in which fiscal transfers are conditional or earmarked for a specific purpose.

Fiscal federalism literature provides at least three standard fiscal relation features between multi-tiered governments that influence intergovernmental transfers. The first one is the role of fiscal transfers from the upper to the lower levels of government in order to solve vertical fiscal imbalances ([Boadway, 2001](#)). The second is the role of fiscal transfers to achieve the objectives of upper-level government when fiscal transfers are conditional or earmarked. The third regards fiscal equalization among jurisdictions. This type of fiscal transfer is applied when jurisdictions are less able *“to carry out their fiscal responsibilities”* ([Boadway, 2001](#), p. 455).

Intergovernmental transfers from the upper to lower levels of government are also essential to ensure the provision of several public services and local governance. Although public goods took the spotlight for a long time in this field, recent studies have pointed out that what matters for public expenditure arrangements and the size of jurisdictions simultaneously is the provision of some public services that can vary from one country to another (Blom-Hansen et al., 2016).

The mechanism to determine the type of revenues to be shared can be provided by constitution, advice, and recommendations of quasi-independent bodies or by the federal government. However, several theories “provide a strong rationale for decentralized decision making and a strong role for local governments” (Boadway and Shah, 2009, p. 243), and the main argument is that decentralized governments can better serve citizens’ preferences at the local level (Tiebout, 1956).

Thus, the optimal size of jurisdiction to provide these public services may vary according to the principle of fiscal equivalency, the correspondence principle, the decentralization theorem, and the subsidiarity principle. That is, “taxing, spending, and regulatory functions should be exercised by lower levels of government unless a convincing case can be made for assigning them to higher levels of government” (Boadway and Shah, 2009, p. 245).

Countries such as Indonesia, Vietnam, and Brazil (the last one increased the number of municipalities after the transition from the military rule) are examples of the decentralization movement. In contrast, with the argument for reducing the cost of public service provisions (economies of scale), there is a massive global municipal merger wave across countries (Blom-Hansen et al., 2016). Denmark, New Zealand, the United Kingdom, and Mexico are examples of the implementation of various reforms in line with the centralization movement.

## 2.2 ENVIRONMENTAL FEDERALISM

According to Ring (2002, p. 416), “environmental federalism links environmental issues with the basic theory of fiscal federalism”. Environmental federalism literature involves intergovernmental relations and public finances that address environmental policies. The wide literature on environmental federalism deals with centralization versus decentralization and, thus, discusses this movement as part of environmental policies. Following Tiebout’s work, it serves citizens’ preferences through the adoption of local environmental policies or considers economies of scale with centralized environmental policies.

However, the environmental policies are generally associated with extremely mobile environmental compartments and pollutants that can easily cross jurisdictional boundaries. Explicitly, these policies have high spatial externalities and are adopted

by an upper level of government. However, environmental policies associated with less mobile environmental compartments and pollutants are adopted, in general, by lower levels of government (Ring, 2002).

Some studies assert that the decentralization of environmental policies across intergovernmental relations could reduce the quality of environmental requirements. Two empirical studies that dealt with cases in the United States support this argument. Fredriksson and Millimet (2002) conclude that what matters is the spatial dependence of rules that exist among neighboring jurisdictions, and McConnell and Schwab (1990), in dealing with the impact of environmental regulations on industrial location decisions, concluded that the differences in environmental regulations between regions have a relevant influence.

However, the literature demonstrates that, at decentralized levels of government, the adoption of environmental policies has several benefits. First, local governments minimize the cost of acquiring information about citizens' preferences concerning the expected level of environmental quality. Second, due to the considerable cost for the central government, it would have to invest to find out the preferences of a given area. Eventually, the participation of citizens in local decision arena provides the appropriate consumption of some environmental public goods to satisfy each local community preference. Hence, most countries apply the subsidiarity principle to environmental federalism, that is, taxes, spending, and environmental regulations functions are conducted by lower levels of government unless there is convincing evidence that they should be assigned to higher levels of government. The European Union, since the Treaty of Maastricht in 1992 (Ring, 2002; Oates, 2001), and Brazil are examples of the application of the subsidiarity principle to environmental federalism.

Thus, adapting the concept of environmental federalism to fiscal federalism in a decentralizing institutional setting, Olson's principle of fiscal equivalence recommends *"that there is a need for a separate governmental institution for every collective good with a unique boundary, so that there can be a match between those who receive the benefits of a collective good and those who pay for it"* (Olson, 1969, p. 483). Consequently, it is essential to relate jurisdiction with environmental issues and include all the parties affected.

Based on Olson's principle, most of the environmental policies addressed in the literature concerning the decentralized level of government also deal with others' inefficiency in the market economy beyond economies of scale. There are at least three more sources of inefficiency: 1) public goods, 2) externalities, and 3) imperfect information. Most ecological public services have the characteristics of being non-rival, non-exclusive, and associated with environmental federalism literature with externalities between jurisdictions, that is, spill-overs (Ring, 2002).

The main difficulty presented is that certain types of ecological public services go beyond the limits of local jurisdictions. Following public choice theories, concerns about

the self-interest of bureaucrats, the vote-maximizing interests of politicians (Mueller, 2008), and the influence of pressure groups (Olson, 1965) end up causing externalities and the appearance of free-rider behavior in environmental policies. For example, occasional federal policies that allow state governments to run their programs induce free-riding. Empirically, this may also lead to an expenditure equilibrium different from Pareto efficiency (List et al., 2002; Sigman, 2005).

A combination of policy instruments can be applied to minimize moral hazard problems or at least to provide some stability to the process through political institutions. This combination is known as *policy mix* in the literature (Ring and Barton, 2015).

### 2.3 POLICY-MIX, ECOLOGICAL FISCAL TRANSFERS AND BIODIVERSITY CONSERVATION

According to Flanagan et al. (2011b), the term "*policy mix*" emerged in the 1960s in economic policy literature, remaining limited to use in this field until the early 1990s. Then, it was explored by other research areas interested in the interaction between policy and instruments to reach specific goals. Recently, this terminology has been more clearly adopted in regulation and environmental policies literature.

The general literature of policy instruments classifies the theories of policy instruments at least in two generations (Howlett, 2004). The first-generation addresses techniques used by state authority to achieve services to the public and for governments, and stresses the identification of market failures to justify government intervention in market exchange. It was based on the normative discussion and welfare economics about what governments should do instead of what they efficiently do.

Thus, the first generation of policy instruments fails to examine the context of tools used, limiting it to pro-market choices and non-market ones. In Howlett's terminology, it was a dichotomy between "*good*" and "*evil*" in instrument choices. In the second generation, the consideration of "*good*" and "*evil*" was overcome, and recent studies have focused on the appropriate design of instrument mixes. The critical task is to explain the reason behind the use of a particular combination of procedural and substantive instruments in a specific sectoral context (Howlett, 2004), considering the challenges in the interaction between multi-level and multi-actor governance.

Applying policy instruments in the conservation and sustainable use of biodiversity context, Ring and Barton (2015) present some policy challenges as rationale for the "*policy mix*". Namely, the problems are heterogeneity, multiple objectives, irreversibility, information gaps, conflicting values, market failures, a combination of external pressures, policy failures, impact accumulation, spatial externalities, multi-level governance, and multi-actor governance. Therefore, "*the heterogeneity immanent*

*in the complex adaptive nature of biological diversity and ecosystems calls for policies with heterogeneous objectives” (Ring and Barton, 2015, p. 416).*

In this context, policy mix can be understood as *“a combination of policy instruments which has evolved to influence the quantity and quality of biodiversity conservation and ecosystem service provision in public and private sectors” (Ring and Schröter-Schlaack, 2011, p. 15).* Following the literature, at least three major categories can be applied to biodiversity conservation policies to form a policy mix: 1) regulatory instruments; 2) economic instruments; and 3) informational and motivational instruments (Ring and Barton, 2015; Ring and Schröter-Schlaack, 2011).

Of the many economic instruments, the general literature of environmental policy stresses the adoption of environmental taxes, charges, and fees to internalize negative externalities (following the polluter-pays principle). However, following a Coasean approach, other instruments were developed in environmental policy literature to address payments for environmental services - PES (Muradian et al., 2010).

At the beginning of the 1990s in Brazil, the ecological fiscal transfers (EFT) emerged on the environmental policy institutional setting. This environmental policy instrument is based on intergovernmental transfers between upper and lower levels of government aiming to enhance the ecological public goods and services (Ring and Barton, 2015). Following the literature on ETF, there are several possible reasons for ecological fiscal transfers: 1) compensation of expenses/supply costs for ecological and public services, 2) compensation for opportunity costs, 3) payments for external benefits, and 4) fiscal equalization and distributive fairness (Ring and Barton, 2015; Ring and Schröter-Schlaack, 2011).

#### 2.4 POLICY-MIX, ECOLOGICAL FISCAL TRANSFERS AND SOLID WASTE MANAGEMENT

Traditionally<sup>1</sup>, local governments are responsible for collecting a service fee from households to provide waste-related public services such as the collection, removal, and disposal of trash. Although Brazilian municipalities report this revenue in their budgets, the amounts collected are not enough to ensure adequate waste-related public services for their households. Also, these public services require high economic burden on their budgets. Thus, some Brazilian municipalities with uncollected or poorly disposed-of waste end up suffering from public health hazards. All these issues are reported as major problems for the developing countries (Pearce and Turner, 1994).

<sup>1</sup> This section is largely based on the draft working paper presented at the Biennial Conference of the United States Society for Ecological Economics in 2017 (Paulo et al., 2017).



According to Welivita et al. (2015), solid waste management in developing countries such as Brazil is a considerable challenge to local authorities. The authors point out the increase in the population, constraints in the financial, technical, institutional, and social structure, urban migration, and higher consumption levels among households as problems faced in those countries. Thus, to solve these issues, policy instruments have to be implemented at all levels of governments. The environmental literature points out two main types of policy instruments: the first is based on command and control, i.e., environmental rules and their enforcement; and the second, market-based instruments, are characterized as instruments of positive incentive, mixed-incentive instruments, and voluntary instruments (Jones et al., 2010; Pearce and Turner, 1993).

In the Brazilian case, there are both types of policy instruments: command and control and market-based instruments. The Brazilian National Policy on Solid Waste attempts to provide a mix of command and control, as well as market-based instruments (Jabbour et al., 2014). Besides, there is another policy instrument based on fiscal transfers already adopted in some Brazilian states. Only in Brazil are ecological fiscal transfers (EFT) also used for solid waste management. In the other countries, EFT focuses mostly on biodiversity conservation policies (Borie et al., 2014; Droste et al., 2017b). In the Brazilian case, ecological fiscal transfers are part of an overall policy-mix to achieve many public policy objectives. According to Flanagan et al. (2011a, p. 702), the term policy mix can be understood as "*interactions and interdependencies between different policies as they affect the extent to which intended policy outcomes are achieved*". Some Brazilian states adopted EFT as a means to achieve solid waste policies, such as recycling, the creation of landfills, and so on. To date, eight out of twenty-six states adopted indicators related to solid waste management to fiscal transfers, in which some local governments receive more money from them to collect and dispose of their waste correctly.

## 2.5 ECOLOGICAL FISCAL TRANSFERS

Ecological fiscal transfers (EFT) redistribute revenues from upper to lower levels of government using ecological indicators (Ring and Barton, 2015). Typically, intergovernmental transfers use inhabitant or area-related indicators, being the use of ecological indicators the main novelty in EFT schemes. EFT can be adopted both in centrally organized countries, in which fiscal transfers are distributed from central to local levels and in federally organized countries, in which fiscal transfers are distributed by the states (Boadway and Shah, 2009; Ring and Barton, 2015).

There are at least three different rationales for EFT adoption. First, most countries adopt the "principle of subsidiarity" to environmental policies, in which municipalities bear the costs of biodiversity conservation. In this case, the role of EFT is to

compensate sub-national government's expenses (supply costs) on ecological public goods and services. Second, according to the "principle of equivalence" (Olson, 1969), some decentralized levels of government provide ecological public services that end up generating external benefits beyond their boundaries (spill-over effect). Thus, EFT may be used as payment for external benefits (Ring and Schröter-Schlaack, 2011). Third, an EFT scheme may be implemented to compensate the opportunity costs due to revenue loss generated by land use restrictions (Sauquet et al., 2014) imposed by national to sub-national governments, as well as to compensate tax revenue losses from private landowners. In practical terms, these rationales are "highly dependent on the country's legal and institutional framework - not least the financial constitution" (Ring and Barton, 2015, p. 439).

According to Schröter-Schlaack et al. (2014), each specific EFT scheme in place differs in the type of transfers applied, which can be either lump-sum (unconditional fiscal transfers) or earmarked (conditional fiscal transfers). Other features of EFT can be highlighted: the costs or benefits that are imposed; the type of indicators (quantitative or qualitative); the scale, that is, "the number of decentralized governments that can benefit from EFT" (Schröter-Schlaack et al., 2014, p. 108); the origin or type of financial funds allocated, and the overall amount of financial resources distributed.

So far, three countries have adopted an EFT scheme: Brazil (Ring, 2008), Portugal (Santos et al., 2012), and, on a small scale, France (Schröter-Schlaack et al., 2014). Only Brazil and Portugal have implemented ecological fiscal transfers to compensate municipalities for the costs of land-use restrictions related to protected areas (Santos et al., 2012). In France, the EFT scheme is a lump-sum allocation to municipalities with part of their territory situated in national parks or natural marine parks (Schröter-Schlaack et al., 2014).

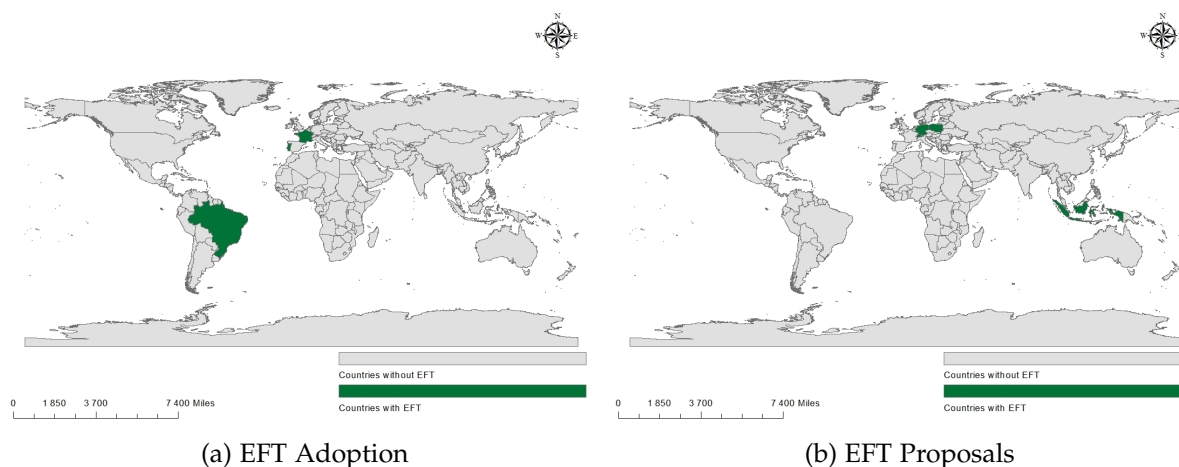


Figure 2.: EFT adoption and proposals

The pioneer in adopting an EFT scheme was Brazil at the beginning of the 1990s. The state of Paraná implemented it in 1991, and others followed the diffusion process (Medeiros, 2013). To this date, there are sixteen states with an EFT scheme dealing with biodiversity conservation as well as ecological public goods and services. While different indicators are used, all states have at least one ecological indicator in common based on conservation units, term assigned to protected areas in Brazil (Ring, 2008; Santos et al., 2012).

In Europe, Portugal was the first country to adopt an EFT scheme with the approval of a revised Local Finances Law in January 2007 (Santos et al., 2012). The ecological fiscal transfers are non-earmarked and the criteria adopted are the total area under protection and the percentage of local land designated as protected area. More recently, Droste et al. (2017b, p. 1) studied *"whether introducing EFT in Portugal incentivized municipalities to designate PA and has led to a decentralization of conservation decisions"*. The authors conclude that the EFT in Portugal contribute to *"a significant increase in the ratio of municipal and national PA designations"* (Droste et al., 2017b, p. 1). In France, the EFT scheme is based on the "ecological solidarity" idea, that is, *"the municipalities are compensated for the opportunity costs of conservation imposed by the land-use restrictions associated with strictly protected areas"* (Schröter-Schlaack et al., 2014, p. 104).

In other countries, the issue of EFT entered the political arena, such as in Poland (Schröter-Schlaack et al., 2014), while in others their theoretical effects were simulated, such as in Germany (Ring, 2002), in Switzerland (Köllner et al., 2002), and in Indonesia (Mumbunan et al., 2012). The EFT mechanism in Poland was drafted by the Council of the Rural Boroughs Association, aiming compensation payments due to land-use restrictions relating to Natura 2000 sites or protected areas. These transfers were prepared to be implemented as lump-sum transfers and based on algorithms proposed by the Ministry of Finance (Schröter-Schlaack et al., 2014). In Germany, theoretical proposals to consider ecological indicators in the fiscal transfers systems have been presented for almost two decades, but the primary task nowadays is to put them for discussion in the policy arena (Ring, 2002; Schröter-Schlaack et al., 2014). In Switzerland, the ecological fiscal transfers were theoretically modeled by the integration of cantonal biodiversity benchmarking in the intergovernmental fiscal relations (Köllner et al., 2002).

In sum, EFT proposals across these countries focus on biodiversity conservation policies only, aiming to enhance protected areas. However, EFT literature still needs to *"provide potential positive and adverse effects of such ecological fiscal transfers in diverse ecological and social contexts"* (Borie et al., 2014, p. 8). In Brazil, some Brazilian EFT schemes across states have already adopted EFT in other ecological and social contexts, mainly for solid waste management.

### 2.5.1 Ecological Fiscal Transfers in Brazil

The ecological fiscal transfer (EFT) in Brazil constitutes part of the ICMS tax, which is collected by the state governments and transferred to local governments. The states are free to decide upon the criteria used in these transfers. Some states include environmental criteria to transfer the ICMS, mainly those related to incentivize the creation and maintenance of protected areas, landfills, recycling centers, and composting plants. This section provides an overview of the EFT literature at the state level and the local level in two types of policies: the policy for biodiversity conservation and the policy for solid waste management.

At the state level, Ring (2008) describes EFT in Brazil. Based on public finance theories, the author states that EFT have two goals: to provide a *"compensation for land-use restrictions and an incentive to value and engage in more conservation activities at the local level"* (Ring, 2008, p. 485). In the end, the study suggests the use of EFT in other federal systems such as in European countries. Concerning EFT adoption, Medeiros (2013) raises the hypothesis that the party-political affiliations matter in spreading EFT across Brazilian states. Also, the author compares the group of adopters to the group of non-adopters using the mean of the protected areas, the mean of the gross domestic product, and the mean of the human development index. The study concludes that *"the differences between the two groups were not significant in the t-test"* (Medeiros, 2013, p. 7). It is the only study to address this issue in Brazil. Therefore, so far, there is not a conclusive study that discusses how the adoption occurred across Brazilian states and what explains the differences in the timing of adopting the policy instrument. Moura (2015) conducts a comparative study of the legal and institutional aspects of the EFT across Brazilian states through an analysis of its historical path and legal development. This study presents a lacuna to be filled in the EFT literature to explain to what extent the conflicts between the state governments and local governments may affect the policy process of formulating and implementing the EFT.

At the local level, Grieg-Gran (2001) studied the compensation and incentive component of the ecological fiscal transfers to the protected area in Minas Gerais and Rondônia. The author compares these two states to Paraná, the first adopter of EFT in Brazil. Concerning the compensation component, the study concludes that *"the inclusion of a new criterion in the ICMS allocation implies that the weight given to an existing criterion has to be reduced"* (Grieg-Gran, 2001, p. 30). In the incentive dimension, the *"ICMS ecológico has the potential to create incentives for conservation but the effect appears to be highly variable"* (Grieg-Gran, 2001, p. 31). Droste et al. (2017c) provide an overview of the incentives of EFT for Brazilian states. Specifically, the authors investigate *"whether the introduction of this economic instrument in a state offers incentives to municipal responses in terms of further protected area (PA) designation"* (Droste et al., 2017c,

p. 1). The findings suggest an incentive effect of EFT over the years, highlighting that *"there are clear indications for local responses to the implementation of EFT: after an ICMS-E introduction additional municipal PA are designated"* (Droste et al., 2017c, p. 13).

Moreover, Loureiro (2002) offers an analysis of how the EFT contributed to biodiversity conservation policies in Paraná. The author concludes that *ICMS Ecológico* contributed to an increase in the number of protected areas and the quality of such enterprises. In addition, the adoption of EFT affected positively the quality of the management in the environmental agency in six municipalities. Sauquet et al. (2014) describe and explain the sources and consequences of the incentive component of EFT in creating protected areas and promoting strategic interaction among local governments. The study concludes that the creation of local PA in the state of Paraná *"reveals strategic substitutability in municipalities' conservation decisions"*; that is, *"the creation of [PA] by a municipality decreases the incentive of neighboring municipalities to create [PA]"* (Sauquet et al., 2014, p. 249, 252).

Silva Júnior and Sobral (2014) investigate the effectiveness of the EFT in Pernambuco to incentivize the improvement of education, health services, and local tax revenues. They assume an altruistic hypothesis in which *"os gestores municipais são agentes econômicos que maximizam o bem-estar social de seus municípios"* (Silva Júnior and Sobral, 2014, p. 192). The findings point to a higher incentive across local governments in health services followed by the local tax revenues and education. Silva Júnior, et al (2012) analyze the effectiveness of the EFT in Pernambuco to improve the protected area. The authors conclude that the ecological fiscal transfers are inefficient to achieve that policy at the local level. Paulo (2013) also evaluates the EFT for protected areas in Pernambuco from 2008 to 2013. The findings highlight that the local policies lose performance over time when compared to the municipalities from the countryside to those that belong to the metropolitan region. Paulo and Pedrosa (2009) offer an in-depth analysis to check the effectiveness of an EFT in Camaragibe, a municipality that belongs to the state of Pernambuco. The authors conclude that an EFT scheme does not incentivize the municipality to improve local protected areas. They also suggest that the state government should implement the quality index to measure the protected area and the creation of a municipal fund for environmental policies since the EFT are not earmarked. Paulo, F. L. L. and Pedrosa, I. V. (2015) discuss the importance of monitoring the EFT performance by the state government to improve the desired outcome of the policy instrument. They offer in-depth analysis in Araripina, a municipality which is located in the countryside in the state of Pernambuco.

Gonçalves (2003) analyzes the EFT based on the fiscal federalism literature. The study focuses on the redistributive and compensatory impact of the EFTs in Minas Gerais. The author concludes that the redistributive effect of EFTs is essential to support environmental policies at the local level, mainly for poor municipalities. In

addition, the compensation dimension contributes to cover the opportunity cost of economic activities across local governments. [Fernandes et al. \(2011\)](#) address the compensation and incentive component of the EFTs in Minas Gerais. The results point out that the *ICMS Ecológico* works as an instrument to incentivize and compensate the municipalities to create new protected areas, despite the fact that ecological fiscal transfers have been weakened over the years.

In Rio de Janeiro, [Conti \(2015\)](#) addresses the implication of the EFT for the management of protected areas at the municipal level, focusing on their creation and maintenance. The author concludes that the *ICMS Ecológico* is an important policy instrument to incentivize the creation of protected areas at the local level, despite the effectiveness of the EFTs being affected negatively by the absence of human resources in environmental agencies in the municipalities and by the absence of social control to monitor the financial resource received from the EFT.

Some studies also address the effectiveness of the EFT on solid waste management in Brazil although this is still very scarce. In Minas Gerais, [Prado Filho and Sobreira \(2007, p. 52\)](#) conclude that the EFT scheme *"has been promoting substantial environmental benefits to the local communities, despite it is still small the number of cities which have been attended by this regulation for solid waste management"*. [Souza et al. \(2015, p. 571\)](#) assess the *"applicability of CONAMA Resolution 358/2005 in the public healthcare establishments, located in 48 municipalities that receive Ecological ICMS in the state of Minas Gerais"*. The authors conclude that the local governments faced problems in the intra-establishment stage, which includes the generation, segregation, internal packaging, collection, transportation, treatment, and disposal of the solid healthcare waste. In contrast, in the extra-establishment stage, which includes the external transportation, treatment, and disposal of the healthcare waste, they found that most of the municipalities had success, *"probably because of Ecological ICMS they received, including the disposal of waste"* ([Souza et al., 2015, p. 571](#)). In the state of Pernambuco, [Silva Júnior, et al \(2012\)](#) conclude that the *"ICMS Socioambiental"* did not contribute to the increase of the solid waste management across local governments. [Paulo \(2013\)](#) notes a similar pattern in Pernambuco. The author concludes that only twelve municipalities out of one hundred eighty-four presented an increase in landfills.

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## ESSAY 1. UNDERSTANDING THE ADOPTION OF ECOLOGICAL FISCAL TRANSFERS IN BRAZIL: A TRANSACTION COSTS APPROACH

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Ecological Fiscal Transfers (EFT) from states to municipalities was adopted by sixteen of the twenty-six Brazilian states since 1990's to stimulate and compensate districts for achieving some environmental goals. This study describes and explains the adoption of EFT policy instrument across Brazilian states framed on the transaction-costs politics and the institutional collective action frameworks and argues that the vertical relations between the federal and state governments increase the EFT adoption rate across states. The hypotheses are built in two types of transaction-costs, legislative decision-making costs and commitment costs, and are empirically tested using event history analysis for the period of 1990 to 2015. The conclusions point to the idea that the adoption rate increases over time and, more broadly, that the transaction cost-politics framework and the institutional collective action framework can explain EFT adoption partially.

**Keywords**— Policy Adoption, Ecological Fiscal Transfers, Transaction Cost Theory

### 3.1 INTRODUCTION

The Ecological Fiscal Transfers (EFT) was adopted in Brazil since the 1990's to redistribute revenues to lower levels of government using indicators based on environmental criteria (Ring and Barton, 2015). This mechanism is known under different names: *Hoobin Hood Law* in the state of Minas Gerais; *Imposto Sobre Circulação de Mercadorias e Serviços (ICMS) Socioambiental* in the state of Pernambuco; and *ICMS Ecológico (ICMS-E)* or *ICMS Verde* in other states. They are all referred to as a policy instrument to compensate opportunity costs associated with land-use restrictions for biodiversity conservation, watershed protection, or landfills, as well as to promote the creation of new municipal protected areas and programs related to solid waste management. A common feature in all adopted mechanisms is its redistributive effect, which may generate conflicts among several political actors (Lowi, 1972; Jatobá, 2005).

The extensive literature on EFT brings some empirical evidence on the compensation and incentive of this policy instrument. Concerning the incentive dimension, Droste et al. (2017c) conclude that *"the introduction of ICMS-E schemes [in Brazil] on average corresponds, ceteris paribus, to higher total PA coverage"*, while Grieg-Gran (2001) concludes that in Minas Gerais the EFT *"would be very financially attractive to create protected areas. [but] for others, the motivation for setting aside land for protection would have to come from other factors."* Concerning the compensation dimension, in Minas Gerais the *"ICMS ecológico was partially successful in compensating counties for the restrictions on land use implied by the presence of protected areas"* (Grieg-Gran, 2001). To be precise, the compensation dimension in Minas Gerais tends to be stronger for poor local governments (Fernandes et al., 2011).

The first state to enact an EFT scheme was Paraná (Ring, 2008) and, by now, through a diffusion process (Medeiros, 2013), sixteen states, out of twenty-six, use EFT to redistribute the ICMS, a type of Value Added Tax (VAT). But, as expected, not all Brazilian states have adopted this scheme. So far the interaction of state government and municipalities is not entirely understood. The EFT play a substantial role in the overall environmental policy mix in Brazil. It may explain the EFT adoption across the states, because the EFT constitute just one policy instrument within many others that are used to achieve policy goals in environmental fields. A pioneering study adopted a descriptive and qualitative methodology, raised the hypothesis that party ideology and the convergence zone (CZ) between adopters and non-adopters could explain EFT adoption and diffusion (Medeiros, 2013). In sum, the literature of EFT adoption is still very scarce and calls for further investigation.

Framed on the transaction-cost politics this study describes and explains the adoption of EFT policy instrument across Brazilian states from 1990 to 2015. The next section presents the specific case of EFT implementation in Brazil. Section three develops a set of hypotheses to explain the EFT adoption within the political transaction costs framework and institutional collective action framework. Section four presents the research design and the event history analysis approach. Section five presents the findings and discusses its theoretical and empirical relevance. Section six conclude with some policy recommendations and discusses some suggestions for future studies.

### 3.2 ECOLOGICAL FISCAL TRANSFERS: BRAZILIAN INSTITUTIONAL AND LEGAL CONTEXT

The Federal Constitution (CF) establishes the primary rule of the EFT scheme and asserts that it may potentially be adopted across any Brazilian state. According to article 154 of the CF, twenty-five percent of the total amount raised by the Brazilian



tax on the circulation of goods, interstate and intercity transportation and communication services (*ICMS*) belongs to municipalities. Three-quarters of such tax revenue is transferred to cities using the criterion of value-added. It means that states are free to distribute only one-fourth to local governments, so they can define the requirements to be used in the design of intergovernmental fiscal transfers. The EFT mechanism is just a small part dedicated to environmental or conservation policies included in the twenty-five percent freely distributed by states to municipalities, that is, a share of six point twenty-five percent of total *ICMS* revenue collected by the state governments. Figure 3 details this scheme of distributing *ICMS* revenues to states and municipalities and how it turns into distribution.

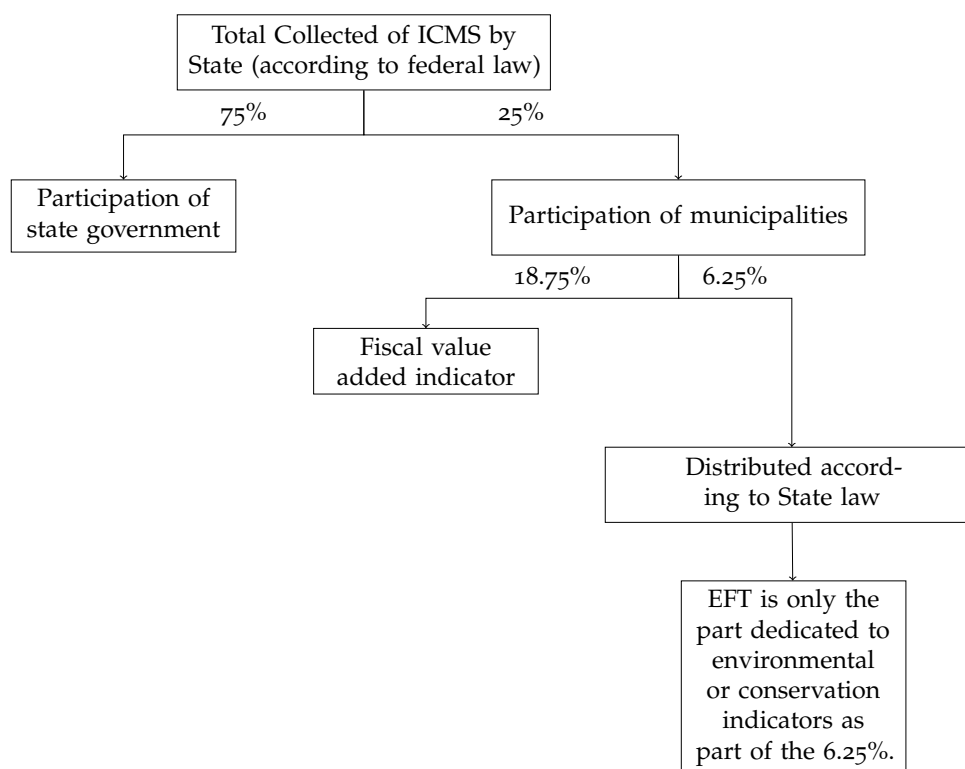


Figure 3.: EFT scheme in Brazil

While standard intergovernmental transfers use inhabitant or area-related indicators, the use of ecological indicators is the main novelty in EFT schemes. The literature presents at least three different rationales for EFT adoption (Ring and Barton, 2015). First, most countries adopt the *principle of subsidiarity* to environmental policies, in which municipalities bear the costs of biodiversity conservation. In this case, the role of EFT is to compensate sub-national governments' expenses (supply costs) on ecological public goods and services. Second, according to the *principle of equivalence* (Olson, 1969), some decentralized levels of government provide ecological public services that end up generating external benefits beyond their boundaries (spill-over effect). Thus, it may be used as payment for external benefits (Ring and Schröter-Schlaack, 2011). Third, an EFT scheme may be implemented to compensate the opportunity costs due

to revenue loss, generated by land-use restrictions (May et al., 2012) imposed by national to sub-national governments, as well as to compensate tax revenue losses from private landowners. In practical terms, these rationales are *"highly dependent on the country's legal and institutional framework - not least the financial constitution"* (Ring and Barton, 2015, p. 439)

Theoretically, Schröter-Schlaack et al. (2014) declare that each specific EFT scheme in place differs according to the type of transfers applied, which can be either lump sum, i.e., unconditional fiscal transfers, or earmarked, i.e., conditional fiscal transfers. EFT adopted in Brazil are non-earmarked, meaning that the local governments are free to decide upon the use of EFT revenue in their budgets. Other features of EFT concern the type of costs or benefits imposed. Quantitative or qualitative indexes may measure the protected areas hosted by local governments, and both can compose the environmental index to be used in EFT. The scale of the EFT scheme also varies across countries, that is, *"the number of decentralized governments that can benefit from EFT"* can differ in each EFT scheme (Schröter-Schlaack et al., 2014, p. 108). The origin or type of financial funds allocated may also be different, and the overall amount of financial resources distributed in the scheme can differ between them.

Concerning the policy process to adopt EFT, the governor may suggest changes in the taxes laws only in some specific examples, as the case described in the constitutional law in the state of Paraíba. Apart from that, citizens, governor, or congressmen may propose an EFT law to be discussed and, then, approved or rejected by the legislative or executive branches. When the policy process of adopting the EFT begins with the governor, the executive branch proposes it, and the governor may approve or veto it after receiving the project from the legislative branch. Beginning with the legislative branch, the congressman introduces an EFT proposal, and if the governor vetoes it, the absolute majority of the State Congress can ultimately approve it. The governor can veto the draft law claiming that it does not meet public interest or that it is unconstitutional. If approved, environmental agency of the state details the EFT procedures and implement the ecological fiscal transfers to local governments.

Through the Brazilian Constitution of 1988, municipalities were consolidated as autonomous bodies, sharing a role in the environmental protection of their territories with upper levels of government. After that, the National System of Protected Areas (SNUC), enacted in 2000, shaped many aspects concerning protected areas at local level in Brazil, mainly regarding the classification of the categories of protected areas. Later on, the National Policy on Solid Waste (PNRS), enacted in 2010, imposed to local governments a deadline for the deactivation of irregular landfills - an enormous garbage dump that is usually adopted in Brazil due to the low cost of its implementation and operation. Within this institutional setting, the EFT arose in the 1990s as a new economic instrument for Brazilian states, mostly due to the referred overall

absence of technical and financial capacity to cope with environmental issues across municipalities (May et al., 2012).

The EFT scheme adopted in Brazil imposes redistributive effects to municipalities, creating the group of local governments positively affected (*winners*) and the group negatively affected (*losers*) throughout policy operation stage. This effect may lead to resistance within political actors involved in the policy process in the sense of changing the current institutional arrangement to a new one.

### 3.3 THE POLICY ADOPTION OF ECOLOGICAL FISCAL TRANSFERS

Intergovernmental relations between the state government and municipal governments can be seen as a contract between states (principals) and municipalities (agents). In the case of EFT laws, the proposers of each state, who can be either the governor or the state congressman, will seek to maximize their interests according to the set of institutional environment. The mayors in local governments follow the same pattern, that is, to maximize their chances of reelections and, accordingly, they tend to create the best structure of governance to reach that goal. In this type of policy arena, as noted by Epstein and O'Halloran (1999), the state and the local governments will arrange their structure of governance to minimize the overall transaction costs. Similarly, our goal is to explain the EFT adoption across states which regards some types of transaction costs that may impose barriers to enact such fiscal transfers.

The core of our analysis addresses two types of transaction costs that surround any EFT scheme in Brazil: 1) the commitment costs, and 2) the legislative decision-making costs. The commitment costs relate with the uncertainty that surfaces the ecological fiscal transfers scheme due to the changes in the amount of money to be transferred to municipalities over time (Grieg-Gran, 2001) and the delegation from the state legislature to the state executive branch, which may lead to changes in the criteria in the EFT legislation over the years. The legislative decision-making costs deal with costs in the policy-making process at the legislative and executive branches. At this point we agree with Hawkins and Andrew (2011) which demonstrate that the vertical relations between different levels of governments reduce barriers that inhibit cooperation.

Most of the drafters of the EFT scheme perceive that they will be affected during the first years of policy implementation and they tend to be cautious in the EFT design. Even though more power to enact an EFT law (*ex-ante* power) and hold the *residual rights* the environmental criteria (*ex-post*). There are two main reasons to explain the drafters' precautions in changing the institutional context of the fiscal transfers: first, the municipal governments tend to predict the loss of money from the state fiscal transfers in their budgets and to forecast the difficulty of state government to support

them along the first years of the policy implementation (Jatobá, 2005; Grieg-Gran, 2001); second, the delegation process from the legislative branch to the environmental state agency in order to detail the procedures and to implement the scheme tends to increase the uncertainty of the criteria to be used in the fiscal transfers over the years. Usually, environmental agency in the state may change the environmental criteria over the years. These uncertainties may lead to commitment costs, that is, to increase the costs to guarantee the effectiveness of the EFT legislation in the future. At this point we agree with Horn (1995, p. 01) which states that *"to secure continued electoral support, [the] coalitions must deliver durable net benefits to their constituents"*.

The state government may suffer pressure from organized groups, such as from the associations of municipalities, to hold back the adoption process (Jatobá, 2005; Grieg-Gran, 2001). Although the state government owns most of the residual rights during the policy process, we expect it to be more difficult for the state government to impose a new institutional arrangement when the groups of *winners* and *losers* among local governments are substantial (Jatobá, 2005; Grieg-Gran, 2001). Thus, as the districts own more environmental assets to meet the requirements of the EFT, the probability of an EFT scheme adoption by the state government decreases to avoid conflicts among jurisdictions and, accordingly, to decrease commitment costs. The transaction-cost politics framework also predicts that the municipalities expect to maximize their budgets, while state governments hope to achieve specific goals in their environmental public policies (Epstein and O'Halloran, 1999). Therefore, both tend to structure their arrangements of governance to minimize the level of transaction costs. Formally, the first hypothesis is the following:

*H1: The likelihood of adopting the EFT is higher in the states with fewer protected areas among municipalities.*

The legislative decision-making costs also play a substantial role, together with the impact on local budgets measured by the total of protected areas at the beginning of the policy implementation. As Pinho and Veiga (2005, p. 18) have noted in the literature of rational opportunistic business cycles models, the *"incumbents relax fiscal policy before balloting periods to increase their re-election chances."* Then, electoral years tend to increase the legislative decision-making costs. Therefore, to avoid risking electoral support during electoral years because of legislative decision-making costs, we expect that the state government tends to enact an EFT scheme in a non-electoral period. Therefore, the hypothesis is:

*H2: The probability of adopting the EFT is higher in a non-electoral year.*

The EFT policy instrument should also be evaluated considering the set of environmental public policies, even though different levels of government apply those policies. The extensive literature of EFT finds that this policy instrument is a component of the policy-mix (Ring and Schröter-Schlaack, 2011; Ring and Barton, 2015). The

institutional collective action framework predicts that vertical relations may facilitate implementing policies among different levels of governments (Hawkins and Andrew, 2011).

In Brazil, there are two central national policies which drive environmental policies at the state and local level: 1) the National Policy on Protected Areas (SNUC) and 2) the National Policy on Solid Waste (PNRS). The SNUC and PNRS impose primary stringent performance standards to be met by the state and local governments to receive financial support from the federal government and from private enterprises in order to implement policies related to solid waste management and protected area. Therefore, the implementation of these policies ends up leading to coordination of environmental policies among the state governments to meet the federal requirements, as well as to guarantee grants from public and private sources. Therefore, we argue the EFT adoption may be faster when the federal government adopts directives to drive environmental policy instruments across states. The expectation is that SNUC and PNRS policies play an essential role in EFT adoption across Brazilian states. Thus:

*H3: The probability of adopting the EFT is higher after the implementation of the National Policy on Protected Areas (SNUC) and the National Policy on Solid Waste (PNRS)*

### 3.4 EMPIRICAL STRATEGY

After the descriptive analysis of the evolution of EFT legislation over time and across states, our analysis is based on the event history analysis (EHA)(Box-Steffensmeier and Jones, 2004). With EHA we describe how an event occurred (failure), tracking the states until EFT adoption (failure) and those who do not adopt (survival) through the hazard rates. In addition we run Weibull regressions to test the hypotheses presented in the last section. To check the robustness of the results, two different regressions were performed. (see Appendix B for a technical note on EHA)

The dependent variable in the regression is a combination of time to adoption and the event described as a dummy variable (one if the state adopts the EFT scheme, the first EFT law; zero otherwise). We include all twenty-six Brazilian states, excluding the federal district because, according to the CF, it is not under the EFT rules. We included all states that enacted the EFT law, even if they have not effectively implemented later on. In order to know the exact year for each policy adoption, we consulted each state's EFT law. The period under analysis comprises 1991 to 2015.

The first explanatory variable is the share of protected areas in the total territory of the state. It is computed as the sum of protected area in each state in the year of EFT adoption divided by the total area of the state. This total area includes municipal, state and federal PAs and the data was collected directly from the Brazilian states

under the law of access to public information. Also, in order to complement the data collected, part of the database used in the study of [Droste et al. \(2017c\)](#) was accessed.

The second explanatory variable is the electoral years, measured as dummies variables (one for the electoral years, zero otherwise). The expectation is that the EFT adoption is more likely during non-electoral years. Due to the redistributive effects of this policy instrument, the governors and proposers will tend to avoid conflicts between mayors across local governments. These mayor can support them during electoral years. The third explanatory variable used the PNRS and SNUC, estimating them by dummies variables (one for the years with PNRS and SNUC adopted, zero otherwise). This data was collected directly from the PNRS and SNUC law. The expectation is that the EFT adoption is more likely after PNRS and SNUC adoption.

As control variables, we used the party ideology of the governor and the neighboring states. The political literature predicts that the ideological polarization may shape the process of policy adoption ([Murillo and Martinez-Gallardo, 2007](#)). Taking into account that the governor has veto power and can facilitate or retard the policy process of adopting an EFT scheme, we expect that the probability of adopting the EFT is higher when the governor belongs to a center-leaning political party. We collected the data related to the political party of governors in the official gazette and through a formal request by the author under the law on access to public information. The policy adoption literature also addresses that the states are used to observing their neighbors policy experimentation. Bureaucrats attending regional conferences usually tend to share ideas with their neighboring states ([Berry and Berry, 1990](#); [Matisoff, 2008](#)). Therefore, we included a dummy variable: one if the state has a neighbor adopter, zero otherwise. The expectation is that the EFT diffusion across states tends to be higher when it is noticed that a neighbor state adopted an EFT scheme.

Summing up, table 2 presents the entire group of variables and their expected effects and table 3 presents the descriptive statistics of the variables:

Table 2.: Expected results

Variables	Expectation
Share of PAs of total territory of state	Increase the duration of the event
Center-leaning political party	Decrease the duration of the event
Non-electoral years	Decrease the duration of the event
National Policy of Protected Areas	Decrease the duration of the event
National Policy of Solid Waste	Decrease the duration of the event
EFT scheme in a neighbor state	Decrease the duration of the event

Source: the author

Table 3.: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Duration in years of the event	15.115	8.608	0	24	26
1 in case of EFT adoption, 0 otherwise	0.654	0.485	0	1	26
Share of PAs of total territory of state	11.302	10.23	0.076	32.497	26
Center-leaning political party	0.385	0.496	0	1	26
Non-electoral years	0.923	0.272	0	1	26
EFT scheme in a neighbor state	0.885	0.326	0	1	26
National Policy of Protected Areas	0.654	0.485	0	1	26
National Policy of Solid Waste	0.462	0.508	0	1	26

Source: compiled by author

### 3.5 FINDINGS

#### 3.5.1 *How was the adoption of the EFT across states?*

The states of São Paulo, Mato Grosso do Sul, Minas Gerais, Amapá, Rondônia and the Rio Grande do Sul followed Paraná in early 1990s, the first adopter. They adopted a first wave of legislation introducing one or more ecological indicator to distribute fiscal transfers from ICMS. The executive branch proposed an EFT scheme in the states of São Paulo, Minas Gerais, Pernambuco, Tocantins, Rio de Janeiro, and Pará. In the states of Paraná, Mato Grosso do Sul, Amapá, Rondônia, Rio Grande do Sul, Mato Grosso, Acre, Ceará, Piauí, Goiás and Paraíba the state congressmen played this role. Figure 4 graphically depicts the pattern of enactment of the first legislation of EFT across Brazilian states.

The hazard rate is raising more markedly after twelve years, which means that the probability of adopting an EFT scheme increases as time evolves (see figure 5). The interpretation is that, as time passes, the states are more likely to experience the event adopted by others and are more likely to take an EFT scheme.

The Kaplan-Meier survival estimate (see figure 6) shows that, at the end of the period, thirty-six percent of states remained in the sample, that is, those that did not adopt an EFT scheme. This study considered only those states that at least enacted the EFT law, which means that the research includes Paraíba state that approved its EFT legislation but has not implemented it so far. Moreover, between the thirteenth and fifteenth year, sixty percent of the sample remained without an EFT scheme.

There are two leading groups of ecological indicators to be considered in EFT schemes: the first is related to protected areas, that is, biodiversity conservation policies at the local level, and the second concerns solid waste management across municipalities (see table 4).

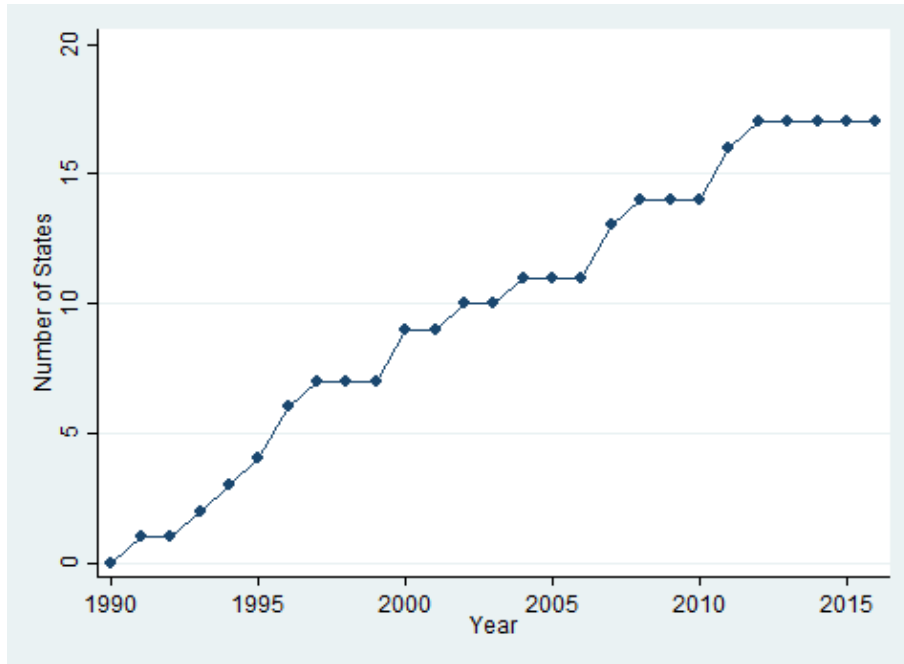


Figure 4.: Evolution of EFT adoption in Brazil (1991 to 2015)

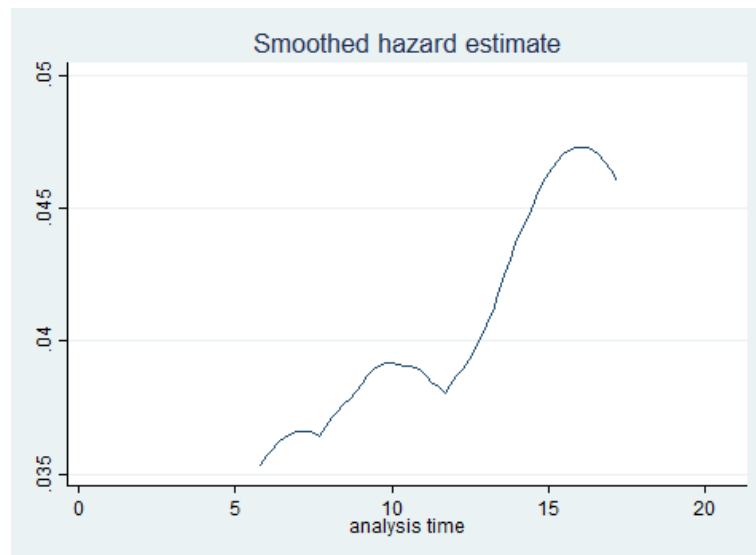


Figure 5.: Hazard ratio for adoption of EFT

Figure 7 offers the spatial distribution of the states with an EFT scheme already adopted in which use protected area and solid waste management indicators. Figure 8 depicts the states grouped into geographic regions. The states from the northeast part of the country have higher survival rate than other. Although this difference is not statistically significant, this means that this group of states tends to be more likely to survive, that is, to delay or simply not adopt an EFT scheme. This difference is higher if we compare the Northeast to the states located in the Midwest (see Table 9 in the appendix). Seven adoptions are expected in the Northeast, while in the Midwest



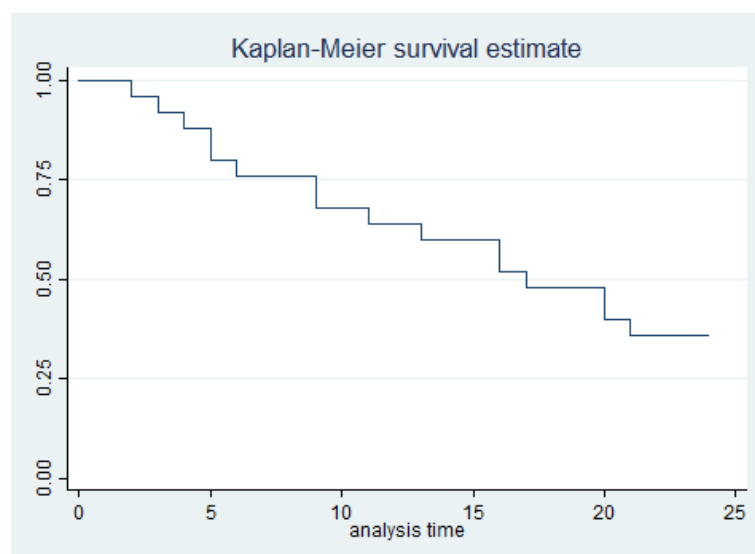


Figure 6.: Survival

Table 4.: EFT Schemes

State	Protected Area	Solid Waste Management
Paraná	x	
São Paulo	x	
Mato Grosso do Sul	x	x
Minas Gerais	x	x
Amapá	x	
Rondônia	x	
Rio Grande do Sul	x	
Pernambuco	x	x
Mato Grosso	x	x
Tocantins	x	x
Acre	x	
Ceará	x	x
Rio de Janeiro	x	x
Piauí	x	x
Goiás	x	x
Paraíba	x	x
Pará	x	

Source: compiled by author from [The Nature Conservancy](#)

only one is expected to occur. However, only four states adopted an EFT scheme in the Northeast, while three states did it in the Midwest.

Among the group of adopters, some of them designed their EFT scheme in way to avoid the short-run direct impact on the municipalities' budget (see figure 9). Due to the redistributive effects of the EFT, some adopters used the strategy of the gradual implementation of the percentage dedicated to ecological criteria. It means that the rates related to the environmental criteria were not fixed immediately as their final

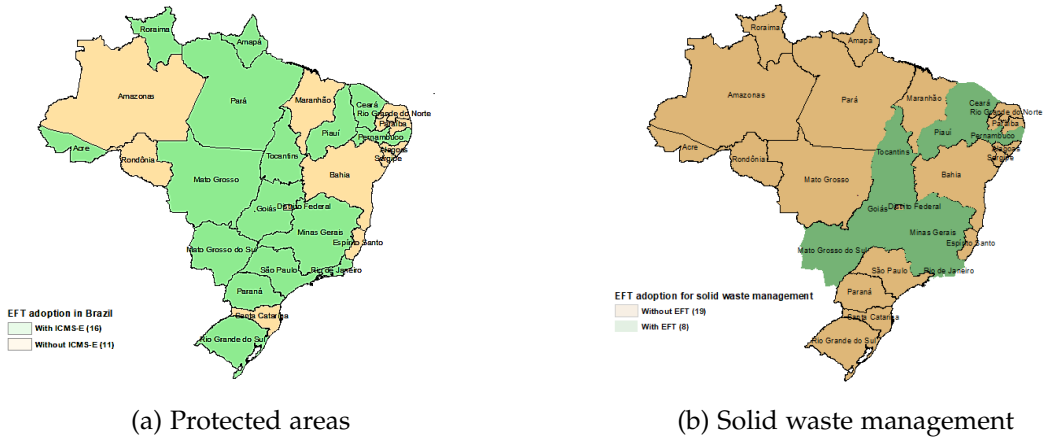


Figure 7.: Spatial distribution of EFT (2017)

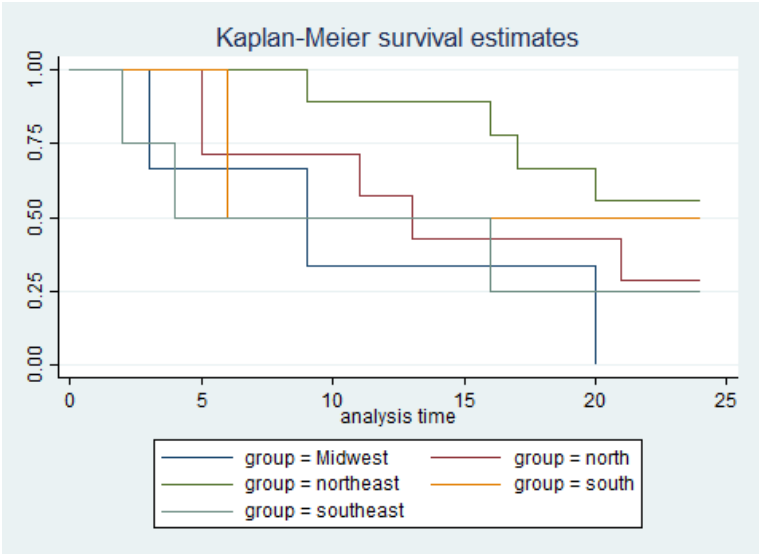


Figure 8.: Groups of states by geographic regions

value but, instead, increased over the years until the target of the policy instrument was reached. This result is consistent with the theory of transaction costs, which asserts that the legislators tend to minimize conflicts in the policy-making process to decrease the commitment costs.

The temporal gap can be up to five years, and the delay to reach the policy outcome is slightly higher among the last adopters (see again figure 9). Each point in the graph represents the time lag in years of each state to adopt EFT. For example, the state of Tocantins, the tenth adopter, took five years to implement its indicator related to the protected area and indigenous land (UCTI). One percent for the first year, one point five percent for the second year, two percent for the third year, two point five percent for the fourth year, and three point five percent for the fifth year. The other environmental criteria followed the same pattern: fire control (CCQ); soil conservation (CS);

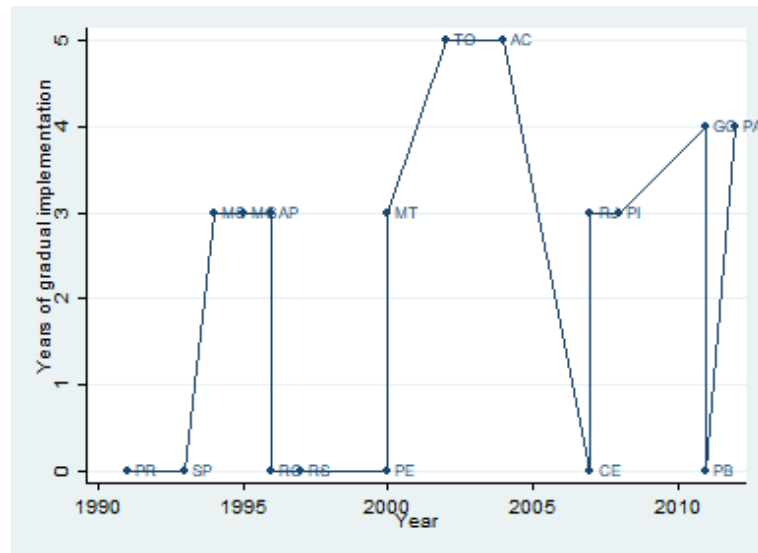


Figure 9.: Gradual increase of ecological rates

local ecological policy (PNMA) water conservation, and the collection and treatment of solid waste (SBCA) (see figure 10).

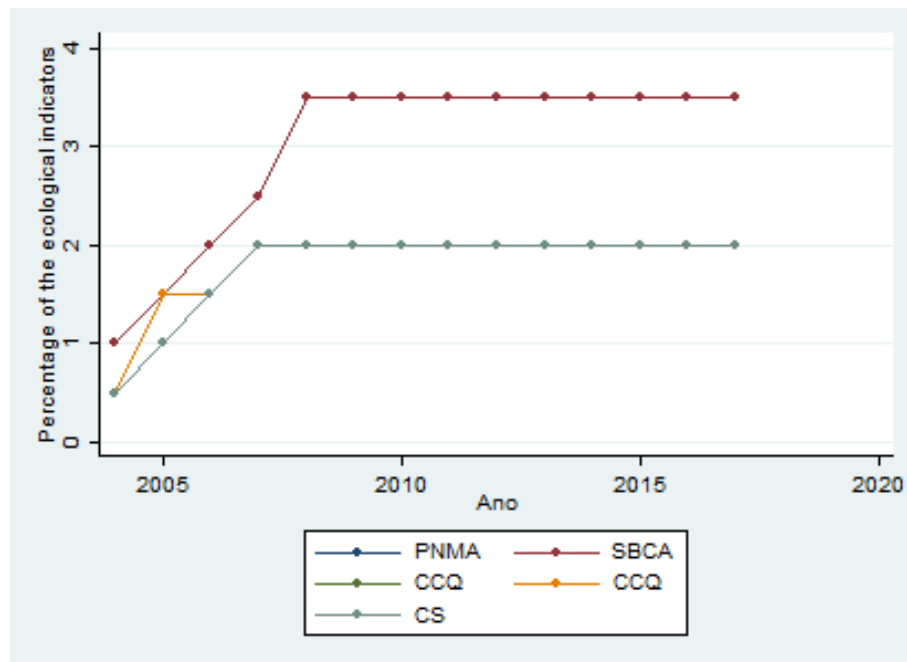


Figure 10.: Graduate increase of ecological criteria in the state of Tocantins

In contrast, the state of Paraíba, which is the penultimate adopter to enacted the EFT law, did not propose to implement the percentage dedicated to environmental criteria in a gradual pace over time. It may also explain the barriers which this state faced to implement the EFT scheme. It is suspended at present.

Some studies stress that the politics and ideology may lead to a political competition which plays a significant role in policy adoption (Murillo and Martinez-Gallardo, 2007; Pinho and Veiga, 2005). As Pinho and Veiga (2005, p. 14) have noted, mayors

may pressure “the central government in order to receive a larger amount of funds during municipal election years.” Exploring EFT adoption across Brazilian states, we found that the first legislation is more frequently enacted in the first year after elections, as depicted in figure 11.

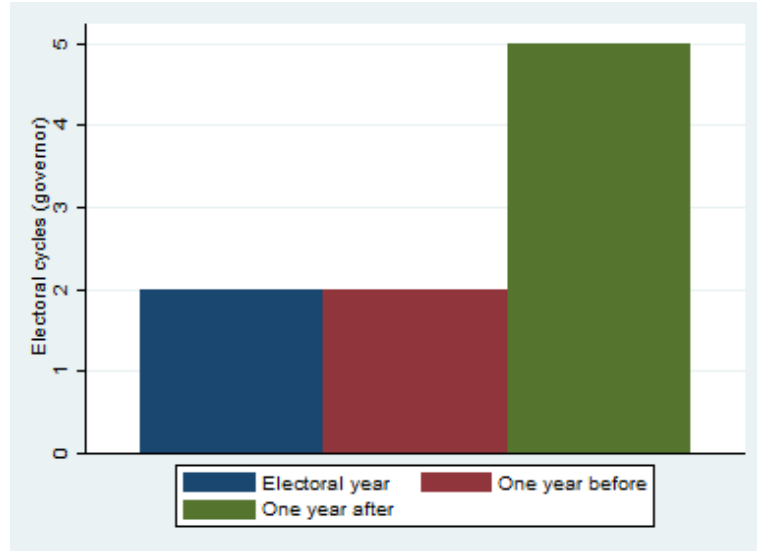
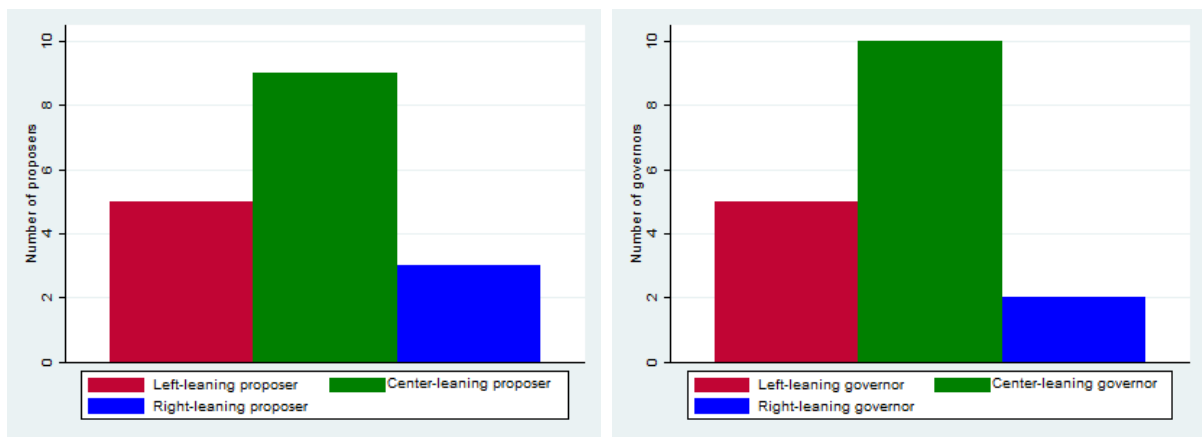


Figure 11.: Electoral cycles

This descriptive result suggests a strategic timing of adoption, arguably as a way to minimize conflicts among coalitions due to the redistributive effects of the EFT. So, the literature points that the ideological polarization may shape the process of policy adoption (Murillo and Martinez-Gallardo, 2007). In this sense, it is clear that the center-leaning political parties in Brazil are more likely to both propose and enact EFT laws (see the details in the appendix - table 8 and 7). Figure 12a and 12b depict the EFT adoption and the party ideology of proposers and governors respectively.



(a) Party ideology of the proposer

(b) Party ideology of the governor

Figure 12.: Party ideology of the governors

The idea is that central-leaning parties are in a better position to fill the median voters preference as they can reduce some conflicts between political actors across coalitions (Mueller, 2008; Roozendaal, 1990). It seems that an ideologically central party is more present in the coalitions enacting an EFT law.

### 3.5.2 What explains the adoption of the EFT across states?

Table 23 presents the results of Weibull regression. The most important finding is that the non-electoral year increases the adoption rates over time. This result is coherent with what we observed in the descriptive analysis and supports the second hypothesis which asserts that the probability of adopting the EFT is higher in a non-electoral year. The theory of transaction cost politics predicts that the legislators tend to avoid conflicts during electoral years to decrease the legislative decision-making costs, that is, to prevent an adverse and feared reaction of the electorate.

Table 5.: Weibull regression

	(1)	(2)
Share of PAs of total territory of state	0.0539 (1.49)	0.0464 (1.31)
Center-leaning political party	-0.0919 (-0.11)	
Non-electoral years	-2.320* (-2.38)	-2.290* (-2.39)
National Policy of Protected Areas	-4.425*** (-3.38)	-4.228*** (-3.89)
National Policy of Solid Waste	-2.711** (-3.13)	-2.431** (-2.89)
EFT scheme in a neighbor state		15.45 (0.01)
Constant	-5.707*** (-3.46)	-21.16 (-0.01)
ln_p Constant	1.415*** (6.83)	1.405*** (6.85)
Observations	25	25

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Besides, although non statistically significant, the share of protected area in the territory appears with the expected positive sign, meaning that the adoption tends to be slower in the states with more protected areas. However, we have to be cautious with this interpretation. In the state of Amazonas, for example, a different definition of this result may mean that the state most likely does not need more protected areas, so the EFT scheme does not make a substantial contribution to protecting the biodiversity.

The situation where the governor belongs to a center-leaning political party appears not significant to explain the timing of adoption of EFT. The effect of the figure 12b turns not to be substantial when we control it with other independent variables. In fact, the transaction cost politics framework asserts that the political actors are rational in their choices. Therefore, political ideology plays no substantial role in this case.

We also performed the regression with and without neighbor effect as recommended by the traditional literature. The results were not statistically significant. In fact, this is not surprising, because new technologies bring new ways of sharing and supporting ideas among political coalitions, reducing the relative importance of neighborhood.

Finally, in our model, the National Policy on Solid Waste (PNRS) and the National Policy on Protected Area (SNUC) play similar roles in the EFT adoption. Both contribute to increase the adoption rate over time. The difference is merely the moment when the federal government enacted each law, that is, while the enactment of the SNUC occurred in 2000, the PNRS enactment was in 2010. This result corroborates the institutional collective action framework in the sense that the vertical relations of different levels of governments matter to coordinate environmental policies at the state level. Also, it corroborates the policy-mix theoretical framework (Flanagan et al., 2011b), in the sense that the combination of a policy instrument actively contributes to the desired policy outcome.

Globally, the parametric results partially support that the legislators tend to minimize the conflicts at the legislative decision-making moment. The EFT adoption leads to several redistributive effects among jurisdictions, which impacts the budgets across local governments. In addition, the results support the hypothesis related to the vertical relation which is built in the institutional collective action framework.

### 3.6 CONCLUSION

This research contributes to the EFT and the policy adoption literature. This study is the first to investigate the effect of the redistributive forces of their policy instrument to explain its adoption over time, mainly in the sense of conflicts among political actors.

We present empirical evidence which supports the idea of legislative decision-making costs and commitment costs. To be precise, the probability of adopting the

EFT is higher in a non-electoral year, demonstrating that politicians tend to avoid conflicts during electoral years and, consequently, to minimize the costs related to the legislative decision-making process.

The results also provide some ground for policy recommendations, particularly for developing or emerging countries, such as Brazil. However, we need to be cautious about how to export these policy recommendations to other countries, with different economic, political, social, and environmental contexts. The ecological fiscal transfers are a new policy instrument, as we pointed out throughout the essay. Brazil is a vast country and has several differences especially in social, economic and environmental aspects. It is a characteristic of most of developing countries. However, this policy instrument carries with it a top-down decision, from the state to local governments. Therefore, we recommend the involvement of the local governments during the policy process of adopting the EFT due to the redistributive effects.

Some research avenues can be foreseen. First, within the group of adopters there are time lags between the enactment of the EFT law and its practical implementation. Most of the adopters presented throughout this study faced technical or staff limitations or pressures from various interest groups. One example is the Paraíba, which suffered an action of unconstitutionality by its state court, thereby interrupting EFT's effective adoption. The difference between the year of the first legislation of EFT and its practical implementation may be explained by the delegation process of EFT, from the legislative and executive branch to the state environmental agencies (Epstein and O'Halloran, 1999; Horn, 1995). The limitations in technical support for rules supervision, as well as the pressures of political actors, may be negatively affected by the changes in the way the ICMS is and may be an explanation for it. Theoretically, the literature points out that *"a simple rule change can lead to major changes in outcomes"* (Ostrom et al., 1994, p. 96), then it may lead to several conflicts among municipalities and inside the environmental agencies as well. However, these possible explanations call for future studies and more empirical evidence.

APPENDIX A - TABLES

Table 6.: Survival

time	begin	fail	net_lost	survivor	std_err	lb	ub
2	25	1	0	0.96	3.9191835884530853E-2	0.74838502419475794	0.99426695074883775
3	24	1	0	0.92	5.4258639865002144E-2	0.71639033725806356	0.97937058542804956
4	23	1	0	0.88	6.4992307237087696E-2	0.67256145286335944	0.95963983233203254
5	22	2	0	0.8	8.0000000000000016E-2	0.58444908820295327	0.91145805956458303
6	20	1	0	0.76	8.5416626016250483E-2	0.54204812246675282	0.88427763784153512
9	19	2	0	0.68	9.3295230317524805E-2	0.46093445128271304	0.82527313468308128
11	17	1	0	0.64	9.600000000000002E-2	0.42214773839248976	0.79377831371292273
13	16	1	0	0.6	9.7979589711327114E-2	0.38449139267534937	0.76109265247556113
16	15	2	0	0.52	9.9919967974374371E-2	0.31248728063699899	0.69237585468463081
17	13	1	0	0.48	9.9919967974374371E-2	0.2781326746201539	0.65640285360017647
20	12	2	0	0.4	9.7979589711327128E-2	0.21281600601784664	0.5812317287465063
21	10	1	0	0.36	9.6000000000000016E-2	0.18194728513007274	0.54197897642953419
24	9	0	9	0.36	9.6000000000000016E-2	0.18194728513007274	0.54197897642953419

Source: compiled by author



Table 7.: Governor's Party Ideology

State	Governor's Name / Acronym of the Political Party	Party Ideology
Paraná	Alvaro Fernandes Dias / PMDB	Center
Paraná	Alvaro Fernandes Dias / PMDB	Center
São Paulo	Luiz Antonio F. Filho / PMDB	Center
Mato Grosso do Sul	Pedro Predossian / PTB	Center
Minas Gerais	Eduardo Brandão de Azeredo / PSDB	Center
Amapá	João Capiberibe / PSB	Left
Rondônia	Valdir Raupp de Matos / PMDB	Center
Rio Grande do Sul	Antonio Brito Filho / PMDB	Center
Pernambuco	Jarbas Vasconcelos / PMDB	Center
Mato Grosso	Dante Martins de Oliveira / PSDB	Center
Tocantins	José Wilson S. Campos / PFL	Right
Acre	Jorge Viana / PT	Left
Ceará	Cid Gomes / PSB	Left
Rio de Janeiro	Sérgio Cabral / PMDB	Center
Piauí	Jose Wellington B. A. Dias / PT	Left
Goiás	Alcides Rodrigues / PP	Right
Paraíba	Ricardo V. Coutinho / PSB	Left
Pará	Simão Jatene / PSDB	Center

Source: compiled by author from each state legislation

## APPENDIX B - TECHNICAL NOTE ON EHA

*Mathematical components of EHA*

Considering that our dependent variable has a continuous probability distribution, the EHA explains failure as the probability of an event (adoption) occurring in a time interval. The approval of an EFT scheme is the probability that an event (transition from non-adopter to adopter) occurs during the range from 0 to  $t$  (Blossfeld et al., 2007; Box-Steffensmeier and Jones, 2004). Moreover, it has to be less or equal to  $t$  (see equation 1):

$$\mathbf{F}(t) = \mathbf{Pr}(\mathbf{T} \leq t) = \int_0^t \mathbf{f}(s) \mathbf{d}s$$

(1)

Using the survival estimation, we measured the Brazilian states that remain in the sample as time goes on. Formally, the survival function is the probability that the duration will be at least  $t$ , and "that the event by which the current episode comes to an end occurs later than  $t$ " (Blossfeld et al., 2007, p. 34) as described through the probability distribution by Blossfeld et al. (2007) and Box-Steffensmeier and Jones (2004) (see equation 2):

$$\mathbf{S}(t) = 1 - \mathbf{F}(t) = \mathbf{Prob}(\mathbf{T} \geq t)$$

(2)

Estimating the probability of the Brazilian states that fail (to adopt an EFT scheme) and the probability of the states that survive (do not adopt an EFT scheme), we measured the hazard rate. The hazard rate is the probability that the duration will end at time  $t$ , given that the Brazilian states are at risk at time  $t$  (see equation 3).

$$\mathbf{lambda}(t) = \frac{\mathbf{F}(t)}{\mathbf{S}(t)}$$

(3)

The equation above is described by Blossfeld et al. (2007) and Box-Steffensmeier and Jones (2004).

#### *Non-parametric descriptive methods*

According to Blossfeld et al. (2007), the non-parametric method is suited for the first exploratory data analysis. This method does not make assumptions with regard to the distribution of the process, that is, there are no regressors in the study. Thus, first we calculated the hazard function, that is, the number of events as a proportion of the number of observations at risk. Then, we measured the cumulative hazard function, that is, summed up all of the hazard functions over time (see equation 4).

$$\Lambda(t_j) = \sum \frac{d_j}{n_j}$$

(4)

Another method that we used in this study for the non-parametric estimation of the survivor function was the Kaplan-Meier estimator, also known as product-limit estimation. This method "is based on the calculation of a risk set at every point in time where at least one event occurred" (Blossfeld et al., 2007, p. 72). Mathematically, the Kaplan-Meier estimator takes the ratios of those without events over those that are at risk and multiplies them over time (see equation 16).

$$s(t_j) = \prod \frac{n_j - d_j}{n_j}$$

(5)

Graphically, the Kaplan-Meier survival functions present the decrease of the function step by step with a skip at each discrete event time.

#### *Parametric method*

Among the set of parametric models, we choose the Weibull. In our distribution, the hazard rates are not constant. Therefore, the Weibull model is the appropriate model

that allows increasing or decreasing hazard rates. Formally, the hazard function in Weibull model has the following mathematical formulation (equation 17):

$$\gamma\alpha^{\alpha-1}$$

(6)

Additionally, the survival function in Weibull model has the following mathematical formulation (equation 18):

$$\exp(-\gamma t)^\alpha$$

(7)

For this choice, we follow [Box-Steffensmeier and Jones \(2004, p. 25\)](#), that state *"if a researcher suspects the hazard rate is increasing or decreasing then a Weibull distribution function may be appropriate."*

Table 8.: Proposer's Party Ideology

State	Proposer's Name / Acronym of the Political Party	Party Ideology
Paraná	Neivo Beraldin (State Congressman) / PP	Right
São Paulo	Luiz Antônio Fleury Filho (Governor) / PMDB	Center
Mato Grosso do Sul	Waldir Neves / PTB (State Congressman) / PTB	Center
Minas Gerais	Eduardo Brandão de Azevedo (Governor) / PSDB	Center
Amapá	João Alberto R. Capiberibe (Governor) / PSB	Left
Rondônia	Dede de Melo (State Congressman) / PDT	Center
Rio Grande do Sul	Darci P. de Mattos (State Congressman) / PDT	Center
Pernambuco	Jarbas Vasconcelos (Governor) / PMDB	Center
Mato Grosso	Gilney Viana (State Congressman) / PT	Left
Tocantins	Jose Wilson S. Campos (Governor) / PFL	Right
Acre	Taumaturgo Lima (State Congressman) / PT	Left
Ceará	Lula Morais (State Congressman) / PCdoB	Left
Rio de Janeiro	Sérgio Cabral (Governor) / PMDB	Center
Piauí	Lilian Martins (State Congressman) / PSB	Left
Goiás	Daniel Goulart (State Congressman) / PSDB	Center
Paraíba	Francisco Quintans (State Congressman) / DEM	Right
Pará	Simão Jatene (Governor) / PSDB	Center

Source: compiled by author from each state legislation

Table 9.: Geographical regions

State	Geographical regions
Acre	North
Amapá	North
Rondônia	North
Tocantins	North
Pará	North
Roraima	North
Amazonas	North
Ceará	Northeast
Pernambuco	Northeast
Piauí	Northeast
Paraíba	Northeast
Alagoas	Northeast
Bahia	Northeast
Rio Grande do Norte	Northeast
Sergipe	Northeast
Maranhão	Northeast
Mato Grosso do Sul	Midwest
Mato Grosso	Midwest
Goiás	Midwest
Rio de Janeiro	Southeast
Minas Gerais	Southeast
São Paulo	Southeast
Espírito Santo	Southeast
Paraná	South
Rio Grande do Sul	South
Santa Catarina	South

Source: compiled by author from the Brazilian Institute of Geography and Statistics (IBGE)

Table 10.: EFT adoption

State	First Law (EFT)	Time-lag (years)
Paraná	1991	0
São Paulo	1993	0
Mato Grosso do Sul	1994	0
Minas Gerais	1995	3
Amapá	1996	3
Rondônia	1996	0
Rio Grande do Sul	1997	0
Pernambuco	2000	0
Mato Grosso	2000	3
Tocantins	2002	5
Acre	2004	5
Ceará	2007	0
Rio de Janeiro	2007	3
Piauí	2008	3
Goiás	2011	4
Paraíba	2011	0
Pará	2012	4

Source: compiled by author from each state legislation





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## ESSAY 2. BETTER LATE THAN NEVER: AN ANALYSIS OF THE DELAY IN IMPLEMENTING ECOLOGICAL FISCAL TRANSFERS IN BRAZIL

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This paper seeks to explain the delay and termination following the adoption of the ecological fiscal transfers (EFT) schemes across Brazilian states. Based on the transaction cost-politics framework, the central argument is that the legislative branch tends to minimize their costs at the policy-making stage. At the implementation stage, the legislative branch delegates to the state agencies the role of refining EFT procedures and, as such, increases the costs to them. To test these arguments, an empirical strategy based on case-study analysis was used to describe the time-lags and the policy terminations of each state. Our findings provide evidence of the presence of gridlocks in the formulation stage and delegation problems in the political-bureaucratic relationship at the implementation stage. Also, the absence of a gradual increase to implement the percentage dedicated to ecological criteria in each state, explains the delays in the implementation of the EFT schemes. In the end, we recommend flexibility in the design of the scheme and the involvement of political actors in the policy process of adopting EFT.

**Keywords**— Ecological Fiscal Transfers, Policy Delay and Termination, Transaction-Cost Politics

### 4.1 INTRODUCTION

Extensive literature highlights the Ecological Fiscal Transfers (EFT) in Brazil as a state policy instrument, created to extend protected areas (PA) and based on a mechanism to compensate local governments for the positive externalities derived from biodiversity conservation (Grieg-Gran, 2001; Loureiro, 2002; Ring, 2008; Droste et al., 2017d). The EFT scheme affects the municipal budgets (Ring, 2008) and the spatial interaction between local governments (Sauquet et al., 2014). Nevertheless, the adoption of EFT by Brazilian states presents several cases of delay and termination. In most cases, the delay occurred between the first enacted EFT law by the legislative power and the

beginning of the practical implementation of fiscal transfers to municipalities (Paulo and Camões, 2017; Droste et al., 2015). Nine states, out of seventeen, with at least the first EFT law enacted observed this type of delay. As an extreme case, the state of Paraíba has not adopted the EFT scheme yet. Figure 13 depicts the time-lags between the first EFT law enacted (moment of policy formulation) and its practical implementation across Brazilian states.

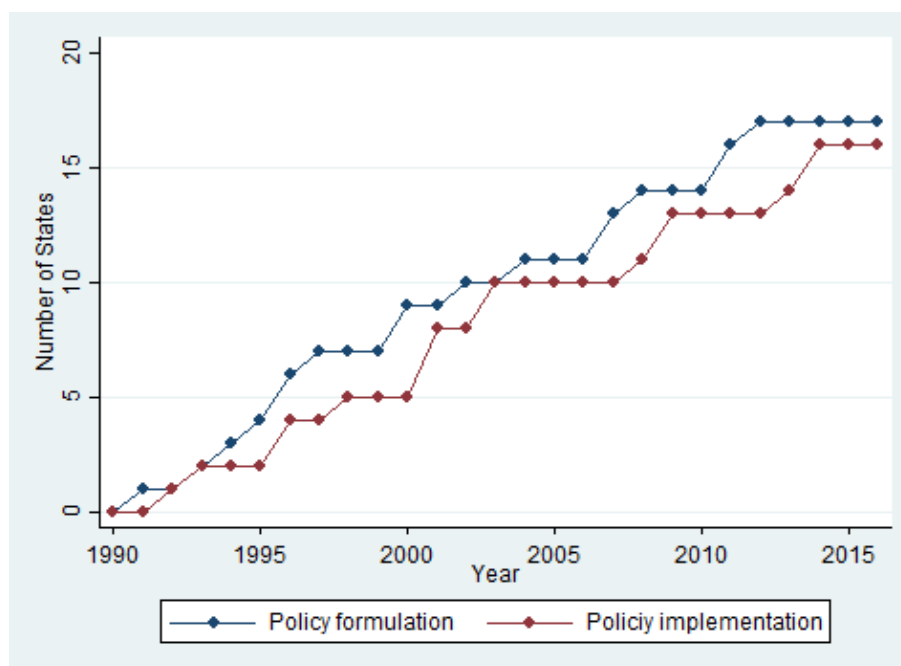


Figure 13.: EFT adoption and implementation

As Ring and Barton (2015, p. 440) have noted, an EFT scheme constitutes “part of a country’s or a state’s constitution and are regulated by additional laws and decrees.” In Brazil, the process of EFT formulation starts either on the legislative or executive branch. Both have the power to propose a draft of the EFT law and then send it to the legislative branch. Later, the governor receives the law project and may either approve or veto it. If the governor backs the EFT project, the legislative branch can enact it at the end of the formulation process. There are occasions when a law may be proposed by citizens’ initiative also. After the formulation process, the state environmental agency enforces the EFT scheme. Figure 14 summarizes the policy process of formulation and implementation of an EFT scheme. Delays and terminations can be observed both in the formulation and implementation stage.

The general public policy literature points that a policy delay may constitute part of the policy process (DeLeon, 1978; Geva-May, 2004). We regard the adoption of EFT as the result of the interplay among several political actors involved in the policy process, such as governors, bureaucrats, state congressmen, lobby groups, and mayors. To be precise, we argue that the legislative branch tends to reduce the decision-making costs not to jeopardize the chances of reelection and, accordingly, delegates to envi-

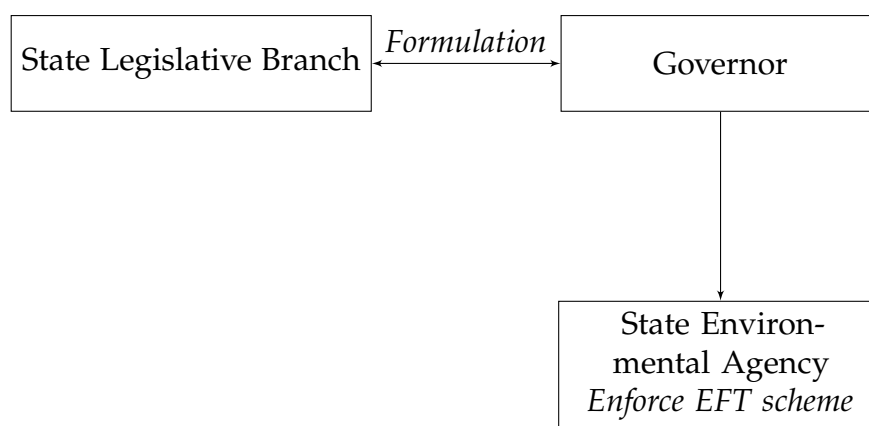


Figure 14.: Policy process of EFT formulation and implementation

ronmental state agencies the role of refining the details in EFT schemes. Therefore, the agencies cost increases, because the delegation process imposes them to state agencies, which complicates the implementation process of EFT. Also, the delegation process may not occur, which means that the legislative decision-making process may be interrupted.

Based on the transaction-cost politics perspective (Horn, 1995; Epstein and O'Halloran, 1999; Dixit, 1996), this essay seeks to detail how the delays and policy terminations occurred in the nine states that adopted an EFT scheme, and to provide possible explanations as well. This paper has four sections more. The next addresses more broadly the theoretical literature for understanding policy delay and termination, framed in the transaction-cost theory. Section 4.3 presents a transaction cost theory to understand delays and terminations in ecological fiscal transfers. Part 4.4 offers a set of in-depth case studies of the time-lags to adopt an EFT scheme and some policy terminations. The last part sums up the findings and provides some policy recommendations, as well as suggestions for future research.

#### 4.2 TRANSACTION-COST POLITICS PERSPECTIVE FOR UNDERSTANDING POLICY DELAY AND TERMINATION

The transaction-cost politics provides some explanations for understanding a policy delay or termination. The process of policy adoption is pervaded with information asymmetries among political actors leading to moral hazard and adverse selection problems (Horn, 1995; Dixit, 1996; Epstein and O'Halloran, 1999). Dixit (2003) classifies the asymmetric information in the political process in three stages: 1) *ex-ante stage*; 2) *interim-stage*; and 3) *ex-post stage*.

The *ex-ante stage* comprises a moment in which there is no information asymmetry, despite being characterized as a moment with a high degree of uncertainty among political players (Dixit, 2003). Typically, during this phase, legislators produce general

rules without detailing specific outcomes, that is, without pointing to special interests. It is the Constitutional stage, in which it is possible to obtain the unanimous consent from political actors for general decisions (Buchanan, 1987; Dixit, 2003). Therefore, the probability of failure in this stage is very low, as long as the political actors share similar powers concerning the policy to be adopted. In an environment without asymmetric information and with similar shares of political power, the policy design tends to be more flexible and more accessible to be enacted.

At the *interim stage*, the information asymmetries begin to be relevant (Dixit, 2003; Spiller, 2003). At this stage, rule-making can lead to moral hazard and adverse selection among political actors (Spiller, 2003). The adverse selection comes from the different qualities of decisions among players. Those who have more quality of information will be in a better-position in the rule-making process. In addition, the rule-making process can facilitate unexpected moves political actors in the future, that is, the moral hazard problem. If at least one player has more veto power than the others, this can lead to failure. To avoid failures in the rule-making process, the various interests related to the predicted outcome of the policy have to be taken into account. It is also important to include incentive-constraints in the rules for all participants, mainly for veto-players, and the design of the policy has to include repeated interactions to create commitment ties.

Overcoming the adverse selection and moral hazard at the *interim stage* of the policy process is a tremendous challenge for many less-developed countries (LDCs). This stage comprises the legislative decision-making and the implementation process. The legislative decision-making process constitutes the step in which political actors discuss a more specific policy. The transaction-cost politics framework assumes that the political actors are self-interested, in the sense of increasing their chances of reelections (Epstein and O'Halloran, 1999; Horn, 1995). Therefore, the legislators face two options at the moment of enacting a law: adopt vague legislation and delegate the role to refine it to agencies to avoid conflicts and, so, increase their political and electoral support; or take a specific law and decrease their chances of reelection. It is, of course, not a general situation that applies to all policy domains. The delegation process varies according to the types of public policies, where one of them can be more relevant to jeopardize the chances of legislator's reelection than others (Epstein and O'Halloran, 1999). With respect to the delegation process and the logic of transaction cost economics, "*the choice of whether or not to delegate is the political equivalent of a firm's make-or-buy decision*" (Epstein and O'Halloran, 1999, p. 63).

The process of delegating the role of refining a vague law to agencies implies to increase the uncertainty costs and to predict all of the unforeseen circumstances that may affect the value of the legislation in the future. As Horn (1995, p. 15) has noted, the "*legislative decision-making costs are also likely to increase with the difficulty*

of identifying, at the time of enactment, all of the contingencies that may affect the value of the legislation." In a policy-making under separating powers, such as between national and sub-national government, the uncertainty can increase the commitment costs and, consequently, impose barriers to achieve the desired policy outcome. The effects of the delegation process can be stronger for LDCs.

These barriers may increase when the interaction between agencies leads to different tasks in the agent's effort costs. For example, when a national state agency imposes functions to a sub-national government, they act as substitutes of their efforts. As Dixit (2003, p. 126) has noted, "if the principal increases the power of the output-based incentive for activity 1, the agent exerts more effort on this activity, which increases his marginal cost of effort on activity 2." In contrast, these costs can lower when agencies act cooperatively.

However, coordination still faces barriers to be implemented in LDCs and emerging countries. Dixit (2003) notes that most of these countries face problems with human capital, infrastructure to provide enforcement services, transparency (communication), and with the design of the institutions that, in most of them, have colonial roots. These problems lead to information asymmetry, as well as to common agency problems, in which there are several groups with varied interests and sufficient power to change the policy-making agencies. These issues may lead to different types of policy delay and termination, such as the implementation of varying paces of the legislative enactment and the interruption of the whole or part of public policy.

Finally, at the *ex-post* stage the information asymmetries do not exist anymore (Dixit, 1996, 2003; Spiller, 2003). If this stage exists at all in the real-world of the policy process, all information is revealed to all players and the probability of policy delays and terminations is very low.

#### 4.3 ECOLOGICAL FISCAL TRANSFERS: DELAY AND TERMINATION

The Federal Constitution of Brazil (CF) determines that twenty-five percent of the total amount raised by the *Imposto Sobre Circulação de Mercadorias e Serviços* (ICMS), a type of Value Added Tax (VAT<sup>1</sup>.) collected by the state government, is dedicated to municipalities. From this amount, three-quarters are transferred to local governments according to the criteria of fiscal value added and with only one-fourth of it, the state government can define environmental rules (Moura, 2015). Figure 25 presents this mechanism.

Therefore, the EFT in Brazil constitute a small part of the ICMS to be transferred from the state government to local governments. According to Sauquet et al. (2014,

<sup>1</sup> In general terms, the Brazilian VAT constitutes the net sales of goods, communication services or transportation under the ICMS rules incurred by each municipality

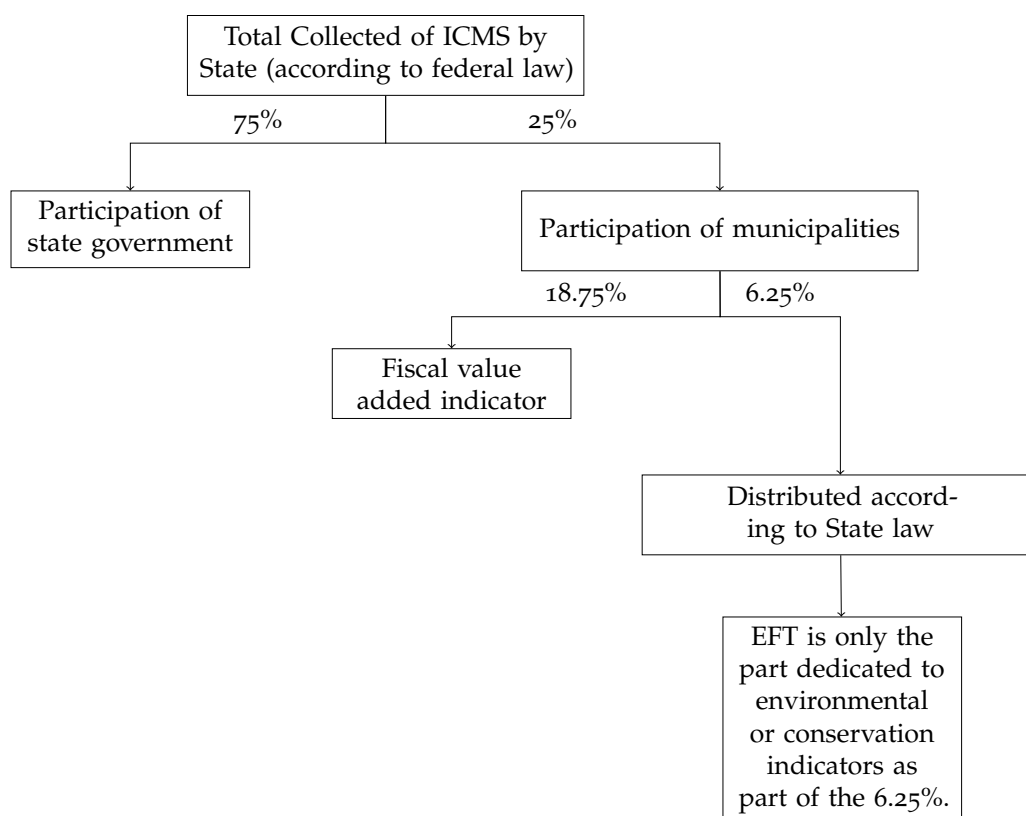


Figure 15.: EFT scheme in Brazil

p. 250), the primary objective of the EFT at the beginning of their implementation in Brazil was to reduce the *"biodiversity loss by stimulating the creation and management of protected areas"*. With the time, other EFT schemes in Brazil also included criteria related to solid waste management (Paulo et al., 2017)

The protected areas indexes which constitute the overall ecological fiscal transfers scheme may use quantitative and qualitative measurements. The EFT usually use the quantitative measurement of total area of the PA, while local governments actions are used to ensure the quality of the protected area in order to guarantee efficient biodiversity protection . As Ring and Barton (2015, p. 442) have noted, *"qualitative indicators is an important requirement for generating better synergies between fiscal transfers and protected area regulation (...)"*. However, it expects that the adoption of qualitative measurements imposes additional costs to local governments related to monitoring the protected areas (Ring and Barton, 2015).

The policy process to propose environmental criteria to distribute the ICMS involves the legislative and executive branches, as well as a state environmental agency. The transaction-cost politics framework assumes that the political actors involved in the adoption and implementation of EFT scheme are self-interested, seeking their own goals. Therefore, during the *ex-ante stage* (Dixit, 2003) of the EFT policy process, political actors face extreme uncertainty. In Brazil, this is the constitutional stage. The rules are flexible and more general. Also, each state has the freedom to enact criteria to

distribute the ICMS revenues to municipalities according to their policy preferences (Ring, 2008). The probability of failure at this stage is very low.

At the *interim-stage* (Dixit, 2003), the draft of the EFT law is proposed by either a governor or a state congressman (Paulo and Camões, 2017). The TCP predicts that these political actors may begin to make private decisions using common rules. Mayors, state congressman, governors, and lobby groups have enough information to predict their losses and gains differently. Local governments may pressure the EFT's proposer. Accordingly, these rules do not necessarily become socially efficient because *"the formal rules, are created to serve the interests of those with the bargaining power to create new rules"* (North, 1993, p. 360). Therefore, it has to distinguish what is an EFT delay and the typical procedures in the policy process.

The executive and the legislative branches enact the environmental criteria to distribute the ICMS to municipalities and delegate to environmental agencies the role to refine the details, such as the operational procedures and specific rules that are highly dependent on technical expertise. As Ring and Barton (2015, p. 440) have noted, the EFT *"policy design, implementation and monitoring may be supported by environmental ministries and conservation or forest authorities"*. In general, the environmental state agencies have a determined time, predicted in the first general EFT law, to design the details, implement, and monitor the scheme. However, the state agencies sometimes delay the EFT enforcement. Also, the legislative and executive branches occasionally decide to modify some previous criteria.

As always the political process of an EFT scheme creates *winners* and *losers* (Grieg-Gran, 2001), when a group of local governments loses revenue from fiscal transfers and while another group gains it. The ICMS redistribution in an emerging country, where inequalities are prominent across local governments, leads to several conflicts and hampers an agreement. As Dixit (2003, p. 114) notes, *"an interim stage where the potential winners and losers are already identified is not likely to result in an easy agreement on a "better" rule or institution."* Moreover, the probability of changing the EFT rules as time evolves is increasing. Powers change among players over time, and they tend to respond to external shocks in the politics and the economy.

In this institutional context, the absence of an institutional environment favoring credible commitments, formal rules, and informal constraints, leads to several policy failures, such as the non-enforcement of public services. It can explain delays and policy terminations in EFT. For less-developed countries and emerging ones, the information asymmetries and self-enforcement of the contracts are extreme problems. In general, they lack sufficient human capital and communication infrastructure *"to provide efficient administrative and enforcement services, such as auditing, tax collection, and the regulation of trade and industry"* (Dixit, 2003, p. 108). Furthermore, these countries usually face several territorial inequalities which can be explained by the colonization

process. In Brazil, the colonization process has different roots across states. It leads to different agencies problems across geographic regions because *"each state contains several groups with conflicting interests and sufficient power to influence the policy-making agencies"* (Dixit, 2003, p. 109).

The redistributive effects of the EFT contribute to such delays and terminations. First, it expects to find problems related to legislative-decision making costs. During the implementation process, the legislative and executive branches may deal with EFT differently. While the EFT proposer can usually be either the governor or the state congressman, only the governor has the veto power. Nevertheless, the legislative branch can enact the law even with the governor's veto. This process may lead to several problems in the context of redistributive policies, such as the case of the EFT. Some Brazilian municipalities still face a deficit in their budgets, then the marginal utility of the expected EFT revenue can be very high (Dixit, 2003). It can make their support very cheap for the EFT proposer, including political parties and coalitions of parties, in exchange for a change in rules.

Second, it expects to find problems related to delegation process from the legislative-executive branches to the environmental state agencies. Issues related to information asymmetry may lead to an observation error, and then to the problems associated with adverse selection, lack of structure and expertise in the state agencies, and pressure from local governments.

#### 4.4 CASE STUDIES

This study considers a delay in EFT implementation when the time-lag between the first law and the EFT implementation is more than two years. The cases of delay in Brazilian states were mostly related to either the time elapsed in the effective implementation of the instrument or the effective termination or delaying of some specific environmental criteria. The states of Mato Grosso do Sul and Rondônia are the most obvious examples of delays in their effective EFT implementation (see table 11). The state of Mato Grosso do Sul enacted its first EFT law by the legislative authority in 1994, but the first ecological fiscal transfers to municipalities were made in 2001 only. The enactment of the ecological fiscal transfers in the state of Rondônia occurred in 1996 (Rondônia, 1996), but the state government implemented them only in 2003. The EFT scheme in Rondônia state focuses on the biodiversity conservation among municipalities using the indicator-related to protected areas. In the state of Acre, the enactment of the EFT law occurred in 2004 (Acre, 2004), but the regulation took place only in 2009 (Acre, 2009). The state of Goiás enacted the EFT law in 2011, although its regulation waited until 2014.



Table 11.: Delay of EFT adoption

State	Delay (years)
Mato Grosso do Sul	7
Rondônia	7
Acre	5
Piauí	5
Goiás	3
Paraíba	6 (interrupted)

Source: compiled by author from each state legislation

In the states of Piauí and Paraíba the delay in EFT has different characteristics. In the state of Piauí, the problem is not exactly with the delay between the first law and its regulation, in spite of the two-year wait (from 2008 to 2010). The municipalities did not claim the financial resources from EFT during the first years. In the state of Paraíba, the EFT failure happened due to the non-observation of the rules contained in the Brazilian constitution. Other political issues may explain in more detail the EFT delay in this state. From 2011 to date, the EFT scheme in this state has not started yet.

Environmental criteria also revealed a time lag to implement the EFT schemes, as in the case of Pernambuco, Minas Gerais, and Mato Grosso (see table 12). The state of Mato Grosso interrupted the criteria related to environmental sanitation in 2004, excluding it from the EFT scheme. In the state of Pernambuco, the qualitative indicator for measuring protected areas has not been implemented so far, although it is still written in the EFT law. The state of Minas Gerais presented the same problem as Pernambuco, but the delay lasted ten years.

Table 12.: EFT failure - effective adoption of the criteria

State	Criteria	Delay (years)
Mato Grosso	Solid Waste Management	Interrupted
Pernambuco	Qualitative evaluation for protected area	from 2001 on
Minas Gerais	Qualitative evaluation for protected area	from 1996 to 2005

Source: compiled by author from each state legislation

The next subsections describe in more detail each EFT failure and delay based on the transaction-cost politics framework. To analyze the rich amount of information presented, an in-depth analysis that considers each state as a case study is necessary. Methodologically, a case study *"is best defined as an in-depth study of a single unit (a relatively bounded phenomenon) where the scholar's aim is to elucidate features of a larger class of similar phenomena"* (Gerring, 2004, p. 341). The analysis proceeded in two steps: firstly, we described each EFT scheme adopted with more detail (from the static

moment of adoption); secondly, we explained each failure, delay, and termination based on our proposed transaction cost theory applied to EFT.

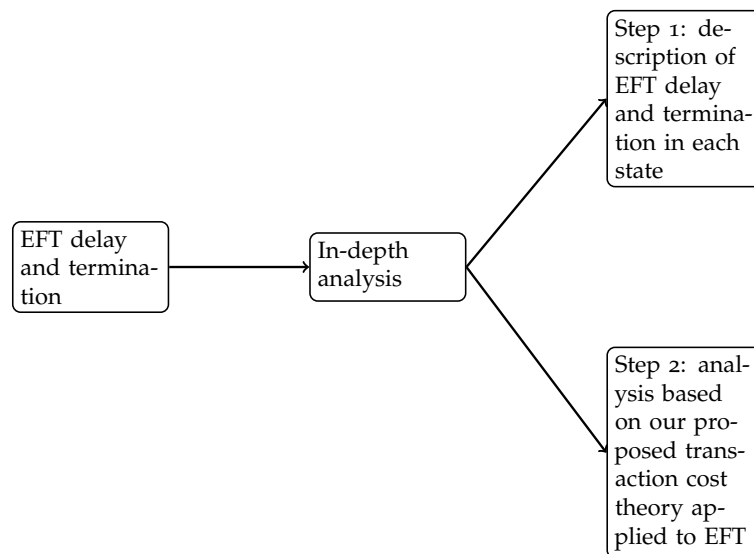


Figure 16.: In-depth analysis of EFT

In order to pursue these two primary objectives, four different data information was selected from four different sources. The first source was merely the comparison between the enactment year of the EFT law in each state and its regulation by decree to determine the delay, both published in the official government gazette. The second source of information was collected from each EFT law and each state to have the description of the specific transfer scheme adopted. Third, it collected data from the legislative branch to analyze the policy process of adopting the EFT in the state of Paraíba, namely from the Direct Unconstitutionality Action (ADIN) number 999.2012.000549-41001. The period of analysis comprises 1991 to 2015. Fourth, it gathered the information to rigorously detail the problems faced by each Brazilian state in the adoption of EFT through the law on access to public information (Brazilian law 12527/2011).

This research has two groups of states to be analyzed: 1) cases of delay and termination in the overall EFT scheme, and 2) cases of delays and termination of adopting environmental criteria. Therefore, three general questions were sent to the environmental state agencies, based on the law on access to public information, to detail the problems faced by each Brazilian state in the adoption of EFT: why did the environmental state agency not implement the qualitative index to measure the percentage dedicated to protected areas in the first years after of the EFT enactment? Why did the environmental state agency not implement the EFT scheme in the first years after of the first legislation enacted? Why did the environmental state agency interrupt the solid waste management criterion predicted in the EFT scheme?

#### 4.4.1 Cases of EFT delay and termination

##### *Mato Grosso do Sul*

The state of Mato Grosso do Sul was the third state to adopt an EFT scheme. This state is located in the Midwest region of Brazil and close to Paraná, the first adopter (Moura, 2015). According to supplementary law 077 enacted in 1994 (Mato Grosso do Sul, 1994), the EFT scheme constitutes the transfer of five percent of the (ICMS) to those municipalities that meet ecological requirements. This law also includes others requirements not related to environmental issues (see figure 17).

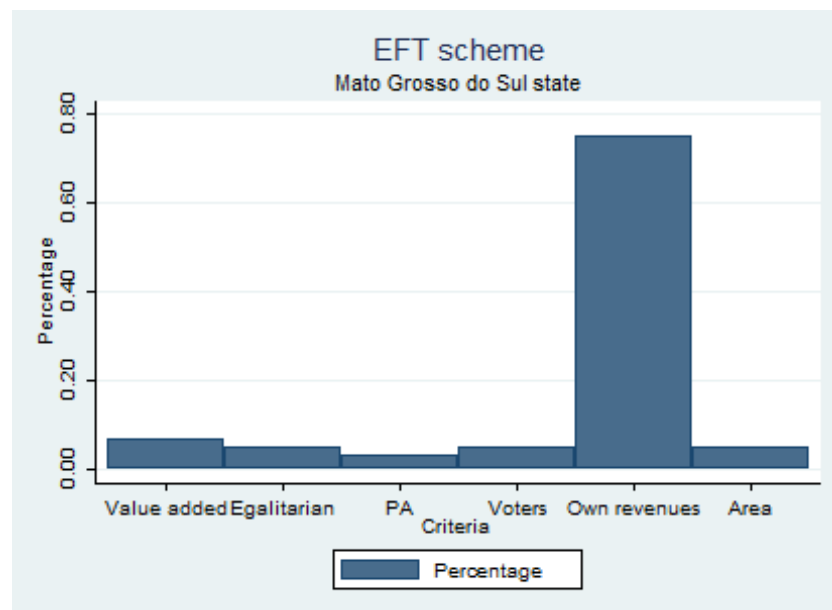


Figure 17.: EFT in Mato Grosso do Sul state

The EFT started only in 2001, but this state enacted its first law in 1994 though. It was after the enactment of the state law number 2.193/2000, state law number 2.259/2001, and its regulatory ordinance 001/2001 promulgated by the state environmental agency known as Pantanal Institute of Environment, "*Instituto de Meio Ambiente do Pantanal*". At that moment, the criteria related to the protected areas started to function in the fiscal transfers to municipalities effectively. One interesting point is that the first law enacted in 1994 did not determine a gradual increase of the percentage dedicated to ecological issues, while the set of legislation passed in 2000 and 2001 predicted three years to gradually increase the rates used in the EFT. It could have a positive effect in reducing the resistance of the political actors in the policy implementation moment.

According to the data collected under the law on access to public information, many reasons could explain the time gap from 1994 to 2001. The information gathered pointed to the absence of regulation of the rules to apply the EFT scheme, the need to

discuss the theme with the political actors involved, and the lack of technical resources and staff, mainly for dealing with environmental issues (we sum up these issues in table 13).

Table 13.: Descriptions of the problems (Mato Grosso do Sul)

Topic	Description
Regulation of the procedures	After enactment of an EFT law, a regulation of the rules of the indicators related with the environmental goals is necessary. This regulation does not follow the same time of enactment as the year of the first EFT law.
Technical resources and staff	Lack of technical support and staff to enforce the EFT rules.
Redistributive effects	Redistributive impacts in municipalities' budgets.

Source: the author

This case illustrates a substantial absence of institutional environment to enforce EFT's rule. The absence of human capital to implement the scheme may have led to problems related to adverse-selection and moral hazard. Adverse selection because the municipalities are at risk of using their lands without knowing the real opportunity cost in terms of EFT revenues. Moral hazard because it could lead to non-compliance with the requirements to be met by local governments. So, some of them can move differently in the policy implementation. Also, the first legislation enacted in 1994 did not have "*a stable structure of exchange*" (North, 1990, p. 50) because the first EFT law did not establish a gradual pace to implement the percentages dedicated to environmental criteria over time.

### *Rondônia*

The state of Rondônia was the sixth state to adopt an EFT scheme and the first adopter in the North along with Amapá state (Paulo and Camões, 2017). According to supplementary law 147 (Rondônia, 1996), local governments that host protected areas in their territories receive five percent of the amount collected from the ICMS. The participation of the municipalities in the ICMS also comprises the following set of criteria: agriculture and livestock, population, equal sharing, municipal area, and the value added (see figure 18).

In 2001 the supplementary law 147 (Rondônia, 1996) regulated the EFT procedures, and the first fiscal transfers under the criteria of protected areas started in 2003. The EFT legislation in the state of Rondônia did not predict any gradual increase of ecological rates over the years. Also, the time-lag observed from 1996 to 2003 to implement the EFT may be explained by the lack of technical resources, mainly by the absence

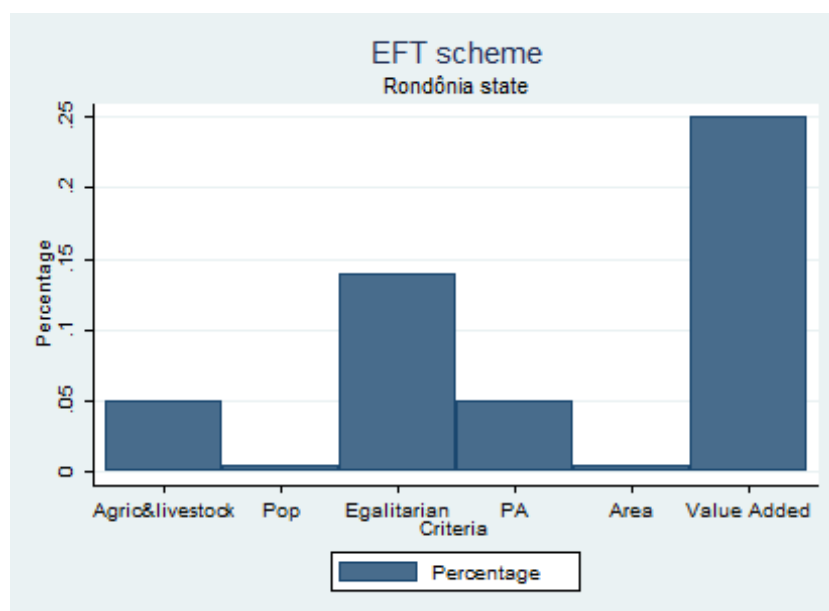


Figure 18.: EFT in Rondônia state

of information systems for the management, monitoring, and transparency to enforce those fiscal transfers. Table 14 summarizes these problems.

Table 14.: Descriptions of the problems (Rondônia)

Topic	Description
Lack of technical resources	Lack of computerized systems for the management, monitoring, and transparency for the implementation of the EFT scheme.

Source: the author

The problems reported decreased over the years. However, they imposed substantial barriers to ensure that the actions of one or more municipalities were not different as initially planned to the implementation of the EFT scheme. Based on the transaction-cost politics framework, a state environmental agency is essential to monitor the EFT scheme and, accordingly, to minimize moral hazard issues.

#### *Acre*

The state of Acre was the eleventh state to adopt an EFT scheme in Brazil and the third in the North following Rondônia and Tocantins state. The law 1530/2004 (Acre, 2004) created the EFT in this state under the name ICMS Verde. The first scheme adopted in that state comprised five percent of the amount collected of the ICMS. It also predicted a gradual increase of the percentage dedicated to environmental issues over the years. In addition, the same law assigned to the environmental agency the

task of regulating the technical criteria related to environmental issues. However, this regulation took place only in 2009, by the decree 4918/2009 (Acre, 2009).

This research faced severe barriers to obtain precise and assertive responses from the state explaining the time gap from 2004 to 2009. We only know that the main problem that could explain the delay is the lack of regulation of the procedures to enforce the EFT scheme. The environmental state agency reported that did not have in that time the structure enough to refine the legislation and, accordingly, impose the policy instrument. Problems related to the moral hazard may arise in the absence of a specific environmental agency.

### *Piauí*

The state of Piauí was one of the last EFT adopters. The EFT in this state was created under the name *ICMS Ecológico* (Piauí, 2008). The EFT scheme comprises three categories of environmental seals to measure the conditions of environmental quality across municipalities. The requirements to achieve the full seal include local government actions related to environmental education, reforestation, fire control, soil conservation, water conservation, biodiversity protection, springs of water protection, control of pollution sources, soil-use control, and the creation of a municipal environmental policy.

The promulgation of the EFT law occurred in 2008, and the state environmental agency refined the details of the scheme in 2010. However, only in 2014 did the first ecological fiscal transfers to municipalities occur. This time-lag from 2008 to 2014 may be explained either by the absence of rules to enforce the EFT scheme or by asymmetric information between the state and the municipalities, mainly from 2010 to 2014 (see table 15).

Table 15.: Descriptions of the problems (Piauí)

Topic	Description
Regulation of the procedures	Absence of procedures to enforce the EFT scheme.
Asymmetric information	Lack of information related to the EFT scheme from the state to municipalities.

Source: the author

There is not a precise explanation concerning the delay to enact the decree by the environmental state agency that refines the details of the EFT scheme. Regarding the asymmetric information, the municipalities did not request the state permission to receive any financial resource in the early years after the enactment of the Decree in 2010. In 2014, the municipality of Teresina was the only one meeting the requirements to receive the money from EFT and, as such, received the total amount of money

allocated to municipalities in that period (around 9 million BRL). In 2017, only six local governments, out of 224, were eligible to receive the EFT.

### *Goiás*

The state of Goiás enacted the EFT by the state law 90/2011. The environmental criteria comprises five percent of the amount collected from the ICMS (see figure 19). It contains a set of ecological indicators, such as protected areas, solid waste management, watershed protection, environmental education, reduction of deforestation, fire control, soil conservation, and control of polluting sources. It also predicted a gradual increase in three years of the percentage dedicated to environmental issues. However, the implementation stage occurred only in 2014 by the decree 8147/2014 (Goiás, 2014).

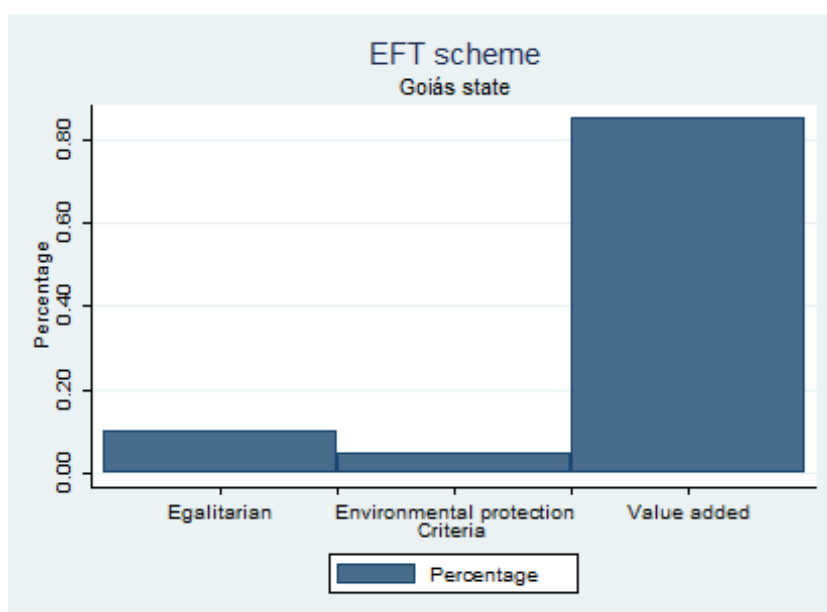


Figure 19.: EFT in Goiás state

The environmental state agency did not provide any further information explaining the time-lag from 2011 to 2014.

### *Paraíba*

The state of Paraíba is the penultimate adopter and enacted its EFT law in 2011, without any gradual increase over the years of the percentage dedicated to environmental criteria (Paraíba, 2011). This law predicted four criteria to transfer part of the ICMS collected by the state to municipalities (see figure 20). The first comprises seventy percent according to the value added in each territory, that is, the sales of good and products. The second, twenty percent equal for all municipalities. The third, five percent related to protected areas, which can be created by either the municipality, state,

or federal governments. The fourth, five percent to support local actions for solid waste management, including the treatment of at least fifty percent of the amount of waste produced in the urban area.

The primary failure in this scheme is because the Federal Constitution of Brazil establishes that the states can freely distribute to municipalities only one-fourth of twenty-five percent of the total amount raised by ICMS. In the Paraíba case, the sum of the protected area, solid waste management, and the equal criteria goes up to thirty percent.

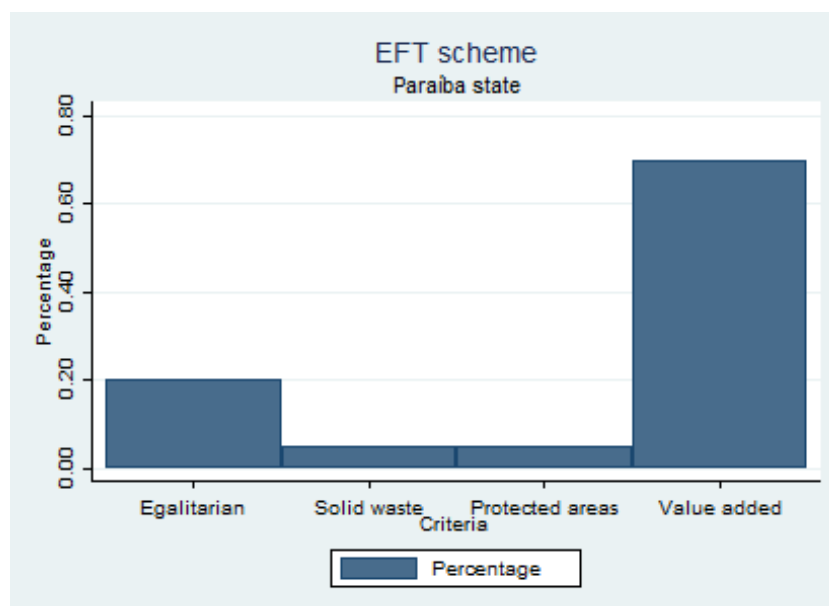


Figure 20.: EFT in Paraíba state

The deputy Francisco de Assis Quintans, who belongs to a right-leaning political party, proposed the EFT scheme under the law project 111/2011. However, the governor Ricardo Coutinho, who belongs to a left-leaning political party, took a stance against to the proposed EFT, using his veto power in October 2011. The governor highlighted at the time the incongruence between the suggested EFT and the Brazilian constitution. In addition, Paraíba's constitution determines that only the governor can create laws related to taxes. Nevertheless, the legislative assembly of Paraíba approved the EFT after the veto. Later on, the executive power filed an action suit in the State Court to repeal the law (Direct Unconstitutionality Action 999.2012.000549-41001). So far, the effects of EFT are suspended.

The extensive literature on ecological fiscal transfers predicts two goals to be achieved by the state governments during the operation stage of the policy instrument: 1) compensation for the surplus of environmental services produced by the municipalities; and 2) to encourage local governments to create new protected areas (Droste et al., 2017c; Ring, 2008; Sauquet et al., 2014). However, these desired policy outcomes may not necessarily be achieved. Dixit (2003) states that in the policy process related to



redistributive policies the private groups are extremely important, including the “*organized groups lobby for taxes and transfers to benefit their members, and political parties and candidates in elections [that] make promises of taxes and transfers to attract the votes of pivotal groups*” (Dixit, 2003, p. 120).

In the Paraíba's state, the gridlock on the legislative-executive decision-making stage plagued the EFT implementation and motivated the judiciary branch to decide by the suspension of the policy implementation process. In fact, even though the federal constitution assigns to the executive and legislative branches the task to propose and enact a law, the judiciary branch may also play an essential role during the policy process. As Dixit (2003, p. 114) noted, “*Lawyers constitute a very large proportion of legislators and high-ranking members of the executive branch in many countries; they therefore wield enormous power in politics and can be a potent veto player opposing reform.*” Therefore, groups of interest from the executive and legislative branches may arise from those who own environmental assets and *vice versa*, and the judiciary branch plays an essential role in the policy process to guarantee that the constitutional principles are met. Accordingly, members of the legislative and executive branches that hold more power to enact the EFT scheme can steer the policy process.

The electoral politics literature also highlights that the members near the center political party do not carry the ideologies very firmly (Dixit, 2003), and most of the adopters of EFT in Brazil belong to a center-political party, either proposing or enacting (Paulo and Camões, 2017). The difference between the party-ideology of the executive and legislative branches in the state of Paraíba can explain the interruption of the implementation process. Therefore, it is essential to distribute the costs and benefits of the proposed EFT scheme among different political actors because “*the distribution of costs and benefits also has a very direct influence on the degree of conflict among private interests at enactment and during the life of the legislation*” (Horn, 1995, p. 30).

#### 4.4.2 Delays and termination of adopting environmental criteria

##### *Pernambuco*

The state of Pernambuco is the eighth adopter, and its EFT scheme is known as *ICMS Socioambiental*. According to the law 11899/2000 (Pernambuco, 2000), the beginning of the ecological fiscal transfers comprised two criteria: one percent for protected areas (PA), and four percent for composting plants or landfill. The same law predicted other economic and social measures for ICMS transfer's: fifteen percent for the relative share of each municipality, two percent for health, two percent for education, and one percent for increasing the local tax revenue. Although any gradual increase over time to the percentage dedicated to environmental criteria was not predicted, the

requirements imposed by the law 11899/2000 (Pernambuco, 2000) changed over the years (see figure 21a and 21b).

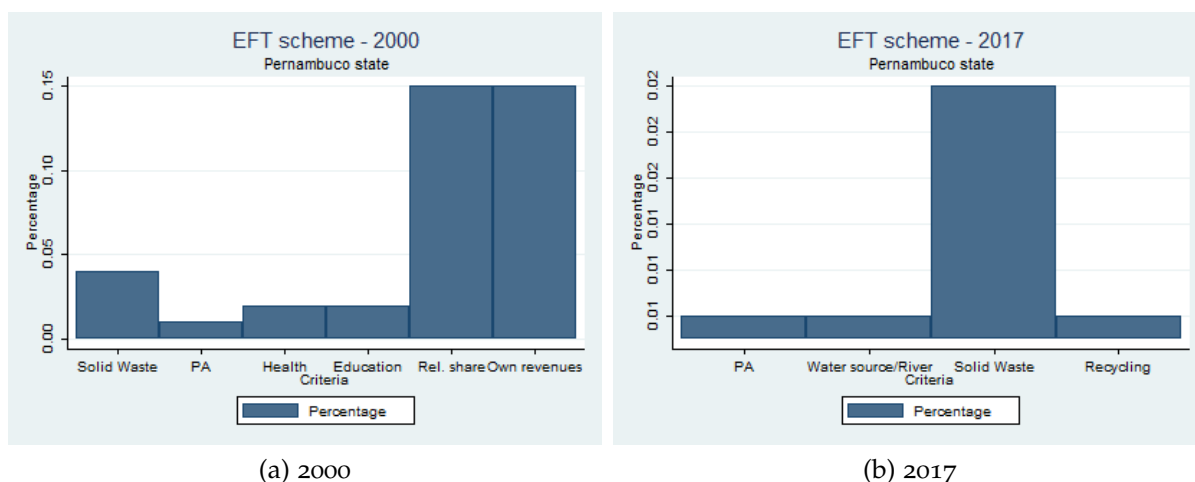


Figure 21.: Evolution of EFT scheme in the state of Pernambuco

The law 15929/2016 (Pernambuco, 2016) predicts the inclusion of more criteria in ICMS transfers in 2018. It determines the use of indicators related to protected areas, solid waste management, water source and rivers, and waste recycling plants (see figure 21b). In addition, it predicts a set of social indexes, such as the number of child mortality (inversely), family health program, children's enrolment in public education (kindergartens), elementary public schools, education development, jails, and the number of lethal violent crimes (inversely). By default, the ICMS transfers also predicts a set of economic indexes to stimulate the increase of municipal tax revenue, and to assist less equipped municipalities measured by the gross domestic products (GDP) "per capita" index (inversely).

The political actors tend to adapt to new institutional arrangements as time evolves due to changes in the politics and economy as a way of minimizing transaction costs issues (Horn, 1995; Dixit, 1996; Epstein and O'Halloran, 1999). As Horn (1995, p. 25) has noted, the "legislators attempt to minimize transaction problems by selecting the best institutional arrangements, or "instruments," from among those available."

However, the quality index to measure the protected area has not taken place yet. In 2002, the state of Pernambuco used the PA *per hectare* only to measure the biodiversity conservation. After that, the Index of Municipality's Biodiversity Conservation (ICBM) began to surface in the EFT, which predicted measurement of the PA quality (see the AQUC variable described in the equation 9 in the Appendix A).

So far, Pernambuco has not enforced the AQUC to measure the quality of the PAs (see the equation 9 in the appendix A), although the EFT law has not changed. The environmental agency of the state (CPRH) still has to refine the details in the legislation to lay down the specific rules on the quality of the protected areas and enforce it in the

ecological fiscal transfers. CPRH needs to contract experts to design the quality index of protected areas due to the lack of specialized public servants of the agency in this field. Therefore, the environmental agency of the state does not have a definite deadline to impose the quality index so far. To minimize the impact of the redistributive effects, they are currently using an egalitarian index for all municipalities (assigning 1 for AQUC described in the equation 9 in Appendix A).

### *Minas Gerais*

The state of Minas Gerais is the fourth state to adopt the EFT in Brazil and enacted its first scheme in 1996. The EFT in this state is known as the Robin Hood Law due to its redistributive effects. The environment criteria include solid waste management and protected areas, which may be created by the federal, state or municipal government, and by private landowners. The environmental criteria comprised 0.333 percent of the total amount of the ICMS in 1996 (see figure 22). This rate increased to 0.666 percent in 1997 and 1 percent in 1998.

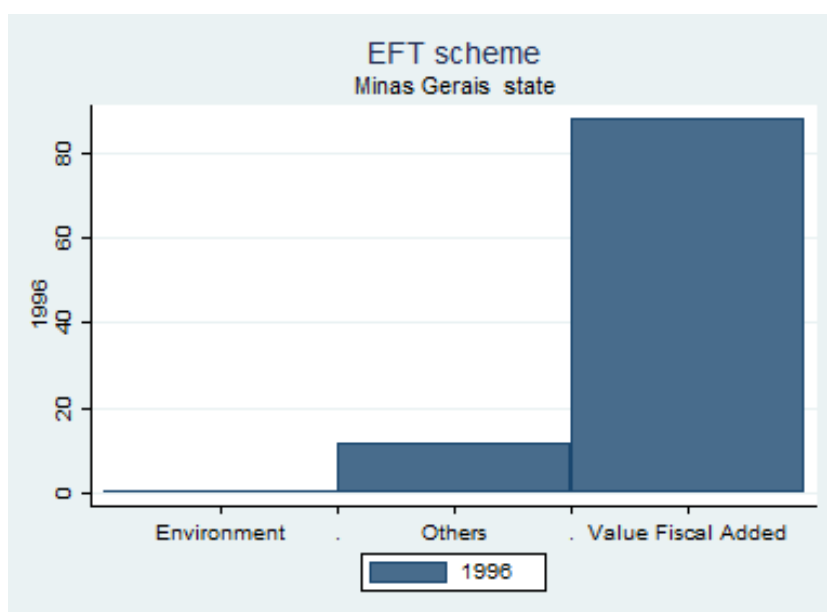


Figure 22.: EFT in Minas Gerais state

The first legislation predicted a qualitative index to measure the protected areas in 1995, but its implementation occurred only in 2005 after the enactment of the regulatory deliberation 86/2005 by the state environmental agency (COPAM).

The quality index of the protected area (FQ), which composes the index of biodiversity conservation factor of the protected area "j" in municipality "l" (FCMil), measures the quality index of the protected area (see equation 12 in Appendix B). The Minas Gerais state assigned one to compose FQ in the FCMil from 1995 to 2005 to minimize the effects of its non-implementation.

Currently, the FQ comprises a set of qualitative measurements, such as monitoring, level of physical quality of the protected area, the management plan of the protected area, the infrastructure of the protected area, and so on.

### *Mato Grosso*

The Mato Grosso state is the ninth EFT adopter and the second in its geographic region. The enactment of the first law in 2000 comprises three environmental criteria: 1) environmental sanitation, 2) protected areas, and 3) indigenous land. The same law predicts other criteria for ICMS transfers, such as total area of the municipality, population, egalitarian transfers, and the increase in revenue from municipal taxes (see figure 23a). In 2004, the complementary law 157/2004 extinguished two criteria: 1) egalitarian transfers, and 2) environmental sanitation (see figure 23b).

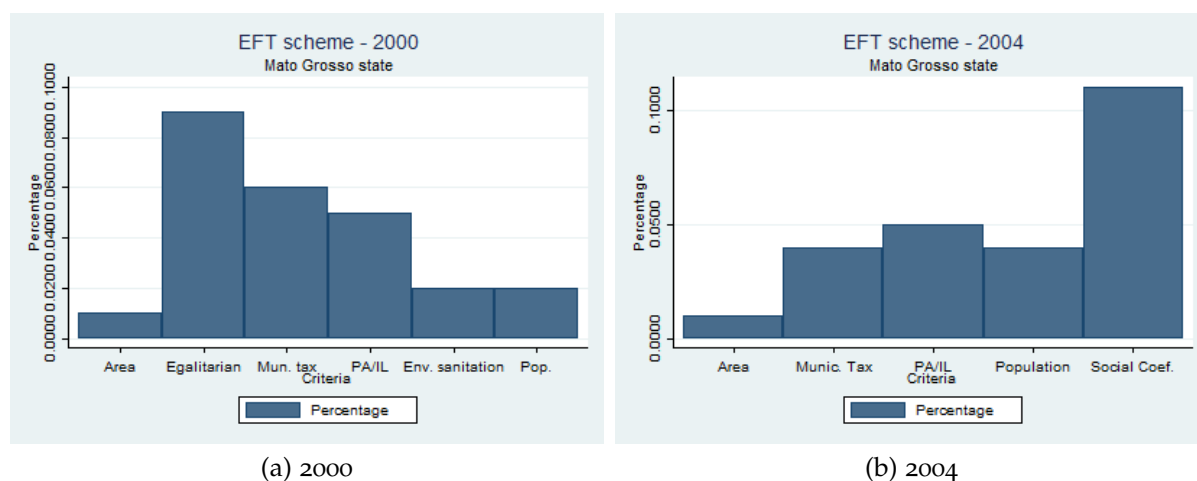


Figure 23.: Evolution of the EFT scheme in the Mato Grosso state

Concerning the termination of the environmental sanitation criterion, the EFT law enacted in 2000 predicted a time horizon of three years to implement the EFT scheme gradually. Therefore, although the legislation writers could not predict the termination of the criteria, they did predict some level of uncertainty to enforce the EFT. In this sense, we conclude that it can be a standard process based on the TCP. It only argues that in a scenario with a high level of uncertainty, the rules should be more flexible, to avoid future mistakes.

### 4.4.3 *Summing up*

The case studies highlight four possible causal links to explain delays and termination presented throughout the policy process of adoption the EFT (see table 16).

Table 16.: Summing Up

State	Stage of the Policy Process	Possible causal links for Delays and Termination
Paraíba	Policy formulation	Executive-legislative relationship: 1) <i>Gridlock: executive and legislative branch controlled by different political parties.</i>
Mato Grosso do Sul	Policy implementation	Political-bureaucratic relationship: 1) <i>Legislative and executive branches delegated the implementation to environmental agencies, and they have lack of structure and expertise;</i>
Rondônia		2) <i>Municipalities press environmental agencies to reach an equilibrium with respect to EFT criteria;</i>
Pernambuco		3) <i>Asymmetric information among municipalities.</i>
Piauí		

Source: the author

The state of Paraíba presented a gridlock during the policy formulation process, that is, the governor belonged to a left-leaning party, while the proposer of the state legislative branch was part of a right-leaning political party. The TCP predicts that in this situation it is more challenging to reach an agreement between political actors.

Also, many states presented problems related to the political-bureaucratic relationship at the implementation stage. First, some state environmental agencies suffered from lack of structure and technical expertise to enforce the EFT scheme (Rondônia and Mato Grosso do Sul). Second, Mato Grosso do Sul needed more time to discuss the theme with municipalities, that is, the state environmental agency had to wait the moment when the scheme reached an equilibrium among political actors. Third, Piauí state presented problems related to asymmetric information to enforce the EFT. In the beginning, only one municipality met the requirements to receive the money from EFT.

Another interesting pattern is the gradual increase of the percentage dedicated to environmental criteria across EFT schemes. Comparing two groups of Brazilian states, adopters with and without delays between the first law and the effective implementation, the gradual increase of the environmental percentages is more noticeable in the group without delays. In contrast, the group with delays presents fewer years to impose the scheme on municipalities effectively (see figure 24).

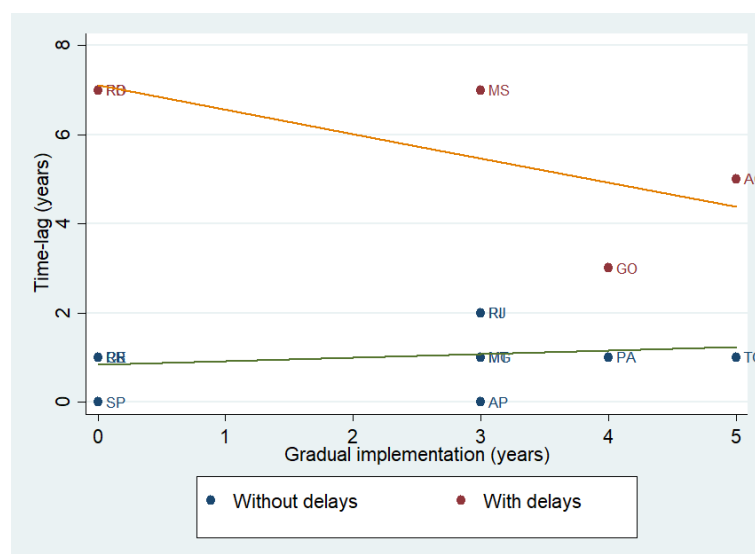


Figure 24.: Groups of adopters with and without delays

This pattern also explains the delays of the EFT schemes across Brazilian states. The transaction-cost politics also predicts that it can minimize the resistance among political actors and, accordingly, facilitate the policy implementation process (Krutilla, 2011). Besides, it can facilitate the learning process in environmental state agencies, as most of them presented a lack of human resources and technical expertise. As Dixit (2003, p. 127) noted, *"the quality of administration in LDCs is often poor. In the agency context, this implies larger errors of observation"*.

#### 4.5 CONCLUSION

This essay described how the EFT delays and terminations occurred across Brazilian states and presented patterns to explain them based on the transaction-cost politics framework. Therefore, it contributes to EFT and policy failure literature. This is the first study to address this issue covering all Brazilian states. Moreover, it focuses on another theoretical lens to understand the process of policy delay and termination.

The main contribution of this research is to provide empirical evidence that the legislative- decision making costs and the agency costs can make the policy implementation of EFT more difficult. In more detail, the case studies provide evidence of absence of technical and human resources, which can lead to agency problems, and issues related to party-ideology and political coalitions, which may increase the legislative-decision making costs. It also seems that the qualitative index of protected area, which may constitute the EFT scheme, imposes additional costs to local governments because Minas Gerais state presented a substantial delay to implement it. The state of Pernambuco has not applied it so far. However, it calls for future research so it can be empirically tested.

The results also provide some ground for policy recommendations, particularly for developing countries such as Brazil. In the first place, it is essential the inclusion of all relevant political actors at the beginning of the EFT political process. Second, in an environment with a substantial lack of human resources, and structure to support the enforcement of the EFT scheme, we suggest a gradual and flexible pace of implementation. Third, technical support from the state government to the municipal governments can decrease the policy delays and terminations, that is, they can act cooperatively.

In conclusion, we state that a window of opportunity opens very often, and the legislative and executive branches have to catch it, since, there are several theoretical and empirical evidences showing that the EFT produce several benefits for the environment (Droste et al., 2017d; Ring and Barton, 2015). Therefore, following the popular saying in Brazil, we support the idea that is *"better late than never."*

APPENDIX A - TECHNICAL NOTE ON THE COMPUTATION OF INDEX OF MUNICIPALITY'S BIODIVERSITY CONSERVATION (ICBM) IN THE STATE OF PERNAMBUCO

ICBM is calculated as follows:

$$\mathbf{ICBM} = \frac{\mathbf{CBM}}{\mathbf{CBE}} \times 100$$

(8)

where:

$\mathbf{ICBM}$  is Index of Municipality's Biodiversity Conservation.

$\mathbf{CBM}$  is Sum of all biodiversity conservation (CB) in the municipality.

$\mathbf{CBE}$  is Sum of all municipality's biodiversity conservation of the state.

To measure the biodiversity conservation coefficient (the CB variable described in equation 8) is used the following formula:

$$\mathbf{CB} = \left( \frac{\mathbf{AUC}}{\mathbf{AM}} \times 100 \right) \times \mathbf{AQUC}$$

(9)

where:

$\mathbf{CB}$  is the biodiversity conservation measure of the protected area.

$\mathbf{AUC}$  is the area of the protected area.

$\mathbf{AM}$  is the municipality area.

$\mathbf{FC}$  is the biodiversity conservation factor according to the type of the PA, i.e., restricted or sustainable land use.

$\mathbf{AQUC}$  is the measure of the quality of the protected area.



APPENDIX B - TECHNICAL NOTE ON THE INDEX OF BIODIVERSITY CONSERVATION OF MUNICIPALITY (ICI) IN THE STATE OF MINAS GERAIS

$$ICI = \left( \frac{FCMi}{FCE} \right) \quad (10)$$

where:

ICI is Index of Biodiversity Conservation of Municipality

FCMi is Biodiversity Conservation Factor of the Municipality

FCE is Biodiversity Conservation Factor of the State

$$FCE = (EF C Mi) \quad (11)$$

where:

FCE is Index of Biodiversity Conservation Factor of the State

EFCMi is Biodiversity Conservation Factor of the Protected Area "j" in Municipality "I"

$$FCMiI = \frac{AreaUCiI \times FC \times FQ}{AreaMI} \quad (12)$$

where:

FCMiI is Index Biodiversity Conservation Factor of the Protected Area "j" in Municipality "I"

AREA UCiI is Area of the Protected Area "j" in Municipality "I"

FC is Conservation Index of the Protected Area

FQ is Quality Index of the Protected Area

AREA MI is Area of the Municipality "I"



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### ESSAY 3. ECOLOGICAL FISCAL TRANSFERS FOR BIODIVERSITY CONSERVATION POLICY: A MUNICIPAL-LEVEL ANALYSIS.

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This paper addresses the influence of ecological fiscal transfers (EFT) on the policy-making process of adopting local protected areas (PA) by municipal governments. Framed on the transaction-cost politics (TCP), it argues that an EFT schema designed at the state level affects the commitment costs of local level decisions and, due to agency costs, the time length to create PA. The mixed research design is composed of two parts: first, a descriptive analysis detailing the evolution of EFT in the state of Minas Gerais since the beginning until its current version; second, an event history analysis of municipal PA adoption from 1966 to 2013. The conclusion suggests that, while there is an overall increase in municipal PA after the introduction of EFT, some design aspects of the instrument such as uncertainty, commitment, and monitoring costs slowed and flattened that increase.

**Keywords**— Ecological Fiscal Transfers, Municipal Protected Area, Transaction-Cost Politics

#### 5.1 INTRODUCTION

The primary aim of protected areas (PA) is biodiversity conservation, halting and reducing biodiversity loss. Ecological fiscal transfers (EFT) became an essential instrument to enhance municipal PA in Brazil (Ring and Barton, 2015; Droste et al., 2017c). Empirical evidence supports their importance to improve biodiversity conservation policies at local level. Fernandes et al. (2011) summarize the advantages of adopting this instrument in the state of Minas Gerais with respect to compensation of local governments, while Droste et al. (2017c) give an overview of Brazilian states regarding the effectiveness of EFT in encouraging municipalities to create new PAs. Conversely, Silva Júnior, et al (2012) argued for the non-effectiveness of the EFT scheme to promote PA and solid waste management in the state of Pernambuco, while attributing the increase of PA to local development and the level of environmental conscious-

ness (EC), measured as the number of city councilors with the party ideology more inclined to ecological issues.

Sauquet et al. (2014) studied the interactions among local governments and its consequences for setting up new PA. The research points out that in the state of Paraná *"the utility gained from the creation of a PA decreased (or increased) if a neighbor created more (or less) protected areas"* (Sauquet et al., 2014, p. 257). Grieg-Gran (2001, p. 7) finds a similar pattern in Minas Gerais state, noting that *"changes in value added or the formation of new counties, can also affect the indices and obscure the effect of the ICMS ecológico"*. However, there is a gap in the literature to explain how the interaction of political actors at the state and municipal level impedes the specification, monitoring, or enforcement of an EFT scheme to encourage the creation of new local PA. This essay begins to fill this critical lacuna in theoretical and empirical analyses of EFT for biodiversity conservation policies, partly as a response to the call made by Moura (2015), who did not emphasize the conflicts among political actors in her institutional and legal analysis of EFT in Brazil. For practitioners, this essay provides relevant empirical evidence to improve the effectiveness of the incentive component of the policy instrument, that is, to choose an adequate governance structure and to reduce the transaction costs (Epstein and O'Halloran, 1999).

In spite of the amount of empirical evidence presented in literature, we join Sauquet et al. (2014, p. 250) to assert that the *"ecological fiscal transfers are interesting in that they constitute a relatively new, innovative and poorly studied conservation instrument."* Most of the literature on EFT is based on the analysis of the policy outcome, but rarely on the policy process and its implication to the desired result of the policy instrument. This research is essential for other countries which intend to design and implement EFT to reach the goal 15 of the 2030 Agenda for Sustainable Development, mainly concerned to protect, restore and promote sustainable use of terrestrial ecosystems. EFT have been mentioned as an essential environmental fiscal reform measure to protect the biodiversity around the world (OECD, 2013).

This paper seeks to understand the influence of EFT in the policy-making process of adopting PA by municipal governments. Framed on the theory of transaction-cost politics (TCP) (Epstein and O'Halloran, 1999; Horn, 1995), it argues that an EFT designed at the state level affects the commitment costs of local level decisions and, due to agency costs, the time length to create a PA. The research design is mixed and composed of two parts: first, a descriptive analysis detailing the evolution of the EFT design in the state of Minas Gerais, from the beginning until its current version; second, an event history analysis of municipal PA adoption from 1966 to 2013.

The paper unfolds in eight sections. The next section presents a literature review on EFT, including recent studies in Brazil and Europe. Section three presents a conceptual model of EFT analysis at the local level based on the menu of transaction costs.

Section four describes how the transaction costs differ according to the categories of PA previous to the EFT implementation. Section five discusses the change in transaction costs with transition from the pre-EFT to the post-EFT period and builds our set of hypotheses. Section six describes the research design and part seven offers the results concerning EFT design in the state of Minas Gerais (Brazil). Section eight concludes and offers some avenues for future research.

## 5.2 ECOLOGICAL FISCAL TRANSFERS: A LITERATURE REVIEW

### 5.2.1 *The EFT in Portugal and Europe*

EFT redistributes revenues from upper to lower levels of government using ecological indicators (Ring and Barton, 2015). Typically, intergovernmental transfers use inhabitant or area-related indicators, being the use of ecological indicators the main novelty in EFT schemes. EFT can be adopted both in centrally organized countries, in which fiscal transfers are distributed from central to local levels and in federally organized countries, in which fiscal transfers are distributed by the states (Ring, 2008; Santos et al., 2012; Borie et al., 2014).

There are at least three different rationales for EFT adoption. First, most countries adopt the "*principle of subsidiarity*" to environmental policies, in which municipalities bear the costs of biodiversity conservation. In this case, the role of EFT is to compensate sub-national government expenditures (supply costs) on ecological public goods and services. Second, according to the "*principle of equivalence*" (Olson, 1969), some decentralized levels of government provide ecological public services that end up generating external benefits beyond their boundaries (spill-over effect). Thus, EFT may be used as payment for external benefits (Ring and Schröter-Schlaack, 2011). Third, an EFT scheme may be implemented to compensate the opportunity costs due to revenue loss generated by land use restrictions (Sauquet et al., 2014) imposed by national to sub-national governments, as well as to compensate tax revenue losses from private landowners. In practical terms, these rationales are "*highly dependent on the country's legal and institutional framework - not least the financial constitution*" (Ring and Barton, 2015, p. 439).

According to Schröter-Schlaack et al. (2014), each specific EFT scheme in place differs in the type of transfers applied, which can be either lump-sum (unconditional fiscal transfers) or earmarked (conditional fiscal transfers). Other features of EFT can be highlighted: the costs or benefits that are imposed; the type of indicators (quantitative or qualitative); the scale, that is, "*the number of decentralized governments that can benefit from EFT*" (Schröter-Schlaack et al., 2014, p. 108); the origin or type of financial funds allocated, and the overall amount of financial resources distributed.

So far, three countries have adopted an EFT scheme: Brazil (Ring, 2008), Portugal (Santos et al., 2012), and, on a small scale, France (Borie et al., 2014; Schröter-Schlaack et al., 2014). Only Brazil and Portugal have implemented EFT to compensate municipalities for the costs of land-use restrictions related to PA (Santos et al., 2012). In France, the EFT scheme is a lump-sum allocation to municipalities with part of their territory situated in national parks or natural marine parks (Borie et al., 2014; Schröter-Schlaack et al., 2014). Borie et al. (2014) presented a studied to expand the EFT scheme in France for other PA.

The pioneer in adopting an EFT scheme was Brazil the beginning of the 1990s. In Europe, Portugal was the first country to adopt an EFT scheme with the approval of a revised Local Finances Law in January 2007 (Santos et al., 2012; Droste et al., 2017a). EFT are non-earmarked and the criteria adopted are the total area under protection and the percentage of local land designated as protected area. More recently, Droste et al. (2017a, p. 1027) studied *"whether introducing EFT in Portugal incentivized municipalities to designate PA and has led to a decentralization of conservation decisions"*. The authors conclude that the EFT in Portugal contribute to *"a significant increase in the ratio of municipal and national PA designations following Portugal's EFT introduction"* (Droste et al., 2017a, p. 1027). In France, the EFT scheme is based on the *"ecological solidarity"* idea, that is, *"the municipalities are compensated for the opportunity costs of conservation imposed by the land-use restrictions associated with strictly protected areas"* (Schröter-Schlaack et al., 2014, p. 104).

In other countries, the issue of EFT entered the political arena in Poland (Schröter-Schlaack et al., 2014), while in in Germany (Ring, 2002; Droste et al., 2017d), Switzerland (Köllner et al., 2002), India (Kumar and Managi, 2009), and Indonesia (Mumbunan et al., 2012) their effects were theoretically simulated. The EFT mechanism in Poland was drafted by the Council of the Rural Boroughs Association, aiming to introduce compensation payments due to land-use restrictions related to Natura 2000 sites or PA. These transfers were prepared to be implemented as lump-sum transfers and based on algorithms proposed by the Ministry of Finance (Schröter-Schlaack et al., 2014). In Germany, proposals based on theoretical simulations to consider ecological indicators in the fiscal transfers have been presented for almost two decades, but the primary task nowadays is to put them for discussion in the policy arena (Ring, 2002; Schröter-Schlaack et al., 2014). Droste et al. (2017d, p. 484) showed that *"on average, sparsely populated states in Germany provide more PA per capita and would thus be eligible for increased fiscal transfers"*. In Switzerland, the EFT were theoretically modeled through the integration of cantonal biodiversity benchmarking in the intergovernmental fiscal relations (Köllner et al., 2002). In sum, EFT proposals across these countries focus on biodiversity conservation policies only, aiming to enhance PA.

### 5.2.2 The EFT in Brazil

In Brazil, the EFT constitute part of the “*Imposto sobre Operações relativas à Circulação de Mercadorias e sobre Prestações de Serviços de Transporte Interestadual e Intermunicipal e de Comunicação*” (ICMS) collected by the state governments and transferred to municipalities. To be precise, three-quarters of the ICMS is transferred to municipalities using the criterion of fiscal added value (VAF). Only a quarter can be redistributed to municipalities using other criteria, such as ecological indicators (see figure 25).

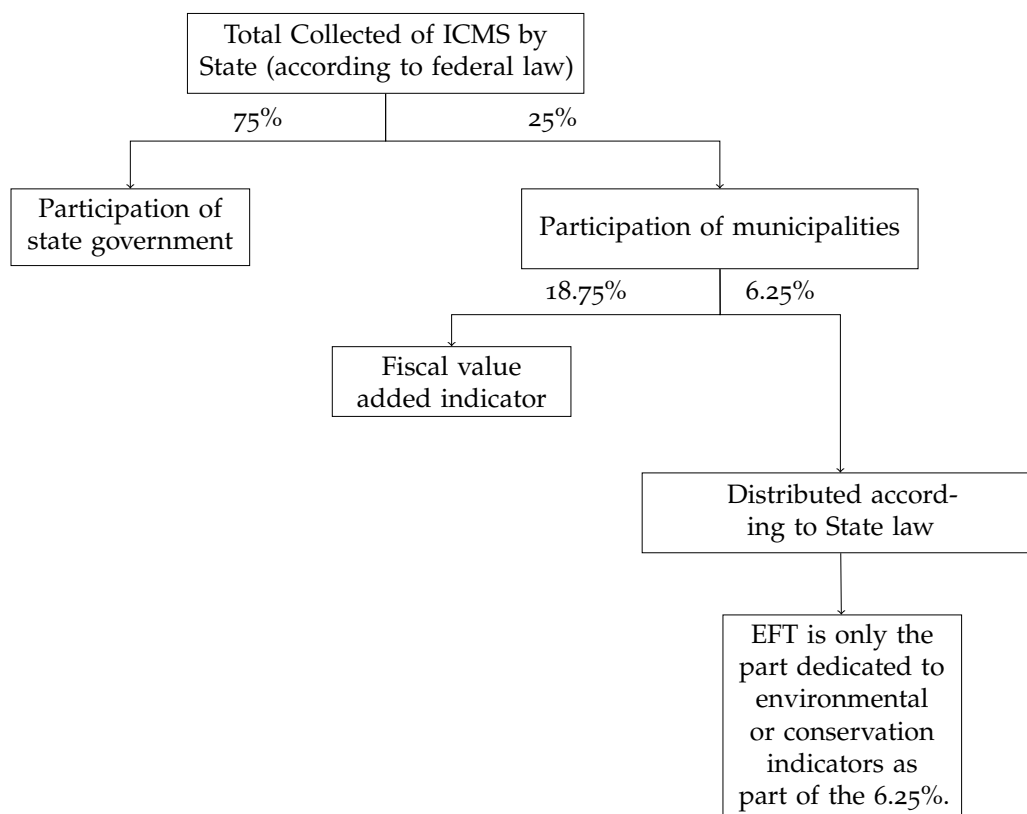


Figure 25.: EFT scheme in Brazil

The states are free to decide upon the criteria used in these transfers, which means that local governments can use the money as they want (Moura, 2015). Some states include environmental criteria to transfer the ICMS, mainly those related to promote the creation and maintenance of PA, landfills, recycling centers, and composting plants. EFT in Brazil are known under several names, such as “*ICMS Ecológico*”, “*ICMS Verde*” and “*ICMS Socioambiental*”.

At the beginning of the 1990s, the state of Paraná created the first fiscal transfers using ecological indicators to municipalities for creating and maintaining PAs. The EFT scheme in Brazil has spread over the years; so far, sixteen states are using PA as indicators related to biodiversity conservation to transfer revenue from the ICMS, that is, the primary EFT objective is to reduce the “*biodiversity loss by stimulating the creation and management of protected areas*” (Sauquet et al., 2014, p. 250). The extensive literature

describes two ways for EFT to reach that goal: first, local governments create new PA; second, compensate municipalities for bearing the cost of building and maintaining PA, which produces environmental services that go beyond their borders (Ring and Barton, 2015; Sauquet et al., 2014; Droste et al., 2017c; Ring, 2008). Ring (2008, p. 485) states that EFT are used to provide a *"compensation for land-use restrictions and an incentive to value and engage in more conservation activities at the local level."* Sauquet et al. (2014, p. 250) summarize these two EFT ways in the sense of *"(i) [...] rewarding municipalities for hosting state and federal PAs, and " (ii) [...] encouraging municipalities to create new PAs."*

As Grieg-Gran (2001, p. 06) notes, the compensation dimension of EFT is justified when municipalities host state and federal PAs, because *"local governments have little scope for influencing decisions made on the designation and maintenance of a large proportion of the area set aside for protection"*. In addition, EFT may include an incentive component to local governments by the creation of municipal PAs (Droste et al., 2017c; Ring and Barton, 2015). A potential incentive is expected from EFT because the ICMS *"constitutes an important source of revenue for local governments"* (Grieg-Gran, 2001, p. 01).

At the local level, Droste et al. (2017c, p. 1) investigate *"whether the introduction of this economic instrument in a state offers incentives to municipal responses in terms of further protected area (PA) designation"*. The findings suggest that *"there are clear indications for local responses to the implementation of EFT: after an ICMS-E introduction additional municipal PA are designated"* (Droste et al., 2017c, p. 13). Conversely, Silva Júnior, et al (2012) conclude that the EFT are inefficient to improve PA at the local level in the state of Pernambuco. What is more, Grieg-Gran (2001, p. 31) highlights that the *"ICMS ecológico has the potential to create incentives for conservation but the effect appears to be highly variable"*.

Moreover, Loureiro (2002) offers an analysis of how the EFT contributed to biodiversity conservation policies in Paraná. The author concludes that *ICMS Ecológico* contributed to an increase in the number of PA and the quality of such enterprises. In addition, the adoption of EFT affected positively the quality of the management in the environmental agency in six municipalities. Sauquet et al. (2014) describe and explain the sources and consequences of the incentive component of EFT in creating PA and promoting strategic interaction among local governments. The study concludes that the creation of local PA in the state of Paraná *"reveals strategic substitutability in municipalities' conservation decisions"*; that is, *"the creation of [PA] by a municipality decreases the incentive of neighboring municipalities to create [PA]"* (Sauquet et al., 2014, p. 249, 252).



### 5.3 THEORETICAL BACKGROUND: EFT AND THE TRANSACTION COSTS AT THE LOCAL LEVEL

Local governments can adopt more or less PA according to EFT criteria implemented at a given moment in time, meaning that the EFT policy instrument alters the transaction costs in the choice to adopt a municipal PA. The information costs is the main point to understand the concept of transaction costs, " (...) which consist of the costs of measuring the valuable attributes of what is being exchanged and the costs of protecting rights and policing and enforcing agreements" (North, 1990, p. 27). As Williamson (1989, p. 142) noted, "transaction cost analysis entails an examination of the comparative costs of planning, adapting, and monitoring task completion under alternative governance structures.". Simply put, our theoretical argument is that the EFT scheme modifies the menu of costs of planning, adapting, and monitoring in the adoption of PA at the local level, that is, the EFT modifies the costs of protecting rights and policing and enforcing agreements in adopting municipal PA.

The EFT are a policy tool that encompasses two types of delegation. First, following the background of intergovernmental institutions in federalist systems, delegation happens through devolution of competencies from the state government to lower more decentral government levels. The decision to delegate competencies from state government to more decentralized governments is similar to the make-or-buy decision which is faced by firms in the economic market, that is, "the legislative body faces a trade-off between internal costs of policy production and external costs of delegation" (Tavares, 2003, p. 12). The external costs are related to the information costs of gathering all preferences at the local level, that is, like governors, mayors seek to increase their chances of reelection. One way to minimize the external costs of delegation is by offering grants to local government, such as the EFT, as a commitment signal of the state government to more decentralized governments.

Second, delegation in federalist systems also occur from state legislators to state agencies. The formulation and implementation process of a state policy instrument may encompass areas in which the state Legislative branches do not open their policy-making discretion to state agencies, because bureaucrats may be not aligned with objectives of the legislators and can jeopardize their chances of reelection. Tax policies are an example of how legislators try to fill all loopholes in the law and, as a result, end up not assigning any discretion to modify it (Epstein and O'Halloran, 1999). Concerning environmental policies, Oliveira (2002, p. 1716) states that "protected areas are rarely perceived as an urgent need, and thus do not attract much political support". The transaction cost politics (TCP) predicts that in these cases the state legislative branches tend to enact vaguer laws and delegate to the state agencies the role to regulate the details because the delegation process ends up minimizing the policy-making costs

to the legislative branch transfer (Horn, 1995; Epstein and O'Halloran, 1999). EFT encompass tax policies and environmental policies; then this delegation process appears during the EFT formulation stage at the state level. When delegation increases, it is easier "for the incumbent legislature to intervene in administration without changing legislation and, therefore, increases the commitment problem" (Horn, 1995, p. 50). Therefore, the commitment costs tend to increase when the design of EFT predicts change in the rules of the policy instrument over time. When the commitment problem arises, the municipalities tend to adopt different policies from those related to the state-policies objective. The costs to the municipalities in maintaining a policy aligned with the state-policies objective tend to increase when commitment problems arise. Usually, the municipalities face some costs to create and maintain a PA: expropriation costs, rent-seeking costs, commitment costs, collective costs, agency costs, monitoring costs, and management costs.

Based on these theoretical explanations, we discuss two arguments in this paper. The first is that the municipalities face a menu of transaction costs to create a PA in the period pre-EFT: expropriation costs, rent-seeking costs, commitment costs, collective costs, agency/monitoring costs, management costs. The EFT may reduce these transaction costs through the financial incentive of fiscal transfers which functioning as a support for local governments (post-EFT). The effects of the financial incentive to minimize the transaction costs are stronger during the first years. Table 17 summarizes our conceptual model of EFT analysis at the local level.

Table 17.: The conceptual model of EFT at the local level based on the menu of transaction costs (first years)

<b>without EFT</b>	<b>with EFT</b>
Expropriation costs, rent-seeking costs, monitoring costs, management costs, collective costs, and commitment costs, are more robust.	EFT minimize expropriation costs, rent-seeking costs, monitoring costs, management costs, collective costs, at the local level.

Source: the author

The expropriation costs are the costs of expropriating private lands to transform in PA, that is, the amount of money the local government has to pay to private landowners. The rent-seeking costs are related to political costs in adopting a municipal PA due to the pressure from companies and lobbying groups, such as the agricultural sector and tourism companies that pressures local governments. The commitment costs are the costs associated with securing the rules agreed upon and the financial support from EFT to local governments over time. The costs to maintain financial aid and the rules agreed upon over time affect the policy choices at the local level, that is, affect the creation and maintenance of municipal PA. The collective costs are faced by local

communities to accept a new institutional arrangement in their land, that is, the costs beared by these communities to create and maintain a municipal PA. The agency costs are internal costs which arise from the manager of municipal PA (agent) which acts on behalf of the municipal government. The municipal government wants the manager of municipal PA to follow EFT requirements, while the manager of municipal PA may act to maximize its power and wealth which can be aligned with the interests of some companies lobbying and lobby groups. This may increase monitoring costs. The management costs are the costs related to the management of the municipal PA, such as spending on staff salaries and training, fuel, maintenance, and so on.

The second argument is that the EFT policy instrument is a mix of tax and environmental policies. Then, the municipalities predict a certain level of uncertainty concerning changes in the EFT legislation by the state agencies over the years. These changes may increase certain types of transaction costs. Also, when the quality index was implemented after the EFT implementation, without any additional support from the state government, the local governments were faced with additional costs related to the improvement of environmental agency technical capacity and the increase in monitoring efforts, which made it more difficult the creation of new PA. Figure 26 represents the level of transaction costs over time after EFT implementation, which increases with quality index implementation and changes in the EFT legislation.

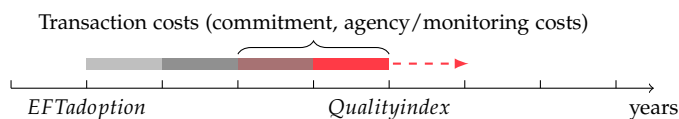


Figure 26.: post-EFT and the different types of costs

Next section presents Brazilian institutional background of adopting protected areas previous to EFT implementation. It discusses the categories of PA adopted at the local level in more detail and the transaction costs associated. Section 5 presents an assessment of the EFT effect in changing the transaction costs that affect the adopting PA (from the non-protected area to a protected area).

#### 5.4 INSTITUTIONAL BACKGROUND: CATEGORIES OF PA AND THEIR TRANSACTION COSTS

Several political and administrative procedures have to be followed to create a PA (Brazil, 2000). In general, the Mayor enacts a municipal decree but it can also be adopted through a law from the municipal legislative assembly. A proposal to create a PA requires public hearings and technical studies, such as Environmental Impact Assessment (EIA) and Environmental Impact Report (RIMA). The public debate has to

be understood by any person regardless of the school level. There are only two exceptions in which the municipal government can skip this stage: 1) to create the category of PA related to the ecological station; and 2) to create the biological reserve protected area. Legislation considers these categories as extremely important for biodiversity conservation in such a way that they have to be protected as soon as possible.

Although most of the categories of PAs are not mandatory for local governments, except the permanent preservation areas created by the Brazilian Forestry Code, most of the local governments have to deal with the lack of expertise and funding for developing and maintaining PAs. Nevertheless, in order to create new PA, some municipalities still apply efforts to financially compensate landowners after encouraging them to stop exploiting their lands economically.

Brazil follows a mix of policy instruments to achieve the goals related to biodiversity conservation (Flanagan et al., 2011b; Ring and Schröter-Schlaack, 2011). According to Sousa et al. (2011), the first governmental action to systematize a national plan for PA occurred in the beginning of the 1970s. At that time, only twenty-six PA areas existed in the whole Brazilian territory. The EIA and the RIMA were created under the National Environment Policy in 1981. In 1988, the Brazilian constitution assigned an essential role to protect the environment to the municipalities. Later on, the National System of Protected Areas (SNUC) shaped many aspects concerning PA at the local level.

According to the National System of Conservation Units (Brazil, 2000), there are two main categories of PA (in Brazil also known as "conservation units"): 1) integral protection; and 2) sustainable use. The integral protection group is more restrictive and allows only the indirect use of the natural resources, such as hiking, climbing, and bathing in waterfalls. It comprises five subcategories: a) ecological station (ESEC); b) biological reserve (REBIO); c) municipal park (PM); d) natural monuments (MONA); and e) wildlife refuge (REVIS). In contrast, the sustainable use group allows the direct use of natural resources, whether or not for economic exploitation. It comprises seven subcategories: a) environmental protection area (APA); b) area of relevant ecologic interest (ARIE); c) municipal forest (FLOMA); d) extractive reserve (RESEX); e) fauna reserve (REFAU); f) sustainable development reserve (SDR); and g) natural heritage private reserve (RPPN).

Concerning the integral group, the ESEC has two primary objectives: 1) to protect the environment, and 2) to support scientific studies if previously approved by the administrator of the PA. In this category, the expropriation process of any private property is inevitable because the land-holder of a ESEC is necessarily the public sector. This category of PA is not open for public visitation, except for environmental education.

The REBIO has the primary role of protecting the biota and other natural assets without human interference. The PM is created to preserve natural ecosystems and their scenic beauty. In both cases, as in the ESEC, private property is not allowed. The public visitation is open in the case of PM, while in the case of REBIO it is restricted to environmental education.

The MONA is created to protect rare nature sites and their scenic beauty, while the REVIS has the primary task of safeguarding flora and fauna. In both cases, private landowners can keep their land inside the protected area if consistent with these objective. Public visits and scientific studies are allowed when authorized in advance by the administrator.

Concerning the sustainable use group, the APA allows human occupation and its primary role is to protect the biological diversity and to discipline the use of land in a sustainable way. APA category can have environmental-ecological zones in their area, which restricts human occupation. The ARIE comprises a small piece of land and has fewer human occupation when compared with APA. ARIE also allows private landowners and its primary role is to protect natural ecosystems.

The FLOMA covers a forest area and its primary role is to promote the sustainable use of the forest resources, while enabling the permanence of traditional communities, public visits, and scientific studies. This category does not allow private use of the land, therefore landowners have their land expropriate.

The RESEX are land-restrictions to ensure extractivist activities and subsistence farming by traditional communities and their primary role is to protect traditional communities with a sustainable use of natural resources. RESEX allows scientific studies and public visits when they are compatible with local interests. This category neither allows private land-use nor hunting activity, except by traditional communities. The SDR has similar characteristics, with the exception of private landowners who can keep their land if compatible with the PA.

Private land is used in RPPN, but these areas are restricted to scientific studies and public visits for eco-tourism, environmental education, and recreational purposes. The public sector can provide technical support for landowners interested in turning their lands in RPPN. Other categories of PA can also arise in local governments' jurisdictions according to state policies, such as ecological private recovery reserves. Local governments can also deal with other types of land-use restrictions beyond PA, such as indigenous lands. In sum, the degree of land-use restrictions varies according to the category of PA.

The level of transaction costs is highly dependent on the type of PA, as well as on the stage of the policy process. As Bruner et al. (2004, p. 1120) has noted, *"the costs of establishing new protected areas may include both designation costs (e.g., stakeholder consultations, biological inventories, boundary demarcation land purchase, and compensation)*

and up-front purchases, construction, and planning". In order to create a PA (policy formulation stage), local governments face four types of transaction costs faced by local governments: expropriation costs, rent-seeking-costs, commitment costs and collective costs. To enforce a PA (policy implementation stage), local governments face agency and monitoring costs as well management costs.

During the policy formulation stage, local governments face barriers relating to expropriation costs for both sustainable and integral use PAs. This effect tends to be more robust for the ESEC, REBIO, PM, RESEX, FLOMA, and REFAU categories. Rocha, Drummond, and Ganem (2010) note that during the expropriation proceedings, the landowners usually claim for fair compensation for the land loss while the state tries to reach an initial agreement. If a contract has not been agreed upon after that moment, the landowner may try to file a suit against the state.

Companies lobbying and lobby groups can also facilitate or complicate the policy process of creating new municipal PAs. Lobbying by non-governmental environmental organizations, such as environmental groups, organizations, networks, and associations, can facilitate the creation of new PAs. In contrast, agribusiness lobby, hydroelectric lobby, and the mining lobby can complicate the process of creating new PAs (Loyola, 2014). In Brazil, for example, "owing to pressures of the agricultural sector, national administration has recently revised the Brazilian Forest Act" (Loyola, 2014, p. 1365). Rent-seeking costs can be substantial for integral PAs because their uses are highly limited due to biodiversity conservation purposes. Private entrepreneurs in the agribusiness sector anticipate future gains and losses before creating a new PA. This cost and benefit analysis has to be discussed with all political actors involved in the policy process before creating a new PA. Also, after adopting a PA, entrepreneurs interested in exploring the land for agribusiness are able to pressure local government to change the category and the extension of the PA.

A municipal PA also faces barriers related to collective costs. As a natural resource, a PA leads to new institutional arrangements that are evaluated by the local communities (Ostrom, 1990). They tend to compare previous agreements with the new ones, leading to a kind of cost and benefit analysis. Extractive reserve and fauna reserve are examples in which traditional communities and surrounding communities have to deal with new institutional arrangements, mainly for hunting and agriculture exploitation. The municipal government tends to spend money and efforts to maximize cooperation among communities to enforce a new institutional arrangement, such as a PA. In Brazil, landholding regularization to traditional communities in extractive reserves may take years due to bureaucracy and the financial costs associated with the process.

Local governments also face the consequences of the over time lack of commitment from the state government with respect to financial and technical support. Most of

the municipalities face financial stress and a lack of technical expertise to create and maintain a municipal PA. For instance, they have to develop technical studies to create a new PA, including Environmental Impact Assessment (EIA) and Environmental Impact Report (RIMA). These studies raise spending in hiring external experts.

During the implementation stage, after creating a municipal PA, the primary barrier to local governments is related to agency costs. Internal conflicts may arise to manage the PA. Pressure from companies lobbying and lobby groups may lead the manager of municipal PA (agent), which acts on behalf of the municipal government, to act in order to maximize their power and wealth which can be not aligned with the environmental conservation target predicted to the PA category. It can increase political and financial costs related to the Municipal Council on the Environment (CMMA) (Decree number 4340/2002, 2002) which is usually designed to oversight the PA, that is, it may increase monitoring costs.

Also after creating a municipal PA, municipal governments face an increase in management costs, that is, the recurrent management costs for existing PA. It includes operation costs "*(e.g., staff salaries and training, fuel, maintenance, community engagement, and monitoring and evaluation), site-level administration, and development projects or recurrent compensation costs that are a direct responsibility Systemwide of the protected area*" (Bruner et al., 2004, p. 1120). Some local governments face lack of funding to maintain these costs which is normally required in the implementation stage.

The political and financial costs to maintain the Municipal Council on the Environment (CMMA) to monitor the PAs and the spending to manage all categories of PA is sometimes an enduring task to local government's budget. Creating a municipal PA requires a relatively short-term political and financial commitment, but maintaining them is necessarily a long-term commitment to political and financial resources (Bruner et al., 2004). The spending may also decrease or increase according to the size of the PA because of economies of scale in monitoring/management, that is, a large PA that has greater inaccessibility area may have "*fewer impacts from edge effects, and a greater likelihood to be ecologically self-sustaining*" (Bruner et al., 2004, p. 1120).

In sum, we argue that the sustainable use and integral protection groups of PA tend to impose different levels of transaction costs, and hence facilitate or complicate the policy-making process of creating a PA. Also, "*different management objectives [for managing protected areas] require widely different activities and expenditures*" (Bruner et al., 2004, p. 1120). Table 18 summarizes the transaction costs at local level according to the different PA categories.

Table 18.: Different categories of PA and their transaction costs

Group	PA category	Land-use restrictions	Transaction cost
Integral protection	ESEC	1) Expropriation of private lands; 2) It is not open for public visitation	Expropriation costs Agency/monitoring/management costs Rent-seeking costs
	REBIO	1) Expropriation of private lands; 2) It is not open for public visitation	Expropriation costs Rent-seeking costs Agency/monitoring/management costs
	MONA	1) Reduced number of expropriated lands; 2) Open for public visitation	Rent-seeking costs Agency/monitoring/management costs
	REVIS	1) Reduced number of expropriated lands; 2) Open for public visitation	Rent-seeking Agency/monitoring/management costs
	PM	1) Expropriation of private lands; 2) Open for public visitation	Expropriation costs Rent-seeking costs Agency/monitoring/management costs
Sustainable use	RPPN	It comprises a private land, and allows: 1) scientific studies; 2) public visits (environmental education, and recreational activities)	Agency/monitoring/management costs
	RESEX	1) It allows scientific studies and public visits 2) Expropriation of private lands;	Agency/monitoring/management costs Expropriation costs
	SDR	3) It does not allow hunting activity, except by traditional communities. 1) It allows scientific studies and public visits 2) It allows a certain degree of private land-use	Collective costs (more intensively) Agency/monitoring/management costs
	FLOMA	3) It does not allow hunting activity, except by traditional communities. 1) Expropriation of private lands; 2) It enables the permanence of traditional communities, public visits, and scientific studies.	Expropriation costs Agency/monitoring/management costs
	REFAU	1) It allows scientific studies and public visits 2) Expropriation of private lands;	Agency/monitoring/management costs Expropriation costs
	ARIE	3) It does not allow hunting activity, except by traditional communities. 1) It allows private lands	Collective costs (more intensively) Agency/monitoring/management costs
	APA	1) It allows private lands, with restrictions in environmental-ecological zones	Agency/monitoring/management costs

Source: the author



## 5.5 THE CHANGE IN TRANSACTION COSTS FROM THE PRE-EFT TO THE POST-EFT PERIOD

The design of the EFT affects the level of transaction costs imbedded at all stages of the policy process. In the case of PA, an EFT scheme may follow requirements from local, regional, national and international levels. Also, public and private actors with different interests are involved in the policy process, including mayors, members of Congress, governors, and municipal associations (Ring and Barton, 2015). At the local level, there are groups with a keen interest in the creation of new PAs, such as landowners that will face land-use restrictions, entrepreneurs who will suffer a reduction in their economic activities, and so on.

Our approach regards EFT as a contract between the state government (principal) and the municipal governments (agents), although the state government has the power to impose an EFT scheme and holds the residual powers to modify the schema over time. Sometimes an agreement between principal and agents is an enduring task. The EFT literature points that EFT introduce a redistributive effects (Grieg-Gran, 2001; Jatobá, 2005). In Minas Gerais, for instance, the introduction of the EFT (known as Robin Hood Law) affected negatively the budget of the largest municipalities, leading *"the Association of Local Governments in the state, [to protest] about the reduction in their income (...)"* (Grieg-Gran, 2001, p. 20). Jatobá (2005) describes the same redistributive effect in the the state of Pernambuco.

With the implementation of EFT, the costs faced by municipal government with the creation of a new PA tend to reduce. The financial resources transferred from the state government to municipal governments reduce the expropriation costs, rent-seeking costs, collective costs, and commitment costs at the local level, particularly in the case of poor municipalities (Grieg-Gran, 2001; Loureiro, 2002). To be more precise, with EFT they have more money to pay compensations for expropriating a land, to increase spending in stakeholder consultations, biological inventories, and demarcation of lands which reduce the collective costs. In addition, they have more political incentives to create more restrictive areas and to deal with lobbying companies and groups because the money they receive from EFT is not earmarked, that is, the mayor is able to expand its budget and spend more money in other policies in order to increase its chances of reelection.

From the perspective of the principal (state government), EFT may be considered as an effort to reduce transaction costs among agents (local governments) in order to guarantee specific environmental policies, mainly in the short run, an argument that was introduced by Tavares (2003) In the long run, the EFT may also impose commitment costs to state government due to political costs in keeping the criteria agreed upon initially.

The extant literature have ignored the changes in EFT rules made by the state environmental agencies over time and their consequences for municipal budgets and, consequently, to local decisions. In Brazil, state legislative branches delegate to state agencies the role to refine the details in the EFT legislation. As Horn (1995, p. 21) notes, "*uncertainty exists at enactment when it is difficult to predict the private benefits associated with a given legislative refinement or standard, or the private costs of compliance with this standard*". These changes in the EFT, such as the weight of the conservation factor for a specific category of a PA to use in fiscal transfers, tend to increase the uncertainty for local governments. The design of EFT schema assigns different weights to transfers according to the type of PA: for integral protection or for sustainable use. Natural monuments, included in the integral protection group, can be used for eco-tourism, while environmental protection areas, extractive reserves, sustainable development reserves, and natural heritage private reserves included in the sustainable use group are also indicated for this purpose (Zaú, 2014).

As a redistributive game, another effect of the EFT is that the adoption of a new PA, that is, the inclusion of one more municipality in the share, reduces the revenue to be transferred to the others. Since the overall "*slice of cake*" decreases, creating the group *winners* and the group of *losers*, the redistributive effects of EFT tend to reduce the incentive to local governments for creating more PA as time evolves (Grieg-Gran, 2001). The commitment problems tend to increase over time accordingly.

The quality index adopted by each EFT scheme, comprising a set of qualitative requirements, such as monitoring the level of physical quality of the PA, its management plan, and its infrastructure, imposes an additional increase in transaction costs to local governments. Despite the importance of this index for biodiversity conservation (Grieg-Gran, 2001; Loureiro, 2002; Veiga Neto, 2000), monitoring all categories of PA is sometimes an enduring task for municipalities and some local governments are short in technical expertise to maintain a PA according to this quality requirements. Moreover, some municipal environmental agencies have to manage internal conflicts because they also bear the responsibility for agricultural, tourism, and environmental purposes (Oliveira, 2002; Pedrosa et al., 2013). Metaphorically, this is like a "*fox guarding the henhouse*". Delegation increases administrative discretion and, therefore, the ability of administrators to act in their interests (Horn, 1995). To minimize this potential problem, some Brazilian municipalities rely on a Municipal Council on the Environment (CMMA) with leaders of local communities, experts, and entrepreneurs (Decree number 4340/2002, 2002), with either consultative, and/or deliberative assignments in monitoring and enforcing new PA. In this institutional setting, the EFT design may facilitate or impede PA creation and enforcement, because the indicators related to local PA used in fiscal transfers may or may not compensate the additional efforts with qualitative requirements. Also, with the implementation of the quality in-

dex, municipal government face an increase in management costs such as staff salaries and training, fuel, maintenance, and community engagement.

The uncertainty about the regularity of money transfers, the lack of stability of the EFT rules over time, and the qualitative measurement that may be imposed by EFT, which *"imply additional transaction costs related to monitoring"* (Ring and Barton, 2015, p. 442), tend to increase transaction costs at the local level. To be precise, municipalities expect that the policy instrument will remain in effect without major revisions or changes by future coalitions. Increases in rent-seeking costs, expropriation costs, commitment costs, and collective costs may be a barrier to create new PA. Table 19 summarizes the levels of transaction costs pre-EFT and post-EFT implementation.

The commitment costs and agency/monitoring/management costs which may change the incentive effect of EFT among local governments have not been theoretically and empirically explored by the literature so far. This paper argues that the EFT scheme designed at the state level affects the structure of transaction costs at the local level. At the beginning of EFT implementation, EFT function as a commitment sign of the state government to municipalities in order to adopt environmental policies aligned with the state objectives. However, as time evolves, commitment costs tend to increase, and the incentive effect reduces. Also, the agency/monitoring costs and management costs tend to increase after adopting qualitative criteria in EFT scheme. Both transaction costs tend to retard or inhibit the adoption of the PA at the local level. Feiock and Stream (2001, p. 318) assert that *"institutional reform provides the promise of overcoming trade-offs between economic and environmental policy goals"*, but such reform have to take into account the structure of costs involved in political transactions.

Table 19 summarizes the change in different types of transaction costs with the implementation of EFT.

Table 19.: Change in transaction costs with the implementation of EFT

Transaction cost in adopting a PA	Hypothetical direction of change
Expropriation costs	Decrease
Rent-seeking costs	Decrease
Agency / Monitoring costs	Increases with a qualitative assessment
Management costs	Increases with qualitative assessment
Collective costs	Decrease
Commitment costs	Decrease at the beginning of EFT, but increase over time

Source: the author

We derive three hypotheses from the theoretical arguments. The **first hypothesis** is related with the difference in transaction costs between the integral protection and sustainable use groups of PA. We expect to find higher transaction costs in integral

categories of PA than in the sustainable use (Parente, and Bursztyn, 2012). Empirically, the implication is to observe higher survival rates, that is, **less adoption of integral categories**. The **second hypothesis** addresses the uncertainty that leads to commitment costs (Epstein and O'Halloran, 1999; Tavares, 2003) and it is related with the implementation of EFT. Since it reduces transaction costs at least in a short-term, the municipalities will be attracted to adopt more PA from the sustainable group. The empirical implication is an **increase in adoption of PA after EFT**. The **third hypothesis** is related to the costs and management costs at the local level (Horn, 1995). Empirically, we expect to find a **decrease in the creation of new PA after the imposition of the quality index** to local governments when the state government does not increase the support to municipal governments.

## 5.6 RESEARCH DESIGN

In order to assess the three hypothesis the empirical analysis follows a mixed-strategy research design that brings together a descriptive case study and statistical analysis that considers the adoption of 199 PA by some of the 853 municipalities of the State of Minas Gerais, locate in the southeast region of Brazil. The opportunity to have access to the reliable information gathered from the environmental agency (*Instituto Estadual de Florestas*) justifies our choice. In addition, since this specific state introduced a delay in the implementation of the quality index (from 1996 to 2005), this presents a richer opportunity to study its effect on the EFT scheme.

The first part of the analysis presents the design of EFT at the state level, detailing the evolution from its beginning until its current version. The analysis will describe the time length to adopt the quality index, as well as the changes of the biodiversity conservation factor over the years. These two indexes imposed important modifications in transactions costs faced by municipal governments because they lead to changes in their budgets due to the increases or decreases in the money transferred through EFT. Therefore, observed over the years, can be explained by these changes

In the second part we use an event history analysis (EHA) techniques to accounts for the changes in the pattern of adoption of PA by municipalities in the period from 1966 to 2013. In order to do this we begin by estimating Kaplan-Meier survival curves (see technical notes on Kaplan-Meier in appendix B, non-parametric descriptive methods). With this analysis, we statistically test the difference in the survival rates between the sustainable and integral groups of PA. We expect to find higher survival rates in integral PA groups (first hypothesis). After EFT enactment, we expect to see a decrease in the time length to adopt new PA in categories related to sustainable groups vis a vis the integral group (second hypothesis).

Then we proceed the EHA to enquire about the factors explaining the duration of PA adoption by municipal governments. According to the standard procedures in these types of methods, the unit of analysis is the PA created in a given year and the dependent variable is the duration time for creating a municipal PA (Box-Steffensmeier and Jones, 2004).

Two methodological notes are in place at this point. The first is about the type of sample available, in which we know only when PA are created but not when they are planned. This type of data is characterized by right truncation, the case when only those units that have experienced the exit event by some particular date are included in the sample (literature refers as an outflow sample). The second note is about estimation. Based on statistical tests, we estimate the model using the Weibull distribution <sup>1</sup> based on the Akaike Information Criterion (see technical notes on Weibull distribution in appendix B, parametric method).

With regard to independent variables, we included four main parameters to capture the effect of the EFT design in PA adoption. The first is related with the fluctuations in EFT money for PA. As Grieg-Gran (2001, p. 28) has noted, *"It is not straightforward to estimate the effect on a county's ICMS revenue [by] creating a protected area."* We measure the change in EFT money for PA with two variables. One is with a dummy for the years after EFT adoption and the other is by the conservation factor (FC) incorporated in EFT rules after its implementation. This factor observed some variations in the EFT regulations over the years (see the formula in the appendix). The second parameter is the quality index imposed in the EFT design to municipalities. We expect to find an increase in time (in years) for adopting a new local PA after the implementation of this index. The third is share of the PA area in the overall municipal area. The inclusion of this ratio is justified because the area of the PA constitutes one component to compute the EFT to be transferred (see the formula 13 in the appendix). The last, which functions mostly as a control variable, is a dummy for the adoption of the National System of Protected Areas (SNUC).

### 5.6.1 Data and Methods

Under the law on access to public information (law 12527/2011), we collected data concerning all municipal PA created from 1966 to 2013, including the group (sustainable or integral) and categories adopted in the State (APA, FLOMA, MONA, REBIO, PM, and SPA). As previously referred, the dependent variable (duration until the adoption of a PA) is measured in years.

<sup>1</sup> I also run Gompertz regression, being the result virtually the same. In no way are the substantive results altered.

Table 20 summarizes the variables used in the analysis, how they are measured, and how they were collected. We collected FC from the environmental agency in Minas Gerais. EFT, the quality index, and the The National System of Protected Areas (SNUC) are all computed as a dummy variables (0 for the years after their implementation, 0 otherwise). The categories of PA are also dummy variables (1 when a municipality adopts that type of PA, 0 otherwise). The share of PA a ratio area of the PA in the total area of the municipality. Table 21 presents descriptive statistics for all these variables.

Table 20.: Variables and sources

<b>Variable</b>	<b>Source</b>	<b>Measurment</b>
Duration	Instituto Estadual de Florestas (MG)	Duration until the PA adoption
Event	Instituto Estadual de Florestas (MG)	1 in case of PA adoption, 0 otherwise
EFT	Law 12040/1995 (Minas Gerais, 1995)	1 for the years after EFT adoption in 1996, 0 otherwise
Conservation Factor	Law 18030/2009 (Minas Gerais, 2009)	Conservation factor for each PA category
Share of Area	Instituto Estadual de Florestas (MG)	Area of the PAs over the total area of the territory of the municipality (ha)
Quality Index	Regulatory deliberation 86/2005	1 after the implementation of the quality index in 2005, 0 otherwise
APA	Instituto Estadual de Florestas (MG)	1 for the years after APA category adopted, 0 otherwise
PM	Instituto Estadual de Florestas (MG)	1 for the years after PM category adopted, 0 otherwise
REBIO	Instituto Estadual de Florestas (MG)	1 for the years after REBIO category adopted, 0 otherwise
MONA	Instituto Estadual de Florestas (MG)	1 for the years after MONA category adopted, 0 otherwise
FLOMA	Instituto Estadual de Florestas (MG)	1 for the years after FLOMA category adopted, 0 otherwise
SNUC	Instituto Estadual de Florestas (MG)	1 for the years after SNUC adopted, 0 otherwise

Source: compiled by author

Table 21.: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Duration	32.452	7.591	0	47	199
Event	1	0	1	1	199
Conservation Factor	0.585	0.342	0	1	199
Share of the PA	0.27	0.43	0	5.371	199
Quality Index	0.945	0.229	0	1	199
APA	0.709	0.456	0	1	199
PM	0.171	0.377	0	1	199
REBIO	0.08	0.273	0	1	199
MONA	0.03	0.171	0	1	199
FLOMA	0.005	0.071	0	1	199
SNUC	0.563	0.497	0	1	199
EFT	0.834	0.373	0	1	199

Source: compiled by author

## 5.7 EFT IN THE STATE OF MINAS GERAIS

### 5.7.1 EFT in Minas Gerais for Biodiversity Conservation Policy

As mentioned previously, Minas Gerais was the fourth Brazilian State to enact the first EFT law (Paulo and Camões, 2017). With regard to its practical implementation, *“the states of Minas Gerais and São Paulo started operating the ICMS ecológico in 1996, followed in 1997 by the state of Rondônia”* (Grieg-Gran, 2001, p. 1). The EFT scheme in Minas Gerais is known as the *Robin Hood law*, because its aim is *“to reduce the allocation to the richer counties and give more to the poorer ones”* (Grieg-Gran, 2001, p. 12).

The EFT scheme constitutes a small part of the ICMS which is collected by the State and transferred to municipalities. As Grieg-Gran (2001, p. 2) has noted *“(…) the introduction of the ecological criterion was accommodated by a reduction in the weight assigned to the value-added criterion”*. The percentage dedicated to the environment is one percent to be split between water sanitation and PA. The first is related to sewage treatment, composting plants, and landfills, *“which attend to the needs of a certain proportion of the population”* (Grieg-Gran, 2001, p. 4). The second includes PA from the federal, state and municipal governments, as well as those from private landowners, *“although any ICMS revenue associated with them accrues to the county and not to the owner of the land”* (Grieg-Gran, 2001, p. 4). Since its beginning of EFT until 2008, 0.5 percent was devoted to water sanitation, while 0.5 percent to the PA (Minas Gerais, 1995, 2000). From 2009 up to now, 0.45 percent is dedicated to water sanitation, 0.45 percent to the PA, and 0.091 percent to fire control (Minas Gerais, 2009). The environmental rates for fiscal transfers increased gradually over the first years (see table 24 in appendix).



From 1996 to 1998 the percentage dedicated to environmental issues increased from 0.333 to 1 (one) (Minas Gerais, 2000, 2009), indicating that EFT legislators were uncertain about how to design this policy instrument. The gradual increases in environmental rates observed over the years where what Douglass North designated as a "stable structure of exchange" (North, 1990, p. 50). But a simple change in the rule of fiscal transfers have the potential of imposing substantial changes in municipal budgets (Paulo and Camões, 2017, 2018). This is important because it may reduce the political resistance of political actors at the policy implementation stage.

The Index of Biodiversity Conservation of Municipality measures the PA that are included in the EFT in Minas Gerais state ("ICi" - see the formula 15 in the appendix). Concerning the operation procedures, the municipalities have to register their PA in the state environmental agency to receive money from the EFT. Currently, the state environmental agency publishes the ICi for all municipalities each trimester. There are three components in the method to determine the ICi index to be used in the EFT formula: i) the area of the PA in hectares; ii) the conservation factor of the PA (FC); and iii) the quality of the PA. The quality index varies from zero point one to one. The FC assigns different weights to each type of PA (see table 22). As Grieg-Gran (2001, p. 5) has noted, "the more restrictions imposed on the use of the land, the higher the conservation weighting."

Table 22.: Conservation Factor of the Protected Area

Group	Management category	1995	2000	2009
Integral protection	Ecological station	1	1	1
	Biological reserve	1	1	1
	Natural monuments	1	1	1
	Wildlife refuge	1	1	1
	<b>Municipal park</b>	0.9	0.9	1
Sustainable use	<b>Natural heritage private reserve</b>	0.9	0.9	1
	Extractive reserve	0.5	0.5	0.5
	<b>Sustainable development reserve</b>	0.7	0.7	0.5
	<b>Municipal forest</b>	0.7	0.7	0.3
	Fauna reserve	0.3	0.3	0.3
	Area of relevant ecologic interest	0.3	0.3	0.3
	<b>Environmental protection area</b> (with env. eco. zoning maps)	0.1 to 1	0.1 to 1	0.1 to 0.5
	Environmental protection area (without env. eco. zoning maps)	0.025	0.025	0.025
	<b>Eco. recovery private reserve</b>	0	0.9	0.1
	Indigenous land	0.5	0.5	0.5
	<b>Specially protected areas</b>	0.1	0.1	0

Source: compiled by author from Minas Gerais (1995), Minas Gerais (2000), and Minas Gerais (2009)

The conservation factors have changed over time although only slightly (see in table 22 with the categories of PA in bold). As explained in section 4, over time the legislative branch delegates to the environmental state agencies the role of refining the details in legislated in the EFT scheme, imposing its preference over local governments. Considering the conservation factors assigned to PA in the integral groups, municipalities significantly choose to increase the adoption of APA, which belong to the sustainable group. But this effect is clearly observed after the adoption of EFT, as the visual inspection of figure 27a) clearly shows.

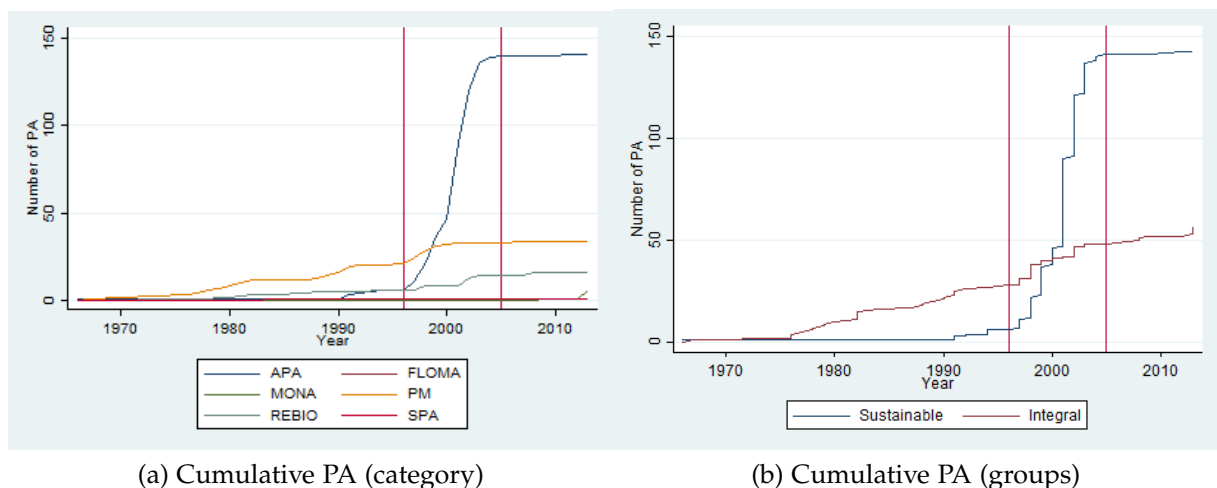


Figure 27.: PA analysis

The vertical lines shown in figure 27 indicate both the EFT implementation in 1996 and the adoption of the Quality Index of the Protected Area in 2005. Although predicted in the first law enacted in 1995, Minas Gerais adopted FQ only in 2005 (regulatory deliberations 86/2005 passed by COPAM, the Environmental state agency). These figures suggest that, after the increase following the implementation of EFT, the introduction of the FQ flattened the evolution of PA across municipalities. The period between the two lines registered transformations that are clearly seen with naked eyes. This result goes in line with our hypothesis which states that the introduction of the quality index increases the transaction costs for local environmental agencies, and, then, decreases the number of adoptions of municipal PA. We turn now to assess the statistical significance of these visual impressions.

### 5.7.2 Event History Analysis

Figure 28 plots Kaplan and Meier survival rates for the integral and sustainable groups of PA. These two curves, measuring the probability of staying in the sample as time evolves, significantly differ (Log-Rank test:  $Pr > \chi^2 = 0.0457$  for null hypothesis of non-difference). This means that the probability of surviving is different for the

sustainable and integral groups of PA at any point in time. This happens because the evolution of the survival rates in the integral group of PA is mostly stable over time. In the case of sustainable group, there is a structural change after about 35 years, with significant decrease in the survival rates, meaning the adoption of more PA of this group, particularly of the APA category. This turning point is shortly after the adoption of the EFT. Our first hypothesis of a higher level of transaction costs in integral categories of PA is corroborated but only for the period after the EFT.

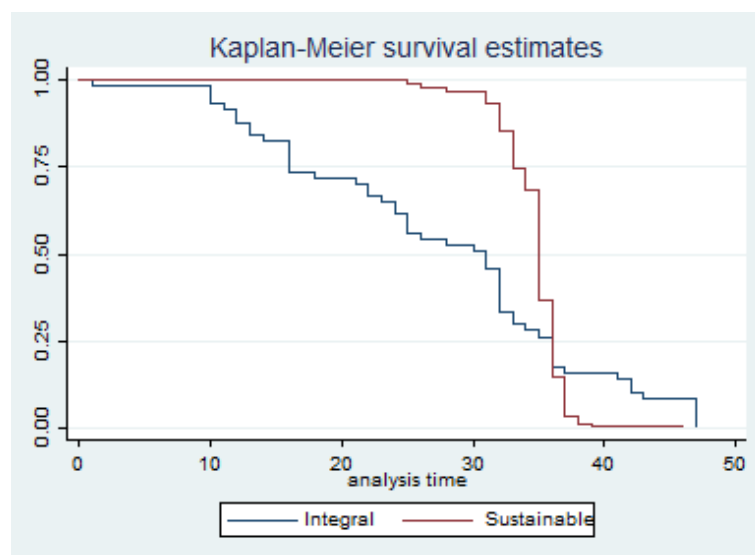


Figure 28.: Groups

These result persists when we control for other factors when we run survival regressions as in table 23. Both the conservation factor (FC) and the dummy for EFT are statistically significant, which clearly shows that the implementation of the EFT contributed to increase timing of adopting local PA, robustly corroborating the conclusions of [Fernandes et al. \(2011\)](#) and [Grieg-Gran \(2001\)](#). On the other hand, the dummy for the adoption of the quality index is also statistically significant and according to our third hypothesis about the deleterious effect this requirement to the adoption of PA. The other variables are all statistically significant as expected. In sum, the regression results provide statistical evidence, that even controlling for other factors, the EFT and the quality index had opposite but significant effects in the adoption of PA.

## 5.8 CONCLUSION

This paper contributes to EFT literature to fill a critical gap to address the influence of EFT on the policy-making process of adopting local PA by municipal governments. The findings presented in the study partly complement the [Moura \(2015\)](#) analyses.

First, we provided empirical evidence that the uncertainty of the EFT revenue increases the commitment costs. It leads to changes in local decisions in the sense of

Table 23.: Weibull regression

	Model (1)	Model (2)	Model (3)
Conservation Factor	-3.325*** (-11.70)		
EFT		-3.594*** (-12.64)	-3.872*** (-12.77)
EFT × Share of Area			15.31 (1.93)
Share of Area	-0.0424 (-0.15)	0.0198 (0.09)	-15.27 (-1.93)
Quality Index	1.501*** (4.28)	2.786*** (7.50)	2.795*** (7.52)
SNUC	-2.708*** (-12.44)	-1.134*** (-6.17)	-1.138*** (-6.19)
Constant	-38.52*** (-14.72)	-41.16*** (-14.88)	-40.98*** (-14.87)
ln_p Constant	2.449*** (37.94)	2.488*** (38.44)	2.490*** (38.67)
Observations	198	198	198

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

choosing the best institutional arrangement through the policy-making at local level, that is, local governments tend not to lose their discretion so much. Second, we provided empirical evidence that the quality index of PA imposes additional costs to local governments.

Finally, we recommend to test this set of hypotheses in other Brazilian states. For practitioners, we suggest the involvement of the local governments in state governments decisions, hearing their needs and supporting them before an institutional change, such as the implementation of the quality index for PA.

## APPENDIX A

$$\mathbf{FCMi} = \frac{\mathit{AreaUCi} \times \mathit{FC} \times \mathit{FQ}}{\mathit{AreaMI}} \quad (13)$$

where:

$\mathit{FCMi}$  is Index Biodiversity Conservation Factor of the Protected Area "j" in Municipality "I"

$\mathit{AreaUCi}$  is Area of the Protected Area "j" in Municipality "I"

$\mathit{FC}$  is Conservation Index of the Protected Area

$\mathit{FQ}$  is Quality Index of the Protected Area

$\mathit{AreaMI}$  is Area of the Municipality "I"

$$\mathbf{FCE} = (\mathit{EFCMi}) \quad (14)$$

where:

$\mathit{FCE}$  is Index of Biodiversity Conservation Factor of the State

$\mathit{EFCMi}$  is Biodiversity Conservation Factor of the Protected Area "j" in Municipality "I"

$$\mathbf{ICi} = \left( \frac{\mathit{FCMi}}{\mathit{FCE}} \right) \quad (15)$$

where:

$\mathit{ICi}$  is Index of Biodiversity Conservation of Municipality

$\mathit{FCMi}$  is Biodiversity Conservation Factor of the Municipality

$\mathit{FCE}$  is Biodiversity Conservation Factor of the State

## APPENDIX B - TECHNICAL NOTE ON EHA

*Non-parametric descriptive methods*

According to Blossfeld et al. (2007), the non-parametric method is suited for the first exploratory data analysis. This method does not make assumptions with regard to the distribution of the process, that is, there are no regressors in the study. We used the Kaplan-Meier estimator, also known as product-limit estimation. This method "is based on the calculation of a risk set at every point in time where at least one event occurred" (Blossfeld et al., 2007, p. 72). Mathematically, the Kaplan-Meier estimator takes the ratios of those without events over those that are at risk and multiplies them over time (see equation 16).

$$s(t_j) = \prod \frac{n_j - d_j}{n_j}$$

(16)

Graphically, the Kaplan-Meier survival functions present the decrease of the function step by step with a skip at each discrete event time.

*Parametric method*

Among the set of parametric models, we choose the Weibull. In our distribution, the hazard rates are not constant. Therefore, the Weibull model is the appropriate model that allows increasing or decreasing hazard rates. Formally, the hazard function in Weibull model has the following mathematical formulation (equation 17):

$$\gamma \alpha^{\alpha-1}$$

(17)

Additionally, the survival function in Weibull model has the following mathematical formulation (equation 18):

$$\exp(-\gamma t)^\alpha$$

(18)

For this choice, we follow [Box-Steffensmeier and Jones \(2004, p. 25\)](#), that state "*if a researcher suspects the hazard rate is increasing or decreasing then a Weibull distribution function may be appropriate.*" Also, we compared Exponential, Gompertz and Weibull regressions based on Akaike Information Criteria (AIC). The results did not change significantly between Gompertz and Weibull, but it pointed out the exponential model inappropriate.



APPENDIX C - ICMS DISTRIBUTION IN MINAS GERAIS STATE

Table 24.: ICMS Distribution in Minas Gerais State

<i>Criteria</i>	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2009	2010	2011
<i>Value fiscal added</i>	88,05	83,46	79,49	79,55	79,61	79,63	79,64	79,66	79,668	79,68	79,68	79.68	75
<i>Geographic area</i>	0.333	0.666	1	1	1	1	1	1	1	1	1	1	1
<i>Population</i>	0.666	2.0420	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.7
<i>Munic. (largest population)</i>	0.666	1.3320	2	2	2	2	2	2	2	2	2	2	2
<i>Education</i>	0.666	1.332	2	2	2	2	2	2	2	2	2	2	2
<i>Food production</i>	0.333	0.666	1	1	1	1	1	1	1	1	1	1	1
<i>Cultural heritage</i>	0.333	0.666	1	1	1	1	1	1	1	1	1	1	1
<i>Environment</i>	0.333	0.666	1	1	1	1	1	1	1	1	1	1	1,1
<i>Health</i>	0.666	1.332	2	2	2	2	2	2	2	2	2	2	2
<i>Municipality tax revenue</i>	0.666	1.332	2	2	2	2	2	2	2	2	2	2	1.9
<i>Minimum quota</i>	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
<i>Mining town</i>	1.5	0.75	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.01
<i>Water resources</i>	0	0	0	0	0	0	0	0	0	0	0	0	0.25
<i>Number of prisons</i>	0	0	0	0	0	0	0	0	0	0	0	0	0.10
<i>Sports</i>	0	0	0	0	0	0	0	0	0	0	0	0	0.10
<i>Tourism</i>	0	0	0	0	0	0	0	0	0	0	0	0	0.10
<i>ICMS Solidario</i>	0	0	0	0	0	0	0	0	0	0	0	0	4.14
<i>Minimum per capita</i>	0	0	0	0	0	0	0	0	0	0	0	0	0.10
<i>Mateus Leme</i>	0.20383	0.1807	0.13555	0.09037	0.04518	0.032	0.024	0.016	0.008	0	0	0	0
<i>Mesquita</i>	0.08755	0.0778	0.05837	0.03891	0.01946	0.016	0.012	0.008	0.004	0	0	0	0
<i>Total</i>	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: compiled by author from Minas Gerais (1995), Minas Gerais (1996), Minas Gerais (2000), and Minas Gerais (2009)



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## CONCLUSION

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### 6.1 CLOSING REMARKS

The objective of this thesis was to investigate the EFT in Brazil and, for that purpose, it adopted the theoretical lens of transaction-cost politics, assuming they can be compared to a contract between the state government (principal) and the large number of local governments (agents). In addition, this contract is also assumed to be incomplete because it is almost impossible to fill all loopholes to avoid future movements contrary to the principles laid out by the policy instrument. Therefore, this dissertation deviates from the traditional research agenda of EFT in Brazil. Traditionally, the EFT literature seeks to evaluate these transfers in the Pareto efficient perspective, that is, whether the policy instrument reaches the environmental efficiency in the sense of promoting and compensating local governments to create and maintain protected areas. Instead, we argue that the commitment problems, legislative decision-making costs, information asymmetry, uncertainty, and agency costs lead to restrictions in contract enforcement and, consequently, to a policy outcome reflecting the goals of the political actors who seek reelection. In other words, EFT do not necessarily achieve the compensation and incentive to create and maintain protected areas across local governments.

With this theoretical lens, this dissertation begins to fill three critical gaps in theoretical and empirical analyses of EFT in Brazil. First, we described the adoption of EFT across Brazilian states and explained the differences in the timing of their adoption based on the transaction-cost theory. This enabled us to perceive the impact of the legislative decision-making costs and the commitment costs of the process of EFT adoption. Second, we described and explained some delays and terminations that followed the adoption of the EFT across Brazilian states based on the TCP framework. This analysis demonstrates that the legislative decision-making costs and the agency costs can make the policy implementation of EFT more difficult. Third, we evaluated the consequences of the implementation of ecological fiscal transfers on the policy-making process of protected areas at the local level. This study shows that

the uncertainty of EFT revenues increases the commitment costs and, accordingly, induces changes in local decisions; that is, local governments tend not to lose their discretion so much. Also, the quality index can affect the creation of new protected areas negatively because it imposes additional costs to local governments.

Globally, the findings of this thesis offer an overview of the policy process of adopting and implementing an EFT scheme in Brazil. The essays also bring some grounds that, jointly, may develop a theory of the policy process of EFT to be tested in other similar institutional settings.

The redistributive effects of the ecological fiscal transfers lead to conflicts among political actors, increasing the legislative decision-making process. These effects may lead to two decisions by the legislative branches: i) Delegate to the environmental state agency the role to refine the legislation; that is, transfer the costs to bureaucrats. ii) Impose a gradual implementation of the percentage dedicated to environmental criteria to municipalities; that is, minimize the resistance of the political actors involved in the policy process to accept a new institutional arrangement.

In sum, our findings provide empirical and theoretical support to understand that the policy process of formulating and implementing a revenue-sharing mechanism or intergovernmental transfer can be affected by the self-interest of politicians who seek reelections, the lack of structure and expertise of agencies, and the uncertainty in maintaining the rules agreed to at the beginning of the policy formulation stage. The local governments face two options in this type of policy instrument imposed by a state government: adaptative or non-adaptative behaviors. This choice is highly dependent on the costs associated with the policy implemented.

## 6.2 LIMITATIONS OF THE STUDY

Following the transaction cost theory, the hypotheses in the first essay are related to commitment costs and legislative decision-making costs. However, other types of transaction costs could be addressed, such as influence costs and adverse selection costs. During the ex-ante moment, influence costs may arise when the local government tries to influence state decisions to change EFT rules. During the ex-post moment, the agency costs generate adverse selection costs from information asymmetry, and moral hazard due to ex-post opportunistic behavior on the part of agents, that is, local governments. In EFT schemes, the states seek information concerning environmental criteria, mainly related to local protected areas, and many times it is challenging to collect them in order to put the policy instrument in practice. Besides, sometimes the municipalities do not know the environmental situation of other local governments either and how the policy instrument functions. Both types of costs, influence costs, and adverse selection costs may also explain EFT adoption.

The second essay discusses the cases of delay and termination in the overall EFT scheme, as well as the cases of delays and termination of adopting environmental criteria. However, we only accessed information in the environmental state agencies, based on the law on access to public information. Other political actors could be interviewed, such as mayors, governors and state congressman.

The third essay presented that some design aspects of the EFT such as uncertainty, commitment, and monitoring costs slowed and flattened the increase of municipal protected area. We used a database collected in the State of Minas Gerais to conduct the empirical analysis. In order to generalize the findings, different databases collected in other states can be used to empirically test the set of hypotheses related to uncertainty, commitment, and monitoring costs in different EFT schema.

### 6.3 POLICY IMPLICATIONS

The OECD (2013) refers to EFT as an essential environmental fiscal reform to achieve biodiversity targets. Also, the role of EFT for biodiversity conservation policies is strongly related to the goal 15 of the 2030 Agenda for Sustainable Development.

Brazil is the first country to adopt EFT and the only to use such mechanism to compensate and provide incentives to local governments to create and maintain protected areas (Paulo and Camões, 2018). In Portugal and France, the compensation dimension of EFT is more robust. Therefore, Brazil may be considered as a laboratory to study EFT. Then, some policy implications can be displayed based on the findings of this study.

Globally, the essays enabled us to perceive that the legislative decision-making costs, commitment costs, and the agency costs can make the process of EFT formulation and implementation at the state level more difficult. At the local level, the findings demonstrate that municipalities are more attractive to adopt less restricted protected areas after EFT implementation. Also, the quality index may impose additional costs to municipal governments. Therefore, this study provides insights that can help policy-makers to consider new ways to design EFT schemes.

The EFT scheme based on a gradual increase in percentage dedicated to environmental criteria reduces the chance of delay in implementing the scheme. The process of delegating to the environmental agencies the role to refine the procedures to implement the EFT may impose delays and terminations of criteria. This is because of the absence of technical expertise and human resources in environmental state agencies to deal with the policy instrument that can lead to agency problems.

At the local level, the commitment costs may appear in two forms: i) The state government may increase the weights for more restricted, protected areas so that the EFT may be more attractive to municipalities; ii) The municipalities may design

their institutional arrangement with less restrictive PAs to maintain a certain level of discretion in their decisions. In addition, the quality index may impose additional costs to municipal governments when state and municipal environmental agencies act as substitutes in their efforts. Therefore, the implementation of the quality index may negatively affect the desired outcome of the EFT when the agencies do not work cooperatively.

#### 6.4 AVENUES FOR FUTURE RESEARCH

The primary goal of this thesis was to develop a transaction cost politics framework applied to ecological fiscal transfers (EFT) in Brazil. Throughout this study, we provided theoretical and empirical evidence that the transaction costs might facilitate or complicate the formulation and implementation of EFT at the state and local levels.

Therefore, as the first avenue for future studies, we recommend testing the set of hypotheses presented in the third essay in other Brazilian states. To be more precise, we suggest checking whether the uncertainty leads to commitment costs and, consequently, to an increase or decrease in the time frame for the creation of new protected areas at the local level. Also, we suggest investigating the agency costs at the local level in other states (i.e., whether the implementation of the quality index in the EFT scheme imposes additional costs to local governments and, consequently, affects the creation of new protected areas negatively).

Second, our findings provide evidence that the policy formulation and implementation process of adopting a redistributive intergovernmental policy instrument is influenced by the self-interest of politicians seeking reelection as well as by the lack of agency structures and expertise. Also, the uncertainty in maintaining the rules agreed to at the beginning of the policy implementation and formulation stage affects adaptive behavior by the local governments to accept the policies imposed by EFT. This rich set of empirical and theoretical evidence provides an encompassing explanation for revenue-sharing mechanisms and intergovernmental transfer from the state to the local government to achieve environmental policies. Therefore, an ecological fiscal transfer scheme or similar policy instrument is the result of changes in the economy, environment (protected areas), society, and power among political actors who shape the policy-making process. These changes can drive the policy process of adopting a policy instrument based on redistributive intergovernmental fiscal transfers. The policy adoption literature uses only internal determinants and regional diffusion to explain the adoption of the public policy. We also suggest considering the transaction cost to explain the process of adopting a redistributive policy in future studies, mainly in developing and emerging countries.

Third, although we focus on protected areas, we believe that the transaction-cost theory can also provide some grounds for understanding the EFT in solid waste management. It is an exciting upcoming research agenda. Brazil is the only country to use EFT for solid waste management purposes and has gained strength over the years within the group of EFT adopters. There are 3,326 Brazilian municipalities out of 5,570 that persist in maintaining dumps or other kinds of inadequate disposal of solid waste even though the federal, state, and municipal governments have implemented several policy instruments (Castagnari, 2005). Therefore, the EFT are an appealing policy instrument that seeks to contribute to improve solid waste management policies despite some empirical evidence presenting the noneffectiveness of EFT in this field (Silva Júnior, et al, 2012; Paulo, 2013). Also, our research presented that the state of Mato Grosso extinguished the environmental sanitation criterion from the EFT scheme, which includes solid waste management policies at the local level.

The EFT scheme for solid waste management differs from the EFT scheme for protected areas in terms of purpose. First, it is costly for municipalities to implement and maintain landfills despite the existence of a fee paid by households for this purpose. The revenue from taxes is sometimes not enough to cover all expenses to create and maintain a landfill or composting plants. In addition, increasing the fee is an unpopular decision by politicians. Therefore, we believe that the transaction-cost politics framework can provide a solid explanation of the political costs associated with the inclusion of solid waste management criteria in EFT schemes.

Finally, concerning solid waste management we suggest investigating how EFT can work to foster even more local experiences based on collective actions (Feiock, 2008). For policy-makers, this research agenda may also contribute to accelerate the integration of the public consortia for sanitary landfill that is ongoing since 2005 into the EFT mechanism. These results also show that local governments may seek collective solutions to collective problems in order to achieve economies of scale and, accordingly, solve efficiently problems related to solid waste management services.





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## BIOGRAPHICAL SKETCH

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