

The adoption of ecological fiscal transfers: An empirical analysis

Felipe Luiz Lima de Paulo^{a,*}, Pedro Jorge Sobral Camões^b

^a Universidade Federal Rural de Pernambuco, Brazil

^b University of Minho, Portugal

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ABSTRACT

The ecological fiscal transfers (EFT) from states to municipalities were adopted by 16 of the 26 Brazilian states since 1990s to stimulate and compensate districts for achieving some environmental goals. This study aims to understand the adoption of this economic-policy instrument by Brazilian states and argues that the vertical relations between the federal and state governments increase the EFT adoption. The hypotheses are derived from the transaction-costs politics and the institutional collective action frameworks, namely built in legislative decision-making costs and commitment costs, and are empirically tested using event history analysis for the period of 1990–2015. The conclusions point to the idea that the adoption rate increases in non-electoral years, suggesting that politicians tend to avoid conflicts during electoral years. They tend to minimize the costs related to the legislative decision-making process. Also, the coordination of the central government has the potential for facilitating the adoption of EFT. More broadly, the transaction cost-politics framework and the institutional collective action framework can explain EFT adoption partially.

1. Introduction

Ecological fiscal transfers (EFT) are an economic instrument used to compensate for opportunity costs associated with land-use restrictions for biodiversity conservation, watershed protection, and landfills, as well as to promote the creation of new municipal protected areas and programs related to solid waste management. They have been adopted in Brazil since the 1990s to redistribute revenues to decentralized governments using indicators based on environmental criteria (Ring and Barton, 2015). This mechanism goes by 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. A common feature in all of the adopted mechanisms is its redistributive effect, which may generate conflicts among several political actors (Lowi, 1972; Jatobá, 2005; Grieg-Gran, 2001).

Among the economic instruments available for biodiversity conservation, ecological fiscal transfers and the payments for environmental services (PES) use payment as incentive to protect the environment (Ring and Barton, 2015). The EFT provides a financial incentive and a compensation to local government affected by the land-use restrictions caused by hosting protected areas, while the PES provides a financial incentive to private resource user to protect the environment. To be more precise, the PES “can be government-financed or

market-based payments made largely to land users and, thus, private actors at the property level” (Ring and Barton, 2015, p. 430), and the EFT “represent public transfers between different levels of government, compensating state or local governments for conservation costs at decentralized levels” (Ring and Barton, 2015, p. 430). Thus, when a protected area is created, the EFT is preferred to compensate decentralized governments due to land-use restrictions and to incentivize them to create more protected areas. To date, the EFT are used in Brazil (Ring, 2008), Portugal (Santos et al., 2012), and on a small scale, France (Borie et al., 2014).

The existing literature on EFT brings some empirical evidence on the compensation of and incentive for this policy instrument. Concerning the incentive dimension, Droste et al. (2017b) concludes 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 municipalities (Fernandes et al., 2011). In Portugal, Droste et al. (2017c) found an increase of municipal and

* Corresponding author.

E-mail addresses: felipe.paulo@ufrpe.br (F.L.L. de Paulo), pedroc@eeg.uminho.pt (P.J. Sobral Camões).

national protected area after the implementation of EFT.

The importance of the EFT to the environment is also referred to by OECD (2013). It states the EFT as an essential example of environmental fiscal reform, and since Brazil was the first country to adopt such scheme and each state can opt for different criteria, it allows one to check for interesting patterns so as to understand the EFT and its consequences for land use policy. In Brazil, the first state to enact an EFT scheme was Paraná at the beginning of 1990s (Ring, 2008) and the primary purpose of introducing the EFT in that state was to compensate poor municipalities that hosted state and federal protected area (Loureiro, 2002). This group of municipalities was facing at the time several land-use restrictions (Loureiro, 2002; Grieg-Gran, 2001). Therefore, the original idea of EFT was to compensate local governments that hosted protected areas in their territories. As time evolves, this idea also expanded so as to encourage local governments to create more protected areas (Loureiro, 2002).

Sixteen out of 26 Brazilian states, now use an EFT to redistribute the tax on the circulation of goods, interstate, and intercity transportation and communication services (ICMS), a type of value added tax (VAT). As expected, not all states have followed this diffusion process (Medeiros, 2013). Thus far, the interaction of state government and municipalities at the moment of EFT adoption 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 among many others that are used to achieve policy goals in environmental fields, as is the case of the National System of Protected Area (SNUC), enacted in 2000, that established criteria and standards for the creation, implementation, and management of protected areas.

A pioneering study adopting a descriptive and qualitative methodology, raised the hypothesis that party ideology and the convergence zone (CZ) between adopters and non-adopters may explain the adoption and diffusion of EFT (Medeiros, 2013). But the literature addressing EFT adoption is still scarce and calls for further investigation. Understanding the adoption of EFT in Brazil has the potential of illuminating the prospects of adopting similar policy tools in different institutional settings, therefore, enhancing the ability to design land use policies at the local level. This paper contends that conflict avoidance explains the adoption of EFT. By redistributing revenues from ICMS to municipalities, the adoption of EFT also raises conflicts among political actors. In the State of Pernambuco, for example, the association of municipalities pressured the state government to change the EFT scheme due to the municipalities that lost revenues from the redistribution of ICMS (Jatobá, 2005). In the State of Minas Gerais, larger municipalities protested about the reduction of revenues in their budgets due to the introduction of the EFT (Grieg-Gran, 2001).

This study seeks to answer the following research questions: *How was the EFT adopted? What determinants explain the state adoption?* Framed by 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 reviews the literature on EFT in Brazil and Europe. Section 3 develops a set of hypotheses on the political transaction costs and institutional collective action frameworks. Section 4 presents the research design and the event history analysis methodology. Section 5 presents the findings and discusses their theoretical and empirical relevance. Section 6 discusses some policy implications based on the findings. Section 7 provides final remarks and some suggestions for future research.

2. Ecological fiscal transfers in Brazil and Europe

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 fiscal 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. 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) note 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. Other features of EFT concern the type of costs or benefits imposed. Quantitative or qualitative indices 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 among them.

2.1. Ecological fiscal transfers in Europe

EFT redistribute revenues from centralized to decentralized governments using ecological indicators. Brazil was the first country to adopt this schema in the beginning of the 1990s in the State of Paraná (Ring, 2008). In Europe, Portugal followed Brazil in 2007 and adopted its EFT using the local finance law (Santos et al., 2012). France adopted its EFT in 2006, although on a small scale, to protect areas related to national parks or marine parks (Schröter-Schlaack et al., 2014; Borie et al., 2014).

The effects of EFT in Portugal were studied recently by Droste et al. (2017c). Using a Bayesian structural time series approach, the authors raised the following hypothesis: "whether introducing EFT in Portugal incentivized municipalities to designate PA and has led to a decentralization of conservation decisions" (Droste et al., 2017c, p. 1027). They found "a significant increase in the ratio of municipal and national PA designations following Portugal's EFT introduction" (Droste et al., 2017c, p. 1027).

Similar schemes were also simulated in some European countries. Borie et al. (2014) theoretically simulated the inclusion of the Mediterranean region of southern France in the French EFT scheme using the surface of the protected area and the population equivalent method. In Switzerland, Köllner et al. (2002) simulated the EFT using cantonal biodiversity benchmarking in the intergovernmental relations. In Germany, Droste et al. (2017c) proposed an EFT scheme using the introduction of ecological indicators in the intergovernmental fiscal transfers system. In Poland, the issue of EFT was drafted by the Council of the Rural Boroughs Association (Schröter-Schlaack et al., 2014). More recently, Droste et al. (2018, p. 373) developed "a proposal for an EFT design within the supranational context of the [European Union (EU)] and [assessed] its potential effects with evidence-based estimates". The authors developed such a model based on the first EFT scheme adopted in the State of Paraná in Brazil.

2.2. 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, 25% of the total amount raised by the ICMS belongs to municipalities. Three-quarters of

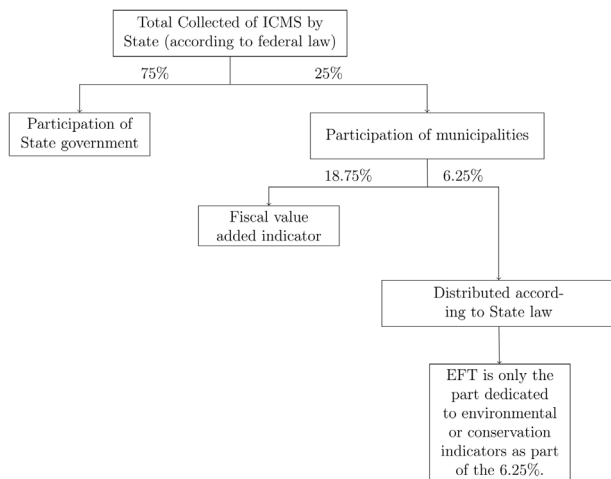


Fig. 1. EFT scheme in Brazil.

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 25% freely distributed by states to municipalities, that is, a share of six point 25% of total ICMS revenue collected by the state governments. Fig. 1 details this scheme of distributing ICMS revenues to states and municipalities and how it turns into distribution.

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. To be precise, EFT in Brazil are performance-oriented transfers “which are conditional on the supply of a particular result but do not necessarily require that transfers received are spent on specified purposes” (Droste et al., 2018, p. 374). The municipalities have to meet the requirements imposed by the State government to receive money from EFT, create a protected area for example, but they are not obligated to spend the money on a specific purpose.

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, executive branch, or legislative branch may propose an EFT law to be discussed. However, there is no case that the process begun with citizens. In practical terms, only two political actors begin the process: the governors or members of the state congress. 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 members of the state congress, 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, the environmental agency of the state details the EFT procedures and implement the ecological fiscal transfers to local governments.

There are two leading groups of ecological indicators to be considered in EFT schemes: the first is related to protected areas, i.e., biodiversity conservation policies at the local level; and the second concerns solid waste management across municipalities (see Table 4 in Appendix A, The Nature Conservancy, 2017). Fig. 6, in Appendix A, illustrates the spatial distribution of the states with an EFT scheme already adopted in which use protected area and solid waste management indicators.

By the Brazilian Constitution of 1988, municipalities were consolidated as autonomous bodies, sharing a role in the environmental protection of their territories with more centralized governments, such

as the state and federal governments. 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 (Loureiro, 2002; May et al., 2012).

The EFT scheme adopted in Brazil imposes redistributive effects on municipalities, creating the group of local governments positively affected (*winners*) and the group negatively affected (*losers*) throughout policy operation stage (Jatobá, 2005). This effect caused resistance within political actors involved in the policy process of adopting EFT in the sense of changing the current institutional arrangement to a new one. Some resistance from municipalities was observed at the beginning of EFT implementation in the States of Pernambuco (Jatobá, 2005) and Minas Gerais (Grieg-Gran, 2001). In general, Jatobá (2005) highlights that the redistributive effects of EFT affected the municipalities located near the state capitals and the medium-sized cities. To be precise, this author asserts that the districts which belonged to the metropolitan areas and did not include protected areas were able to foresee a potential budgetary risks from the introduction of EFT. This group of municipalities resisted to the process of adopting such a policy tool.

In sum, the process of adopting EFT is not consensual among political actors due to its redistributive effects (Jatobá, 2005; Grieg-Gran, 2001), despite the existing amount of empirical evidence presenting the effectiveness of EFT to improve the environment in Brazil (Droste et al., 2017b; Sauquet et al., 2014; Loureiro, 2002) and Europe (Droste et al., 2017a). In some cases, during the process of adopting the policy tool, the group of municipalities affected by the redistributive effects of EFT pressured the executive and legislative branches to change the rules predicted by the proposed EFT (Jatobá, 2005).

3. The policy adoption of ecological fiscal transfers

Epstein and O'Halloran (1999) have shown that, in an inter-governmental setting, state and the local governments “will structure their relationships to minimize the overall transaction costs”. Similarly, our goal is to explain EFT adoption across states which refer to some types of transaction costs that may impose barriers to enact such fiscal transfers. Intergovernmental relations between the state and municipal governments can be regarded as a contract between the principals and the agents. In the case under analysis, the proposers of EFT laws in each state, either the governor or the congressmen will seek to maximize their interests given their institutional environment. The mayors of local governments are expected to follow the same behavioral pattern, i.e., to create the best governance structure to achieve that goal.

The core of our analysis focuses on two types of transaction costs that pervade any EFT scheme in Brazil: (1) the commitment costs, and (2) the legislative decision-making costs. The commitment costs relate to the uncertainty 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 executive branch, which may eventually lead to changes in the criteria adopted in EFT legislation. The legislative decision-making costs deal with the policy-making process at the legislative and executive branches. As Hawkins and Andrew (2011) notes, the vertical relations between different levels of governments reduce barriers that hinder cooperation.

Most of the EFT drafters anticipate that they will be affected during the first years of policy implementation and they tend to be cautious in the EFT design. There are two main reasons to explain this precautions to change the institutional context of fiscal transfers: first, the

municipal governments tend to predict the budgetary loss from state fiscal transfers 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 from the legislative 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 state agencies are able to modify the environmental criteria over the years. These uncertainties lead to commitment costs, that is, to increase the costs to guarantee the effectiveness of the EFT legislation in the future. This idea was expressed by Horn (1995, p. 1) by noting that “to secure continued electoral support, [the] coalitions must deliver durable net benefits to their constituents”.

The state government is pressured by organized groups, such as the associations of municipalities, to block the adoption process (Jatobá, 2005; Grieg-Gran, 2001). Although the state government owns most of the residual rights during the policy process, we expect 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). As long as local governments own more environmental assets to meet the requirements of the EFT, the groups of winners and losers tend to be more substantial (one part of the local governments increases its budget, while other part decreases). Therefore, the probability of such a scheme to be adopted 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). Accordingly, the first hypothesis is the following:

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

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 Veiga and Pinho (2005, p. 14) have noted, mayors may pressure “the central government in order to receive a larger amount of funds during municipal election years.” 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 likelihood of adopting EFT decreases in electoral years.

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 national policies guiding 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 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, 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 likelihood of adopting EFT is greater after the implementation of the National Policy on Protected Areas (SNUC) and the National Policy on Solid Waste (PNRS).

4. Empirical strategy

Following the descriptive analysis of the evolution of EFT legislation both over time and across states, we move forward to introduce our empirical strategy based on event history analysis (EHA) (Box-Steffensmeier and Jones, 2004; Blossfeld et al., 2007). EHA is the way to model time-to-event data, which completely fits our research question of tracking the states until EFT adoption (event) and those that failed to adopt, both computed as hazard rates. We also run Weibull regressions to test the hypotheses presented in the last section. To check the robustness of the results, different specifications of the regressions were performed (see Appendix C 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 26 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 the years from 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 were 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. (2017b) was accessed.

The second explanatory variable is the electoral years, measured as a dummy variable (1 for the election years and 0 for the non-election years). 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 mayors can support them during electoral years. The third explanatory variable used the PNRS and SNUC, measuring them by dummies variables (one for the years with PNRS and SNUC adopted, zero otherwise). This data were collected directly from the PNRS and SNUC law. The expectation is that the EFT adoption is more likely following the PNRS and SNUC adoption.

As control variables, we used the party ideology of the governor and the adoption of EFT in 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 greater when the governor belongs to a center-leaning political party. We collected 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 has shown also that states sometime look at their neighbors for policy experimentation (Berry and Berry, 1990; Matisoff, 2008). Therefore, we included a dummy variable: one if state has a neighbor adopter, zero otherwise. The expectation is that the diffusion across states is higher when a neighbor state has adopted an EFT scheme.

Summing up, Table 1 presents the entire group of variables and their expected effects and Table 2 presents the descriptive statistics of the variables:

Table 1
Expected results.

Variables	Expectation
Share of PAs of total territory of state	Increase the duration of the event
Ideology of Governor	Decrease the duration of the event
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
Gross domestic product (GDP)	Increase the duration of the event
Log of population	Decrease the duration of the event
Agriculture	Decrease the duration of the event
Industry	Decrease the duration of the event

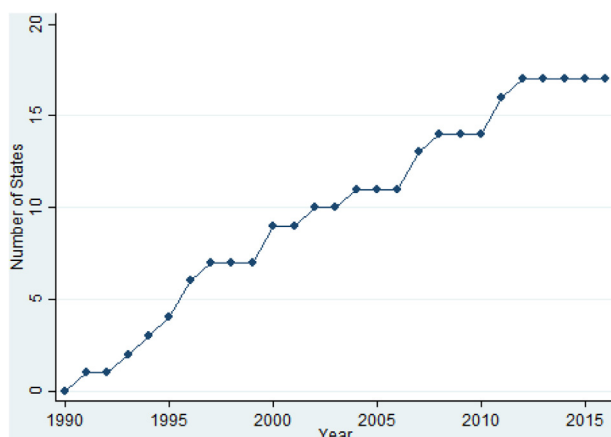
Table 2
Summary statistics.

Variable	Mean	Std. Dev.	Min.	Max.	N
Duration in years of the event	15.115	8.608	0	24	26
Dummy (1 if adoption of EFT in State)	0.654	0.485	0	1	26
Share of PA of total territory of State (PA)	11.302	10.23	0.076	32.497	26
National Policy of Protected Areas (SNUC)	0.654	0.485	0	1	26
National Policy of Solid Waste (PNRS)	0.462	0.508	0	1	26
EFT scheme in a neighbor state (NEIGH)	0.885	0.326	0	1	26
Gross domestic product (GDP)	110,579	158,525	86	751,101	26
Log of population	15.079	1.253	12.283	17.267	26
Ideology of Governor	2.099	0.546	1	3	26
Electoral year	0.077	0.272	0	1	26
Agriculture per cent shares	10.633	7.085	0.388	30.92	26
Industry per cent shares	26.716	9.576	9.960	47.258	26

5. Findings

5.1. Descriptive statistics

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. Fig. 2 graphically depicts the

**Fig. 2.** Evolution of EFT adoption in Brazil (1991–2015).

pattern of enactment of the first legislation of EFT across Brazilian states.

As shown in Fig. 3, the hazard rate rises more markedly after 12 years, meaning that the probability of adopting an EFT scheme increases over time. The interpretation is that, as time passes, states are more likely to emulate others and, hence, are more likely to adopt the EFT scheme. The Kaplan-Meier survival estimate shows that, at the end of the period, 36% of states remained in the sample, that is, those that did not adopt an EFT scheme. This study considers those states that enacted at least the EFT law, which means that includes Paraíba State which approved its EFT legislation but has not implemented it so far. Between the 13th and 15th years, 60% of the sample remained without an EFT scheme. In addition, is interesting note the appearance of some regional differences and some differences in time between EFT adoption and implementation among states (see Appendix B).

Some studies also stress that ideology and political competition play a significant role in the policy adoption (Murillo and Martinez-Gallardo, 2007; Veiga and Pinho, 2005). As Veiga and Pinho (2005) have noted, mayors “may pressure the central government to transfer a larger amount of resources during local election years in order to have more funds available for campaigning.” As depicted in Fig. 4 with regard the electoral cycle in EFT adoption shows that the first legislation is more frequently enacted in the year after elections. 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.

The literature also points that the ideological polarization may shape the process of policy adoption (Murillo and Martinez-Gallardo, 2007). Fig. 5a and b depicts the EFT adoption and the party ideology of proposers and governors respectively (see the details in the appendix – Tables 5 and 6). It seems clear that the center-leaning political parties in Brazil are more likely to both propose and enact EFT laws. 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 ideologically central parties are more likely to be present in the coalitions enacting an EFT law.

5.2. Regression results

Table 3 presents the results of a Weibull regression. The most important finding is that the electoral year decreases 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 lower in electoral years. The theory of transaction cost politics predicts that the legislators tend to avoid conflicts during electoral years to decrease the legislative decision-making costs, i.e., to prevent an adverse and feared reaction of the electorate.

Although not statistically significant, the share of protected area in the territory appears with the expected positive sign, meaning that 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 most robust result in our model regards the role of the National Policy on Solid Waste (PNRS) and the National Policy on Protected Area (SNUC). 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 happened 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., 2011), in the sense that the

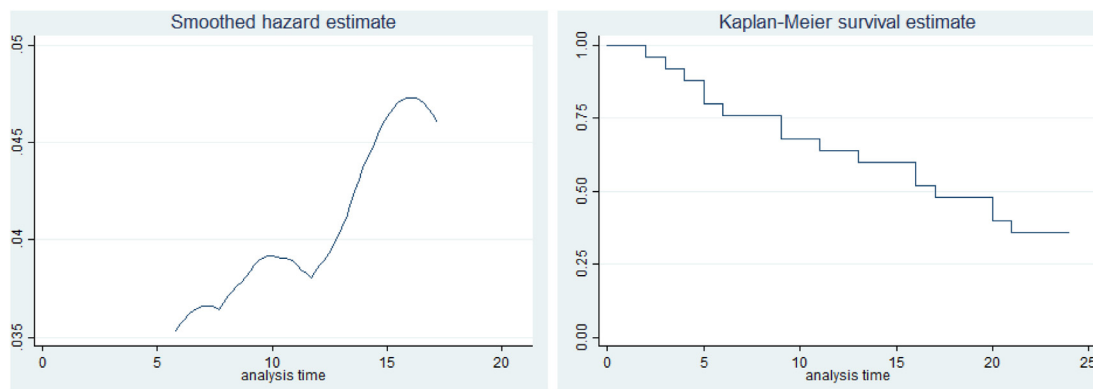


Fig. 3. Hazard ratio and survival estimates for adoption of EFT.

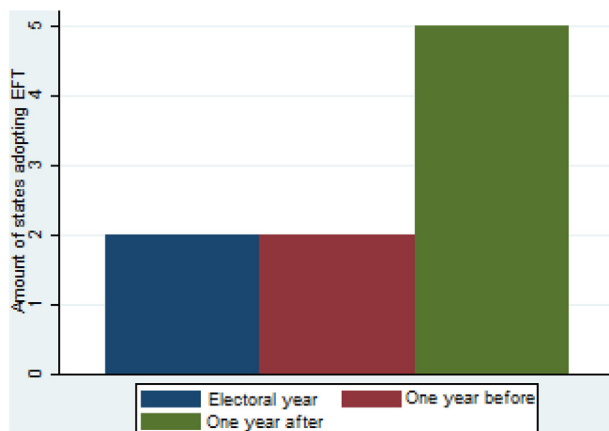


Fig. 4. Electoral cycles.

combination of a policy instrument actively contributes to the desired policy outcome.

The ideology of the governor appears not significant to explain the timing of adoption of EFT. The effect observed in Fig. 5b turns out to appear unsubstantial when we control for 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. Similarly, the effect of adoptions in neighboring states is also not statistically significant. In fact, this is not much of a surprise, since new technologies bring new ways of sharing and supporting ideas among political coalitions, reducing the relative importance of neighborhood.

Globally, the parametric results support, at least partially, that the

legislators tend to minimize the conflict at the legislative decision-making. EFT adoption leads to several redistributive effects among jurisdictions which impact the budgets at the local government level. In addition, the results also support the hypothesis related with the vertical relation which is built in the institutional collective action framework.

6. Policy implications

The OECD (2013) refers to EFT as an essential environmental fiscal reform to achieve biodiversity targets. In addition, the role of EFT for biodiversity conservation policies is strongly linked to goal 15 of the 2030 Agenda for Sustainable Development. Brazil is the first country to adopt EFT and the only to use such a mechanism to provide both compensation and incentives to local governments to create and maintain protected areas. In Portugal and France, the compensation dimension of EFT is more robust (Droste et al., 2018).

Brazil is considered as a laboratory to the study of EFT. Therefore, the findings of this paper serve to illustrate the corresponding policy implications. First, the analysis provided empirical evidence that EFT is rather not adopted in electoral years, which is consistent with the theory of the transaction costs politics that asserts that the legislative decision-making costs and commitment costs may make more difficult the process of adopting a redistributive policy. Second, it also provided evidence that the presence of national policies leads to higher adoption rates, meaning that the upper levels of governments have a role in order to coordinate such policy tools. It also corroborates the policy-mix theoretical framework, which asserts that a combination of policy instrument contributes to achieve the desired policy outcome.

Due to its redistributive effects, EFT is not a consensual policy tool in Brazil (Jatobá, 2005; Grieg-Gran, 2001). Therefore, reducing

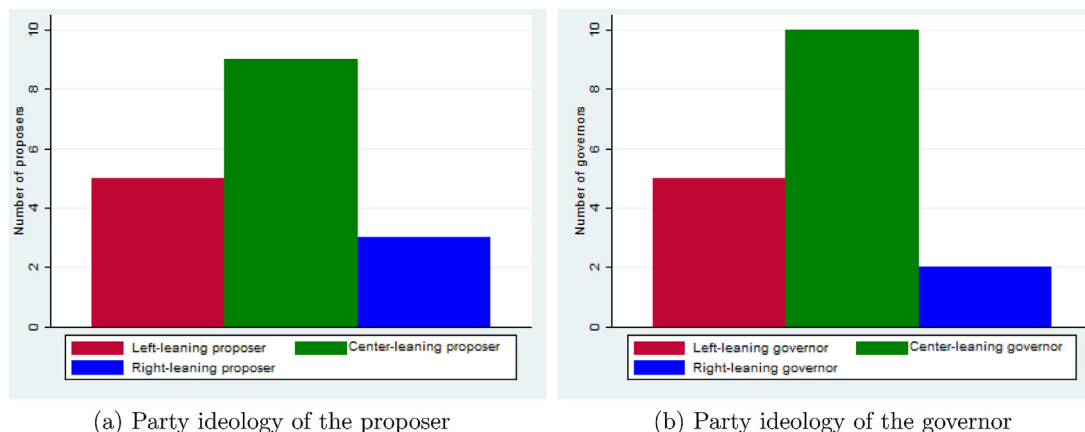


Fig. 5. Party ideology of the governors.

Table 3
Weibull regression.

	(1)	(2)	(3)	(4)
Share of PAs of total territory of state (PA)	0.0568 (1.67)	0.0240 (0.54)	0.0655 (1.42)	0.0653 (1.42)
Ideology of Governor	1.094 (1.63)		2.301* (2.56)	2.906** (2.76)
Election year	4.005** (2.75)	3.450** (2.68)	7.277*** (3.76)	7.623*** (3.76)
National Policy of Protected Areas (SNUC)	−5.300*** (−3.95)	−5.775*** (−3.58)	−8.458*** (−4.21)	−8.527*** (−4.07)
National Policy of Solid Waste (PNRS)	−1.996* (−2.36)	−1.911* (−2.09)	−1.545 (−1.82)	−2.070* (−1.99)
EFT scheme in a neighbor state (NEIGH)	16.50 (0.00)	17.97 (0.00)	17.22 (0.00)	16.01 (0.00)
Gross domestic product (GDP)		1.04e−08** (2.90)	1.30e−08*** (3.48)	1.40e−08*** (3.50)
Population (log)		−0.786* (−2.02)	−0.564 (−1.35)	−0.881 (−1.77)
Agriculture (percent shares of total value added)				0.0233 (0.47)
Industry (percent share of total value added)				0.0815 (1.21)
Constant	−28.11 (−0.01)	−17.26 (−0.00)	−28.70 (−0.00)	−27.43 (−0.00)
ln_p	1.540*** (7.09)	1.664*** (8.16)	1.944*** (9.36)	2.003*** (9.62)
Observations	25	25	25	25

t statistics in parentheses.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

conflicts among political actors may facilitate land use policy at the local level. One way to reduce conflicts is to foster debates, early in the policy process, involving all political actors affected by the implementation of the policy tool, such as mayors, legislative and executive members, environmental agencies, and so on. Another viable way to minimize conflicts is approach the implementation of the percentage dedicated to environmental criteria on the EFT scheme in a gradual mode. The strategy of designing the EFT scheme without implementing the full percentage of the environmental criteria immediately has the appeal of minimizing conflicts among municipalities, a case in which local governments will not suffer a direct impact on their budget. Also, the coordination of central government, such as the case of the National Policy on Protected Areas adopted in Brazil in 2000, has the potential of facilitating the adoption of EFT.

7. Conclusion

This research adds to the EFT and policy adoption literature. Based on transaction-costs politics and the institutional collective action frameworks, this study is the first to investigate the adoption processes of EFT legislation over time. We present empirical evidence that supports the role played by legislative decision-making, as well as commitment costs. To be precise, the probability of adopting the EFT is higher in the non-electoral years, suggesting that politicians tend to avoid conflicts during electoral years and, consequently, to minimize 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 paper. 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 avenues for future research are the following. Among 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 faced an action of unconstitutionality by its state court, thereby interrupting the process of EFT' effective adoption. The difference between the year of the first legislation of EFT and its practical implementation can 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 designed. Theoretically, the literature points out that "a simple rule change can lead to major changes in outcomes" (Ostrom et al., 1994, p. 96); therefore, it can lead to several conflicts among municipalities and inside the environmental agencies as well. These possible explanations call for future studies and more empirical evidence. Also, other research could adopt a qualitative approach to address the adoption of EFT. We choose a quantitative method to describe and explain the adoption of EFT policy instrument across Brazilian states. Our findings bring some general conclusions about the policy tool, and it was the best technique to do it in a large country such as Brazil. However, a qualitative approach in each state through interviews might deepen the analysis and bring more context.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.landusepol.2019.104202>.

References

- Berry, S., Berry, D., 1990. State lottery adoptions as policy innovations: an event history analysis. *Am. Polit. Sci. Rev.* 84 (2), 395.
- Blossfeld, H.-P., Golsch, K., Rohwer, G., 2007. Event History Analysis with Stata. Lawrence Erlbaum Associates.
- Borie, M., Mathevet, R., Letourneau, A., Ring, I., Thompson, J.D., Marty, P., 2014. Exploring the contribution of fiscal transfers to protected area policy. *Ecol. Soc.* 19 (1) Art. 9.
- Box-Steffensmeier, J.M., Jones, B.S., 2004. Event History Modeling: A Guide for Social Scientists. Cambridge University Press.
- Droste, N., Becker, C., Ring, I., Santos, R., 2017a. Decentralization effects in ecological fiscal transfers: a Bayesian structural time series analysis for Portugal. *Environ. Resour. Econ.* 71.
- Droste, N., Lima, G.R., May, P.H., Ring, I., 2017b. Municipal responses to ecological fiscal transfers in Brazil: a microeconomic panel data approach. *Environ. Policy Govern.* 378–393.
- Droste, N., Ring, I., Santos, R., Kettunen, M., 2018. Ecological fiscal transfers in Europe: evidence-based design options for a transnational scheme. *Ecol. Econ.* 147, 373–382.
- Droste, N., Ring, I., Schröter-Schlaack, Christoph Lenk, T., 2017c. Integrating ecological indicators into federal-state fiscal relations: a policy design study for Germany. *Environ. Policy Govern.* (5), 484–499.
- Epstein, D., O'Halloran, S., 1999. Delegating Powers: A Transaction Cost Politics Approach to Policy Making under Separate Powers. Cambridge University Press, Cambridge.
- Fernandes, L., Coelho, A., Fernandes, E., Lima, J.E., 2011. Compensação e Incentivo à Proteção Ambiental: o caso do ICMS Ecológico em Minas Gerais. *Rev. Econ. Sociol. Rural* 49 (3), 521–544.
- Flanagan, K., Uyarrá, E., Laranja, M., 2011. The 'policy mix' for innovation: rethinking innovation policy in a multi-level, multi-actor context. *Res. Policy* 40 (5), 702–713.
- Grieg-Gran, M., 2001. Fiscal incentives for biodiversity conservation: the ICMS Ecológico in Brazil. *SSRN Electron. J.* (December).
- Hawkins, C.V., Andrew, S.A., 2011. Understanding horizontal and vertical relations in the context of economic development joint venture agreements. *Urban Aff. Rev.* 47, 385–412.
- Horn, M., 1995. The Political Economy of Public Administration: Institutional Choice in the Public Sector. Cambridge University Press, Cambridge.
- Jatobá, J., 2005. El impuesto sobre circulación de mercaderías y servicios de transporte (ICMS) como instrumento económico para la gestión ambiental: el caso de Brasil. In: Acquatella, J., Bárcena, A. (Eds.), *Política fiscal y medio ambiente: Bases para una agenda común*. Publicación de las Naciones Unidas, Santiago de Chile, pp. 127–166 (Chapter 5).
- Köllner, T., Schelske, O., Seidl, I., 2002. Integrating biodiversity into intergovernmental fiscal transfers based on cantonal benchmarking: a Swiss case study. *Basic Appl. Ecol.* 3 (4), 381–391.
- Loureiro, W., 2002. Contribuição do ICMS Ecológico à Conservação da Biodiversidade no Estado do Paraná. Universidade Federal do Paraná PhD thesis.
- Lowi, T.J., 1972. Four systems of policy, politics, and choice. *Public Admin. Rev.* 32 (4), 298–310.
- Matisoff, D.C., 2008. The adoption of state climate change policies and renewable portfolio standards: regional diffusion or internal determinants? *Rev. Policy Res.* 25 (6), 527–546.
- May, P., Gebara, Maria, F., Conti, B.R., Lima, G.R., 2012. The “ecological” value added tax (ICMS-Ecológico) in Brazil and its effectiveness in State biodiversity conservation: a comparative analysis. 12th Biennial Conference of the International Society for Ecological Economics.
- Medeiros, O., 2013. Inovação na Política Tributária: Uma Análise da Difusão do ICMS Ecológico no Brasil. Monografia em cumprimento às exigências para obtenção do título de especialista em orçamento e políticas públicas, Universidade de Brasília. Denilson Bandeira Coelho, Orientador.
- Mueller, D.C., 2008. public choice: an introduction. In: Rowley, C.K., Schneider, F.G. (Eds.), *Readings in Public Choice and Constitutional Political Economy*. Springer, pp. 31–46.
- Murillo, M.V., Martinez-Gallardo, C., 2007. political competition and policy adoption: market reforms in Latin American public utilities. *Am. J. Polit. Sci.* 51 (1), 120–139.
- OECD, 2013. *Scaling-Up Finance Mechanisms for Biodiversity*. (accessed 24.01.19). <http://www.oecd.org/>.
- Olson, M., 1969. The principle of “fiscal equivalence”: the division of responsibilities among different levels of government. *Am. Econ. Rev.* 59 (4), 322–336.
- Ostrom, E., Gardner, R., Walker, J., 1994. Rules and games. Rules, Games, & Common-Pool Resources. The University of Michigan Press, pp. 75–104 (Chapter 4).
- Ring, I., 2008. Integrating local ecological services into intergovernmental fiscal transfers: the case of the ecological ICMS in Brazil. *Land Use Policy* 25 (4), 485–497.
- Ring, I., Barton, D.N., 2015. Economic instruments in policy mixes for biodiversity conservation and ecosystem governance. In: Martínez-Alier, J., Muradian, R. (Eds.), *Handbook of Ecological Economics*. Edward Elgar, Cheltenham, pp. 413–449 (Chapter 17).
- Ring, I., Schröter-Schlaack, C., 2011. Instruments Mixes for Biodiversity Policies. Technical Report 2.
- Roozendaal, P.V., 1990. Centre Parties and coalition cabinet formation: a game theoretic approach. *Eur. J. Polit. Res.* 18 (3), 325–348.
- Santos, R., Ring, I., Antunes, P., Clemente, P., 2012. Fiscal transfers for biodiversity conservation: the Portuguese Local Finances Law. *Land Use Policy* 29 (2), 261–273.
- Sauquet, A., Marchand, S., Ferés, J.G., 2014. Protected areas, local governments, and strategic interactions: the case of the ICMS-Ecológico in the Brazilian state of Paraná. *Ecol. Econ.* 107, 249–258.
- Schröter-Schlaack, C., Ring, I., Koellner, T., Santos, R., Antunes, P., Clemente, P., Mathevet, R., Borie, M., Grodzińska-Jurczak, M., 2014. Intergovernmental fiscal transfers to support local conservation action in Europe. *Zeit. Wirtschaftsgeogr.* 58 (2–3), 98–114.
- The Nature Conservancy, 2017. T.N. C. Icms Ecológico. (accessed 21.06.17). <http://www.icmsecologico.org.br/>.
- Veiga, L., Pinho, M., 2005. The political economy of Portuguese intergovernmental grants. *Nipe* 33 (WP 8), 139–156.