The impacts of restrictions to individual rights on Indigenous lands

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Abstract

Many countries in the Americas impose restrictions on Indigenous land transactions to preserve Indigenous ownership, but these policies may inhibit economic growth. This paper evaluates the impact of Chile's 1993 Indigenous Law, which restricts the transfer, lease, and mortgaging of land in Mapuche territories. Using property records, we find that the law has slowed Mapuche territorial loss. However, its effectiveness has declined over time, coinciding with a reduction in properties registered in the Public Registry of Indigenous Territories (PRIT), a key enforcement tool. Analysis of property sales following owner deaths underscores the PRIT's critical role, with listed properties experiencing lower sales rates and smaller reductions in Indigenous ownership compared to unlisted properties. Using remotely sensed data and two complementary identification strategies, we reject meaningfully large impacts of PRIT on land use. The results highlight that transfer restrictions on individual property rights can serve as an effective tool to protect Indigenous ownership without imposing significant economic burdens, although special attention should be given to the design of enforcement mechanisms to ensure their effective implementation.

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1. Introduction

Many countries in the Americas impose restrictions limiting the transfer, division, lease or collateralization of lands managed by Indigenous individuals or communities (Plant and Hvalkof, 2001; Aragón and Kessler, 2020; Dippel et al., 2020). The main goal is to ensure continued Indigenous control over land, which has shrunk since the forced incorporation of Indigenous territories into modern nation-states, and to preserve cultural identity within a territory (United Nations, 2007; Eswaran, 2023). However, a broad body of economic research suggests that such restrictions can slow economic development, potentially sustaining the economic gaps facing Indigenous communities (Akee, 2009; Besley and Ghatak, 2010; Leonard et al., 2020; Dippel et al., 2020).

Prior quantitative studies have primarily focused on the restrictions imposed upon collective or trust ownership in the United States (USA) and Canada. In this paper we examine a legal reform in a different setting, in which individual rights are strengthened while maintaining restrictions on the transfer and lease of land to non-Indigenous individuals. Compared to collective or trust ownership, these restrictions have the potential to foster economic growth by enhancing tenure security and facilitating land marketability, while also preventing the erosion of Indigenous ownership that could occur under unrestricted private ownership. However, such restrictions may impose greater economic burdens than the unrestricted property rights held by non-Indigenous families, raising concerns about equity. Moreover, the effectiveness of these restrictions in preventing territorial loss depends heavily on successful enforcement, which has been imperfect in our setting.

The policy we analyze has been in place since Chile's enactment of its current Indigenous Law on October 5, 1993. This law established special protections for properties owned by Indigenous people within historical reservation's boundaries, including a prohibition on the sale or lease of such properties for more than five years to individuals of a different ethnicity, as well as a ban on mortgaging the property. All Indigenous territories defined by the law are granted *de jure* protection, which applies whenever the owner is Indigenous. To enforce these restrictions in practice, the law created the Public Registry of Indigenous Territories (PRIT, *Registro Público de Tierras Indígenas*), which is intended to ensure the enforceability of these provisions—what we refer to as *de facto* protection. However, to date, no study has assessed the impact of these restrictions on the law's intended protective purposes or their unintended economic burden on Indigenous families.

We compile a novel dataset containing information on all properties registered in the city of Temuco and several surrounding municipalities, a region with one of the largest concentrations of peri-urban and rural Mapuche families. This is the largest Indigenous group in Chile, which makes up 10% of the population. These data are cross-referenced with the PRIT, along with remotely-sensed data on land cover and productivity to assess the impacts of the Indigenous Law's protective clauses on Indigenous ownership and land use. While the Indigenous Law introduced numerous additional policies aimed at improving Mapuche wellbeing—such as funds to restore dispossessed lands or provide scholarships—we focus throughout the paper on territories with similar levels of Mapuche ownership. This approach allows us to isolate the impacts of *de jure* and *de facto* land protections from the effects of other policies, which are available to all Mapuche.

We begin by presenting stylized facts about the evolution of ownership in territories *de jure* protected by the law—i.e., within the historical boundaries of reservations. Although the Indigenous Law prohibits any transfer of protected lands to non-Indigenous owners, Indigenous ownership has declined from 92.06% to 90.48% of the average property since 1993. While this decline is modest, the loss has persisted over time. Notably, this erosion of Mapuche ownership is much less than observed in prior historical periods (Jordán and Heilmayr, 2024), motivating our study's investigation of the causal role that the Indigenous Law has played in maintaining Mapuche territorial control.

Two trends are correlated with the territorial loss documented above. First, the number of property records has increased significantly, rising from approximately 12,000 in 1993 to over 38,000 in 2024, reflecting the subdivision of rural plots in Indigenous territories under urban pressure. Second, there has been a sharp decline in the share of properties listed in the PRIT, which has dropped from covering about 80% of the area of Indigenous territories in 1993 to less than 45% today. Together, these trends suggest that the registry designed to enforce the protective clauses of the Indigenous Law has not kept pace with the increasing fragmentation of properties, potentially contributing to territorial losses.

Given the territorial losses revealed by the descriptive statistics, it is natural to ask whether the *de jure* protection of territories has impacted Indigenous ownership under the imperfect enforcement of the law's restrictions. To address this question, we estimate a matching difference-in-differences model (PSM-DID), pairing 1993 records within Indigenous territories with 1993 records of similar properties outside of them. Critically, the matching ensures that both sets of records exhibit similar levels and trends in Indigenous ownership prior to the law's enactment in 1993. Our findings indicate that, despite imperfect enforcement, the law has had a substantial impact on Indigenous ownership, preventing an average loss of approximately 4.4 percentage points by 2023. This effect is large when compared to the overall territorial loss within Indigenous territories, suggesting that, without the Indigenous Law's protections, territorial losses would have been three times higher.

Consistent with the pivotal role of the PRIT in enforcement, dynamic treatment effects reveal that the law successfully placed Indigenous territories on a different trajectory until the late 2010s, after which the poorly maintained PRIT may have undermined the effectiveness of the restrictions in preventing further territorial losses. To further investigate the importance of the PRIT, we use the staggered difference-in-differences (DID) estimator proposed by de Chaisemartin and D'Haultfœuille (2020) to study the event of a property owner's death and its subsequent impact on sales, Mapuche ownership, and PRIT registration. The death of a property owner is a useful event to analyze, as it is more exogenous than other property transfers and often represents a critical juncture in a property's history, where ownership may shift to non-Mapuche individuals. To examine the impact of the PRIT, we compare properties that were *de facto* part of the PRIT at the time of the owner's death (henceforth PRIT properties) to those that were only *de jure* protected by the law, i.e., owned by Indigenous individuals and located within an Indigenous territory, but not registered in PRIT (henceforth non-PRIT).

The difference in dynamic treatment effects between PRIT and non-PRIT properties is striking. PRIT properties experience a modest spike in the probability of a sale, increasing by about 2 percentage points after three years, while non-PRIT properties exhibit a much larger spike of 10 percentage points in the probability of being sold within two years of the owner's death. Similarly, non-PRIT properties experience a significantly greater decline in Mapuche ownership after five years compared to PRIT properties: over 30 percentage points versus 3 percentage points. The results on PRIT registration indicate that inheritance is a critical moment when properties are removed from the registry. Eighty percent of PRIT properties are dropped from the registry upon inheritance, while only 10 percent of non-PRIT properties enter the registry after inheritance.

These results not only highlight the essential role of the PRIT in enforcing the Indigenous Law's goal of preserving Mapuche land in Mapuche hands, but also demonstrate that the registry imposes meaningful restrictions on property transfers by limiting the pool of potential buyers. The prohibition on sales, alongside restrictions on leasing and obtaining mortgages, may hinder productivity through several channels, including reduced access to credit and lower property values, potentially disincentivizing investments. We investigate these impacts using two complementary identification strategies.

First, we estimate the overall impact of restrictions on land use by comparing remotely-sensed measures of land cover and agricultural productivity between PRIT and non-PRIT properties owned by the same Indigenous individual, employing an owner-fixed effects regression model. We find no evidence of changes in land allocation within properties, ruling out reductions in the most intensive land uses (infrastructure and cropland) that are greater than 1.1 percentage points. Additionally, productivity in the main land cover class, grasslands, did not decline by more than 0.17%, as measured by remotely sensed proxies of productivity.

We conclude the analyses by returning to the staggered DID approach, focusing on the impact of PRIT on the trajectory of land use following the death of a property owner. Given the significant reduction in the probability of a sale, we hypothesize that PRIT exacerbates productivity losses by prolonging the succession process. However, our findings do not support this hypothesis, as we find no differential trajectory of land use or productivity between PRIT and non-PRIT plots upon the death of an owner.

Overall, our results suggest that the protective clauses enacted by the Indigenous Law have been key to preserving Mapuche land in Mapuche hands without imposing a significant economic burden on Indigenous owners. However, the sustained erosion of the PRIT is likely to severely undermine the law's effectiveness if left unaddressed.

The remainder of the paper is organized as follows. Section 2 places our paper in relation to the prior literature and Section 3 discusses the historical and institutional context. The data and identification strategy are outlined in Sections 4 and 5, respectively, followed by the presentation of results in Section 6. Finally, Section 7 concludes.

2. Literature Review

Our paper relates to the literature on the impacts of property rights restrictions in developing countries (Besley, 1995; Udry, 1996; Goldstein and Udry, 2008). In the case of Indigenous groups, these restrictions have mostly been used as a policy to deter the loss of property in their historical territories. A growing body of recent research has studied property rights as a determinant of long-term development in Indigenous territories in the USA and Canada. The General Allotment Act of 1887 (the Dawes Act) in the USA resulted in a mixture of fee-simple and trust plots within reservations. While the latter can be owned by individuals or Tribes, in both cases are under federal oversight. Previous studies (Leonard et al., 2020; Leonard and Parker 2021; Dippel et al., 2020) have shown mostly negative economic effects of reservations trust land tenure systems, and that the reduction of restrictions attached to Trustee status increase investments (Akee, 2009; Akee and Jorgensen, 2014). As most previous studies had focused on comparing unrestricted (i.e., fee-simple) with severely restricted (i.e., trust land) plots, we contribute with the analysis of the impacts of less restrictive individual Indigenous land rights as compared to full individual property rights, which represent a potential policy compromise that simultaneously protects Indigenous control over land, while enabling more efficient development. Relatedly, whereas most prior studies focus solely on economic costs, we estimate the effects on both economic outcomes and Indigenous ownership, providing a more comprehensive assessment of restrictions that considers the policy motivations behind their enactment. Instrumental to this contribution is our access to administrative data on the universe of individuals officially certified as Mapuche by the State. This allows us to complement surname-based ethnicity imputation with more robust information that is less vulnerable to misclassification arising from the loss of Mapuche surnames through intermarriage.

Restrictions in Chile are more similar to the case of restricted-fee land in the USA, in which property restrictions are less severe than in trust plots, and the certificates of possession in Canada which allow transactions within members of a same band. Recent studies have described that these restrictions imply financial costs but potentially improve some economic outcomes relative to the more restrictive property regimes (Banga et al., 2024; Aragón and Kessler, 2020). We also contribute to the literature by focusing on short- and medium-term effects of this kind of restrictions on Indigenous property, which have received limited attention due to lack of data, as well as by testing empirical strategies to study the consequences of these restrictions conditional on owners' characteristics (i.e., without the mediation of changes in the ethnic composition). To the best of our knowledge, almost all estimates in the literature studying property rights in Indigenous territories confound impacts at the individual level with changes in the characteristics of the population.[1]

A key contribution of our study is to leverage variation in PRIT registration to separately estimate the effects of the law's formal protections—that is, over the set of properties covered by the law—and the protections that are effectively enforced through PRIT registration. This distinction is particularly relevant for Latin American countries, where limited state capacity often means that legal protections are not implemented in practice, especially when their enforcement relies on complex administrative procedures, as in the case we study.

In Latin America, a small but growing body of research has studied the impact of land titling programs in historically contested Indigenous territories. The land reform in Mexico during the first half of the 20th century promoted communal land with restrictions to transactions (De Janvry et al., 2014), including Comunidades Agrarias specific for Indigenous groups (Elizalde, 2020). The transactions restrictions were relaxed in the 1990s as part of the PROCEDE program, which introduced the possibility of private property within the former communal Indigenous land. A series of studies have analyzed the effects of the PROCEDE program on agricultural productivity (Castañeda Dower and Pfutze, 2013) as well as other outcomes such as migration (Valsecchi, 2014; De Janvry et al., 2015), elections (De Janvry et al., 2014), and violence (Castañeda Dower and Pfutze, 2020). Most studies in other countries in the region focus on the effects of providing collective titling to Indigenous groups, which has decreased forest degradation, reduced violence, and provided benefits to communities in the Peruvian Amazon (Blackman et al., 2017, 2024) and the Brazilian Amazon (Mueller, 2022; Baragwanath and Bayi, 2020; Baragwanath et al., 2023). Our study contributes to the literature by analyzing restrictions on individual rights specific to Indigenous properties, instead of the previous studies on communal land or programs such as PROCEDE that involves Indigenous communities but also non-Indigenous peasants. Moreover, most of the studies in Latin America have focused on cases related to Indigenous property in frontier regions such as rainforests and remote rural areas. Our

[1] One notable exception is Akee (2020), who studies medium-term impacts of allotment in USA reservations in the early 20th century, when Indigenous people were not allowed to leave reservations.

study analyzes the case of Indigenous property in a peri-urban area, which reflects the situation of an important share of the Indigenous land in the region.

Our study also contributes to the recent studies that have analyzed the impact of the historical formation of property in the traditional Mapuche territory in Chile. Jordán and Heilmayr (2024) show that the allotment of communal land into individual titles in the 1940s improved land use efficiency, while reducing Mapuche ownership and harming families that were more vulnerable to fraud during land sales.[2] Jaimovich and Toledo (2021) show that properties in which Mapuche communities obtained communal rights during the land reform in the 1970s, but then lost them during the Dictatorship's counter-reform, are currently more likely to be affected by conflict events. Jaimovich and Jordán (2025) show evidence suggesting that the massive allotments within Mapuche reservation during the Pinochet dictatorship did not affect Indigenous ownership through inheritance rights, but decreased ownership as a result of relaxing restrictions on long-term leases. Jaimovich et al. (2024) show that recent land restitution to Mapuche using the Fund for Indigenous Land and Water (Fondo de Tierras y Aguas Indígena, FTAI hereafter), which is also part of the Indigenous Law, has an impact on land use and productivity.

3. Historical and institutional background

3.1. The formation of property rights in Mapuche's homeland

The Mapuche, the historical Indigenous inhabitants of South-Central Chile and Argentina, remained independent from both the Spanish Empire and the Chilean state until military occupations between 1860 and 1883. Between 1884 and 1929, they were confined to nearly 3,000 communal reservations totaling about 550,000 hectares (Bengoa, 2000)[3]. Beginning in 1930, a quarter of these reservations were allotted into private plots, but the process was halted in 1952 in part due to substantial land loss, particularly during a period of unrestricted sales (1943–1947). Land reform efforts (1962–1973) briefly expanded Indigenous holdings, but these gains were largely reversed by Pinochet's dictatorship, which reinstated allotment under a 1979 Decree Law (Jaimovich and Jordán, 2025). By 1989, most reservations had been allotted.

[2] Whereas the counterfactual to unrestricted individual property rights is collective land holdings in Jordán and Heilmayr (2024), in this paper the counterfactual to unrestricted individual property rights (when studying *de jure* restrictions) is restricted individual property rights, which is likely more relevant in consolidated agricultural landscapes where Indigenous people tend to hold land individually.

[3] In this regard, our setting is more similar to Indigenous groups in the USA and Canada than to those in the rest of Latin America.

Although new titles included a 20-year sales ban, unregulated leases with purchase options continued to erode Indigenous landholdings, albeit at a slower pace (Jaimovich and Jordán, 2025).

3.2. Current Indigenous policies in Chile

The main public policies toward Indigenous people in Chile over the last 30 years stem from the 1993 Indigenous Law, which created the National Corporation for Indigenous Development (CONADI). The law resulted from an alliance between Indigenous groups and political leaders who had opposed Pinochet's dictatorship (Jaimovich and Jordán, 2025). While it marked a shift from historically assimilationist policies, many Indigenous communities were disappointed by the lack of constitutional recognition. Crucially, the law did not establish governance structures to enable Indigenous self-determination over their territories.

One of its most consequential provisions was the protection of Indigenous lands. Article 12 defines "Indigenous lands" as those currently occupied by Indigenous individuals or communities and meeting at least one of four criteria: (1) originating from historical land grants, such as Títulos de Merced (the legal term for reservations, hereafter TDMs); (2) long-standing community occupation voluntarily registered as Indigenous land; (3) future court declarations based on the previous criteria; or (4) land donated by the state to Indigenous communities. Article 2 defines who qualifies as Indigenous based on descent, surname, or cultural practices.

The law allows transactions between Indigenous individuals of the same ethnicity but prohibits sales or long-term leases to non-Indigenous parties and bars the use of Indigenous land as collateral. These restrictions apply *de jure* to any land meeting Article 12 criteria. To operationalize this, the law created the Public Registry of Indigenous Territories (PRIT).

In principle, all qualifying lands should be registered in PRIT. CONADI is responsible for registering land from historical titles (Criterion 1) *ex officio*, while other properties must be registered voluntarily. Local property registrars are to be informed of PRIT registrations and should notify PRIT of relevant transactions. However, implementation has faced major challenges. Morales Marileo (2023) highlights serious design flaws, including the combination of land- and owner-based criteria, which complicate verification and are foreign to the civil registry system. In addition, tracing title histories for ex officio registration is labor-intensive, and the PRIT has never received dedicated funding for this task. As of 2024, CONADI estimates that fewer than half of qualifying properties are registered.

Legal ambiguities further complicate enforcement. For example, there is no consensus on the interpretation of "currently occupied by Indigenous individuals or communities" in Article 12—whether it refers to 1993 or to the time of review (Cárdenas Villarreal, 2021). Even if title verification were complete, such ambiguities create uncertainty over which lands are protected. Moreover, local registrars are not required or equipped to assess Indigenous status when reviewing deeds and are limited to identifying issues evident in the document itself.

Given these limitations, CONADI interprets PRIT registration as "providing proof of Indigenous status, while non-registration does not imply the land lacks protection" (CONADI, 2024). Thus, while Article 12 defines *de jure* protections, actual registration in PRIT is what enables *de facto* enforcement by providing a centralized registry through which local registrars can easily verify the Indigenous status of a property and block prohibited transactions. In this study, we conceptualize the full, unknown set of properties that meet Article 12 as *de jure* protected under the law, while those properties registered under PRIT are considered to receive, in addition, *de facto* protection.

In addition to land protections, the 1993 law introduced other policies, most notably the Land and Water Fund (FTAI), which aims to compensate for past dispossession and provide land to Indigenous families and communities. Over 260,000 hectares have been purchased, mostly to restore historical territories. However, the process is slow, with limited funding and high administrative barriers, leading to long delays (Bauer, 2021). Other provisions of the law include the creation of Indigenous Development Areas to coordinate state support, legal recognition of Indigenous associations and communities, an Indigenous Development Fund, reserved scholarships, and bilingual schools.

Although both PRIT and FTAI originate from the same law, they serve distinct purposes. FTAI seeks to restore land through communal purchases, while PRIT aims to preserve existing Indigenous holdings. Importantly, land ownership or PRIT registration is neither a prerequisite for nor a barrier to accessing FTAI and other programs. Most FTAI land is located outside reservations (about 80%, per Jaimovich et al., 2024), and only a small share of PRIT-registered properties—less than 10%—originate from FTAI acquisitions (Morales Marileo, 2023).[4]

4. Data

We draw on several data sources and introduce a new method to link property deeds over time, allowing us to construct annual panels of the fraction of Mapuche ownership and other variables of interest, anchored to the set of properties that were active at a specific point in time. This section succinctly explains how we processed the data sources, leaving the details to the Appendix.

4.1. Property registry

Property registry data was obtained from the public website of the Property Registry of Temuco (CBRT, Conservador de Bienes Raíces de Temuco).[5] A record in the registry represents a share over a property, with most records representing 100%. Each record can have one or more owners, which we refer to as the record's set of owners. For example, when a property is inherited, the inheritance is registered as one record that owns the fraction of the property that was inherited, with all heirs registered as co-owners of the succession. It is important to stress that the structure of the data does not allow us to distinguish between *subdivisions*, where a property is split into two or more separate properties, and *fractionation of interest*, where a property is divided among additional shareholders. Hereafter, we use the term `fractionalization' to refer to both phenomena collectively, describing the process by which a record is divided into an increasing number of records over time.

We downloaded all records registered in the CBRT, associated to all properties ever registered in the municipality of Temuco up to 2023, as well as in the municipalities of Cunco, Freire, Melipeuco, Padre las Casas, and Vilcún up to 2005.[6] These municipalities are located at the heart of Mapuche's homeland, containing 635 reservations (21.7% of the total) that encompass 27.7%

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[4] The only intersection between these policies is that, since 2012, a portion of the Indigenous Development Fund has supported FTAI-acquired lands, which are intended to be registered in PRIT. As our study focuses on a peri-urban area with few FTAI cases, we exclude these properties from the analysis.

[5] https://www.cbrtemuco.cl/inicio [accessed: November 13, 2024].

[6] Properties in the municipalities of Cunco, Freire, Melipeuco, Padre las Casas, and Vilcún were transferred to the Second Property Registry on Temuco in 2005 (Ministerio de Justicia, 2005), whose data is not available online.

of the Mapuche population settled in reservations in the late 19th century. Additionally, 28.6% of PRIT records are located within these municipalities.

We analyze the declared addresses using regular expressions to determine the rurality status and area of the property associated with each record. The ethnicity of record owners (non-Indigenous or Mapuche) was imputed by cross-referencing owners' names with a list of Mapuche surnames compiled by the Mapuche Data Project, based on the work of Amigo and Bustos (2008) and Painemal Morales (2011), and a list of individuals officially certified as Mapuche provided by CONADI. Importantly, the structure of the data allows us to reconstruct the history of properties, as each record in the registry includes information about both the records it supersedes and those that supersede it. In addition, each record has information on the type of transaction involved with respect to the records it supersedes (succession, purchase and sale, etc.).

One might worry that, by using individuals' surnames to identify ethnicity, we could underestimate the fraction of Mapuche owners, as Mapuche surnames passed through the maternal line may eventually be lost through intermarriage. We believe this does not introduce significant bias in our case for two reasons. First, legal names in Chile follow the Spanish naming custom, with both paternal and maternal surnames, which are usually not changed after marriage. We classify someone as Mapuche if either surname appears in the Mapuche surname list. Second, we complement this information with administrative data on individuals officially certified as Mapuche, covering 1,355,327 million people. Of the 14,748 owners identified as Mapuche in TDM properties between 1979 and 2023 using the administrative database, 11,460 (78%) were also identified through their surnames, showing that two-surname identification successfully captures over three-quarters of Indigenous owners identified through the administrative records.[7]

[7] Incorporation into the administrative Mapuche certification record is voluntary and occurs only upon request by a Mapuche person seeking official certification from CONADI. For this reason, we use this record as a complement to surname-based identification, rather than as our primary source for identifying Indigenous individuals. The administrative database does not include individuals who, although eligible for certification, have not requested it. Indeed, out of the 41,302 TDM owners identified as Indigenous through surnames between 1979 and 2023, only 11,460 (28%) appear in the administrative database.

4.2. *De jure* and *de facto* protection

To determine if a property is *de jure* protected by the restrictions enacted in the Indigenous Law, we determine if the property is located within the historical limits of a TDM.[8] As explained in Section 3, a property within a TDM (reservation) is considered Indigenous, and therefore protected by the Indigenous Law, if it was owned by an Indigenous person when the law was enacted (according to one interpretation), or if it is owned by an Indigenous person at any point thereafter (according to the competing legal doctrine). Therefore, all land within TDMs is potentially protected by the law. We have decided to focus on TDMs, disregarding other types of Indigenous lands considered under the law, for three reasons: (i) they account for the vast majority of Indigenous territories—with Morales Marileo (2023) showing that over 80% of registered Indigenous land falls within TDMs, (ii) they are historically defined (unlike other Indigenous lands created through State action) and (iii) their exact locations are well-documented and readily available.

We use two data sources to determine whether a record in the CBRT is associated with a property located within a TDM. First, we rely on vector data provided by CONADI, which contains information on all properties originating from the allotment of TDMs into private properties during the 20th century within the six municipalities covered by this study. This dataset includes CBRT unique IDs, enabling us to link it to the CBRT. Second, we use vector data from CONADI on modern properties located within TDM boundaries, which also includes CBRT IDs. A record in the CBRT is considered to be associated to a property within a TDM, and thus *de jure* protected, if the record, a record canceled by it, or a record that cancels it matches either of the two vector datasets provided by CONADI.

De facto protection is more straightforward: if a title in the CBRT is part of the PRIT, we consider it to be *de facto* protected. All titles included in the PRIT but not linked to TDMs are excluded from the analysis, as these Indigenous lands originate from titles other than TDMs and therefore do not serve as suitable controls for estimating the impact of *de jure* protection. 2,612 records, representing less than 10% of PRIT records, are excluded for this reason.

[8] Vector data on TDMs boundaries is publicly available at CONADI website (https://siic.conadi.cl) [accessed: January 5, 2025].

4.3. Identifying ownership across time: the *time traveling* method.

Several characteristics of the CBRT data limit our ability to reconstruct the exact history of ownership for a given property. First, one or more records associated with the property can be valid at a given time, but we lack information on the shares of the property held by each record. Second, not all records include precise information on the area of the associated property. Third, in the case of successions, the sale of inheritance rights appears in the database as superseding the entire succession, even though the rights of heirs who have not sold remain valid.

We developed a method to approximate the history of property ownership in order to address this lack of information, by imputing the fraction of each property held by different owners over time. We refer to this method as *time travelling*, as it enables us to estimate ownership and analyze changes over time. The process defines changes in ownership relative to a specific record, which we call the pivotal record—a record associated with a property at a particular point in time. The pivotal record is chosen based on the research question: to describe the evolution of Indigenous ownership, we select the record for which we have precise area information; for the DID specifications, we select the records that were valid at the time of treatment.

Once the pivotal record is set, the method consists of iteratively constructing the tree of records that supersede and are superseded by the pivot. We normalize the area of the pivot record to one and then, at each branching point, split the area equally among the connected records—allocating it equally among superseding records when moving forward in time, and among superseded records when moving backward. A record is assumed to remain active until it is superseded by the last record that replaces it in the database. As a result, at any given point in time, the imputed areas of all active records sum to one. This allows us to impute the value of any variable as the weighted average across active records, using the imputed areas as weights.

A detailed description of the method is provided in Appendix 1, along with a validation exercise based on a sample of one hundred randomly selected records, for which we gathered property deeds containing information on the share held by each shareholder. For each record in the sample, we identify the record it supersedes and calculate the actual fraction of Mapuche ownership associated with the earlier property at the time the selected record was registered, using all available information. We then compare this benchmark to the corresponding estimate produced by the time-traveling method—pivoting on the superseded record—which relies only on the limited information available across records in our database. The average difference between the Mapuche ownership imputed using the time-traveling method and the actual ownership is just 0.62 percentage points.

4.4. Agricultural land use and productivity

We use data from Graesser et al. (2022) to estimate the fraction of land covered by cropland, grassland, forests, and development (infrastructure). Graesser et al. (2022)'s data provide this classification annually from 2000 to 2018 at a 30-by-30 meter resolution. In addition, we calculate the average of the Enhanced Vegetation Index (EVI) during the Spring and the Summer (October to March) of each year between 2000 and 2018 over the three agroforestry classes. These variables are used as proxies of agricultural productivity for cropland and grassland, and as a proxy of forest health in forests. The calculations are run in Google Earth Engine, using the available imagery from the Landsat program.

4.5. Additional data sources

To georeference selected properties located outside TDMs, we use vector data from the Chilean Center of Information on Natural Resources (CIREN) on all properties within the six municipalities of our study region around the year 2000. While this dataset has no information about the CBRT ID, it has a detailed description of the location of the property and the name of one owner, which is useful for georeferencing properties located outside TDM historical limits.

5. Empirical strategy

5.1. The impact of *de jure* protections on Indigenous ownership

Our study aims to quantify the impact of the protection granted by the Indigenous Law on Mapuche ownership. To achieve this, we employ a PSM-DID approach to compare the evolution of Indigenous ownership between *de jure* protected (within TDM) and comparable properties that are *de jure* non-protected (outside TDM), before and after the enactment of the Indigenous Law in 1993.[9] We restrict the sample to TDMs allotted before 1979 because parcels formed from TDMs allotted in the 1980s were subject to a twenty-year sales ban, placing them under a different regulatory regime even before the enactment of the Indigenous Law (as described in

[9] The analysis uses the Leuven and Sianesi (2018) package to compute propensity scores and perform the matching process.

Section 3). The cross-sectional unit of analysis is a property that was active when the Indigenous Law was enacted in 1993. For every year between 1979 and 2023 (2005 for municipalities other than Temuco), we calculate the fraction of the property owned by Mapuche using the *time traveling* method explained in Section 4, choosing as pivotal records the records active in 1993.

To select properties outside TDMs that are comparable to those within, we estimate the likelihood of having de jure protection using a logit regression over all active properties in 1993. As independent variables, we use Mapuche ownership in 1979, property size (in hectares), the number of owners, and the average number of properties owned by the set of owners. In addition, we impose an exact matching over three categorical variables: rurality, location in Temuco municipality, and the nature of the information regarding the area of the property. The latter is encoded as zero when there is no information on the area (in which case property size is excluded from the logistic regression), one when the information refers to the area of a larger property out of which the property is a part of, and two when the information refers to the size of the property.[10] Mapuche ownership in 1979 helps identify a control group with a similar pre-tratment level of the dependent variable, while the remaining variables ensure that properties in the control group have comparable characteristics in terms of location, property size and ownership structure.[11] For each active property in 1993 within a TDM allotted before 1979, we select the property active in 1993 outside TDMs with the closest probability with replacement (within the group defined by the exact matching variables), thus defining a comparable pool of control properties.

Given the selected sample of non-protected properties, we estimate the following DID model to estimate the impact of protection on Indigenous ownership:

$$y_{it} = \alpha_i + \alpha_t + \beta\, POST_t \times TDM_i + \nu_{it}, \quad (1)$$

where y_{it} represents the fraction of the property i owned by Mapuche in year t—calculated using the time traveling method pivoted in the record active in 1993, α_i and α_t are property and

[10] To implement the exact matching, we run the logit regression on the twelve subsample that result from the cross product of these variables: [Rural, Urban] X [Temuco, Not Temuco] X [0, 1, 2].

[11] Decree Law 2568 was published in March 1979, ushering in a process of massive allotment of reservations that continued until the end of Pinochet's dictatorship in 1989 (Jaimovich and Jordán, 2025). By choosing Mapuche ownership in 1979, we can check for potential violations of the parallel trends assumption due to possible spillovers from recently allotted to already allotted reservations.

year fixed effects, $POST_t$ is a variable that takes the value one after 1992, TDM_i is one if property i lies within the historical boundaries of a TDM, and ν_{it} is a zero-mean disturbance. We also estimate dynamic treatment effects by replacing $\beta POST_t \times TDM_i$ in equation 1 by $\sum_{k \in T, k \neq 1992} \beta_k 1(k = t)TDM_i$, where T are the set of years included in the regression.

5.2. The impact of *de facto* protections on Indigenous ownership

To test the additional role of *de facto* protection provided by PRIT registration on top of *de jure* protections, we focus on the death of a property's owner as a critical event. The death of an owner is particularly relevant to study, as it is more exogenous than other property transfers and represents a crucial moment in a property's history. By limiting the sale of inherited parcels to non-Mapuche buyers, PRIT registration may prevent the loss of Indigenous land. In contrast, for properties that were *de jure* protected but not registered in the PRIT, it is plausible that succession events enable heirs to circumvent *de jure* restrictions by selling to non-Mapuche buyers.

To test this hypothesis, we focus on successions that represent the property's first ownership transfer since 1993. This restriction ensures that we rely exclusively on variation stemming from PRIT's incomplete *ex officio* registration for identification, excluding variation resulting from owners' efforts to opt out of PRIT during a transfer. We then compare the dynamic trajectories of property sales, Mapuche ownership retention, and PRIT registration between PRIT and non-PRIT properties—restricting the sample to properties within TDMs that were owned by at least one Mapuche person prior to succession (i.e., *de jure* protected). These trajectories are estimated using the staggered DID estimator proposed by de Chaisemartin and D'Haultfœuille (2020), treating the year before the succession registration as the base year for comparison. We apply the time-traveling method, pivoting on the record of the deceased owner (i.e., the record preceding the succession), to construct an annual panel of the dependent variables spanning 1987 to 2023.

5.3. The impact of *de facto* restrictions on land use

To estimate the impact of *de facto* PRIT restrictions on land use and productivity, we run two complementary identification strategies. The first focuses on the broad impacts of protection on productivity, while the second focuses on the critical juncture of successions.

5.3.1. De facto restrictions and within-owner differences in land use

We exploit the fact that certain owners hold both PRIT and non-PRIT properties by following in the footsteps of Besley (1995) and Udry (1996), estimating an owner-fixed-effects OLS model:

$$y_{ijt} = \delta_j + \delta_t + \Phi PRIT_i + X_{it}\Theta + \varepsilon_{ijt}, \quad (2)$$

where y_{ijt} is the outcome of interest for the property i owned by individual j in year t, δ_j an owner fixed effect, δ_t a year fixed effect, $PRIT_i$ a dummy equal to 1 if property i is part of the PRIT, X_{it} a vector of property i characteristics—maximum temperature and overall precipitation every year, as well as time-invariant characteristics: the year the record was registered and its duration, potential crop yield, slope, roguishness, elevation, and erodibility—and ε_{ijt} a zero-mean disturbance. If X_{it} successfully controls for land quality, Φ captures the productivity gap between comparable plots due to PRIT's restrictions.

Our sample consists of pairs of properties for each set of owners with two or more properties, where the properties are located within TDMs (i.e., are *de jure* protected), have different PRIT statuses and the ownership of both properties has coexisted for at least two years.[12] For those with more than one pair of eligible properties, the properties were randomly sorted, and the first available pair was georeferenced. After this process, we obtained a sample of 613 pairs of properties, with an average of 18.2 years of coexistence. Appendix Table C1 provides a summary of the statistical description for the sample of properties selected. PRIT and non-PRIT properties

[12] The restriction that both properties in the pair must be located within TDMs is not very binding. When removed, the sample increases by only 22 pairs.

are remarkably similar on average across the rich set of characteristics included in X_{it}, suggesting that unaccounted-for unobservables are unlikely to bias the results.[13]

Heterogeneity by gender is analyzed by interacting $PRIT_i$ with a variable indicating the fraction of female owners. Additionally, we examine whether registration into the PRIT lead to differential responses to changes in the prices of agricultural commodities (wheat, cattle, and timber) by interacting $PRIT_i$ with the prices of these commodities.[14]

5.3.2. De facto restrictions and the divergence of land use after successions

A key mechanism through which restrictions on property transfers impact productivity is fractionation: after a farmer's death, limitations on individual rights may hinder heirs' ability to coordinate investments optimally (Dippel et al., 2020). We extend our analysis of successions as a critical juncture by estimating their differential impact on land use and productivity across PRIT and non-PRIT plots, using again de Chaisemartin and D'Haultfœuille (2020)'s staggered DID estimator and defining the event as the year preceding the registration of the succession in the CBRT. Our sample consists of PRIT and non-PRIT rural plots located within TDMs historical boundaries and inherited between 2000 and 2018 for Temuco and between 2000 and 2005 for other municipalities. As the full sample was too large to georeference completely, we began by georeferencing non-PRIT plots, which were fewer than PRIT plots. Out of 532 non-PRIT plots, we had enough information to confidently georeference the boundaries of 415.

We then estimated four logit-PSM models with replacement in the full sample, partitioned by the variables on which we imposed exact matching (Temuco municipality and a variable indicating whether the area refers to the property itself or to a larger property that includes it), identifying the three best possible matches for each non-PRIT plot.[15] The predictor variables used in the logit-PSM models include the year the inheritance was registered, the year the inherited property was registered, characteristics of the owners of the inherited property (number

[13] They differ substantially only in the year the property was registered and the duration for which the record remained valid, which is consistent with our finding in Section 5 that PRIT reduces the probability of property transfer upon bequest.

[14] Refer to Appendix B for a detailed explanation of how we impute the gender of owners and build the commodity price indexes.

[15] We did not include cases where the registry lacked information on property size, as property size is a key determinant of measurement error in remotely sensed data. Only 39 non-PRIT properties fall into this category.

of owners, average number of properties they own, and fraction who are Mapuche), the area, the year the TDM was settled, and whether the TDM was allotted before or after 1979.[16]

After discounting cases where none of the three matches were located and one subsample where the PSM had too few observations to be estimated, the final sample consists of 358 unique non-PRIT plots and 147 unique PRIT plots. In the regressions, PRIT plots are weighted to reflect the number of non-PRIT plots they match.

6. Results

6.1. The evolution of Mapuche ownership on *de jure* protected lands since 1979

To describe the evolution of ownership in TDMs since 1979, we apply the *time travelling* method, pivoting on the properties originally granted to Mapuche during the allotment of reservations. We focus on these properties because we have precise information about their area, allowing us to separately assess ownership changes at the level of the average property and as a share of the total TDM area.

Panel A of Figure 6.1 shows a small but persistent decline in Mapuche ownership for the average property allotted to Mapuche, with a decrease of over 1.71 percentage points in Temuco between 1979 and 2023 and 0.81 percentage points across the six municipalities in the study region between 1979 and 2005. Panel B reveals that this decline translates to a similar loss in terms of the total TDM area, not exceeding 2.3 percentage points. These trends demonstrate incomplete enforcement of the Indigenous Law's prohibition of transfers of ownership to non-Mapuche owners.[17]

The loss of Indigenous ownership, as documented in Panels A and B of Figure 6.1, coincides with an increase in the number of active records in the CBRT registry. This suggests that the loss of Mapuche ownership is closely tied to the subdivision of properties in the peri-urban areas we study. However, as shown in Panel D, the proportion of hectares within TDM territories registered in the PRIT has decreased by approximately 40 percentage points, following a similar but more extreme trajectory as the reduction in Mapuche ownership. These contemporaneous

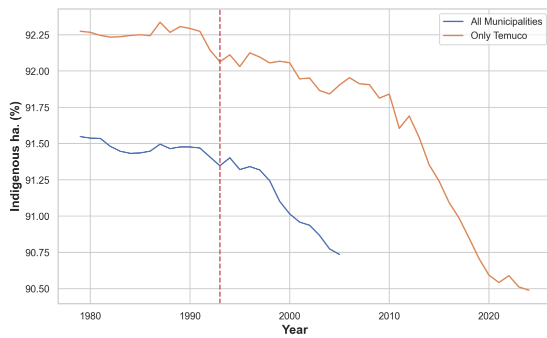
[16] Note that this set of PSM predictors includes variables defined only for properties located within a TDM (settlement year and allotment period), which could not be included in the PSM for the DID strategy estimating the impact of de jure protections on Mapuche ownership.

[17] The only legal mechanism through which Indigenous land can cease to be classified as such is a land swap. In our sample, however, land swaps are extremely rare—only 373 out of 97,836 historical transfers in TDMs fall into this category—and therefore cannot account for a meaningful share of the observed loss of Indigenous land.

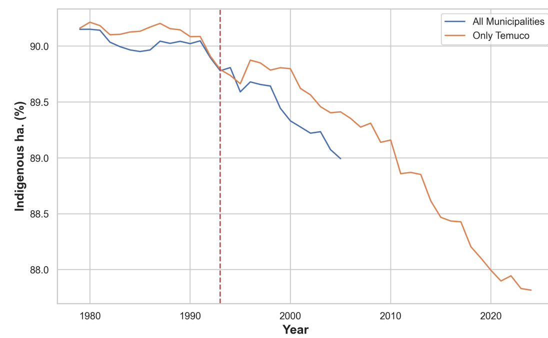
declines suggest that the weakening of PRIT registration is likely an important driver of the loss of Mapuche ownership.

Figure 6.1: Trends in Indigenous Ownership and Registry Records

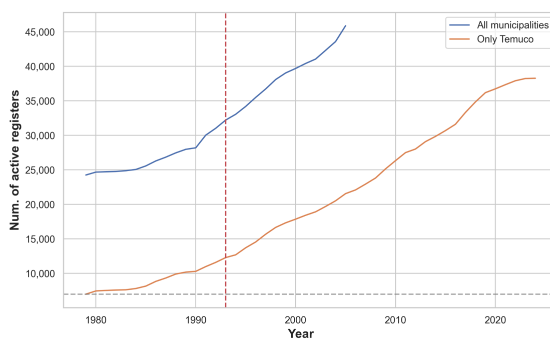
Panel A. Fraction of average property



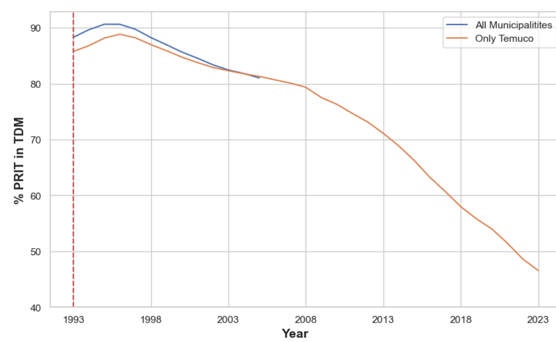
Panel B. Fraction of hectares



Panel C. Number of active records



Panel D. Fraction of TDM hecteres in PRIT



Notes: Panel A shows the average fraction of Mapuche ownership across TDM properties. Panel B presents the share of TDM hectares owned by Mapuche individuals. Panel C plots the number of active property records over time. Panel D tracks the share of hectares registered in the PRIT.

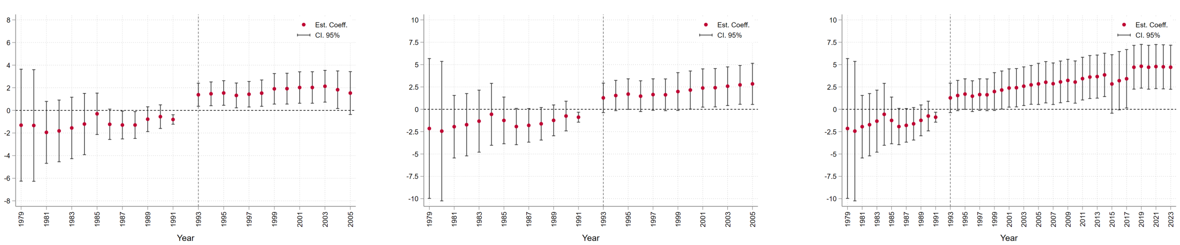
6.2. The impact of *de jure* protections on Indigenous ownership

The post-PSM database used for estimating the Indigenous ownership loss contains 6,162 properties whose registration was active and unchanged for 1993, out of which 4,859 are located inside a TDM territory. Appendix Table C2 presents a statistical summary of the key characteristics of properties active in 1993, categorized by treatment status (where treatment is defined by location within TDMs, excluding TDMs divided after 1979). The first three columns display the mean for each group and the standardized difference before the matching process, while the next three columns present the same statistics for the matched sample. After adjustment, all variables exhibit a standardized mean difference below 0.2.

Parallel pre-trends between de jure protected and non-protected properties are displayed in Figure 6.2, which presents estimated coefficients from three panel event-study specifications on different subsamples. Panels A, B, and C correspond to subsamples covering all municipalities (1979–2005), all municipalities excluding Temuco (1979–2005), and only Temuco (1979–2023), respectively. There is evidence of an anticipatory effect of about one percentage point beginning in 1992, which plausibly reflects the fact that the bill was first introduced in Congress on October 15, 1991. This initial version of the bill already included the definition of Indigenous lands and the associated restrictions, potentially reducing demand for parcels in soon-to-be-protected areas and, consequently, increasing Mapuche ownership relative to the control group.

Figure 6.2: DID Estimates of the Indigenous Law's Impact on Ownership

6.2.A: All Sample (1979-2006) | 6.2.B: Only Temuco (1979-2006) | 6.2.C: Only Temuco (1979-2023)



Notes: Panel A estimates the law's impact using all matched properties from 1979 to 2006. Panel B focuses on Temuco. Panel C extends the window to 2023. Red dots are point estimates; vertical lines show 95% confidence intervals. All models use property and year fixed effects; standard errors are clustered at the property level.

The results suggest that the law successfully placed protected properties on a different trajectory, preventing territorial losses. By 2020, properties with *de jure* protection had, on average, 4.4 percentage points more Mapuche ownership. This represents a substantial impact relative to the overall loss reported in Panel A of Figure 6.1, suggesting that, in the absence of *de jure* protections, the loss would have tripled. However, the results also indicate a gradual decline in the protective effects of the law over time, which appears to have leveled off by the late

2010s—possibly due to challenges in enforcing the Indigenous Law's protective provisions as the number of de jure protected properties outside the PRIT system has grown.

6.3. The impact of *de facto* protections on Indigenous ownership

The plateauing of the law's protective effect, along with the rapid decline in the fraction of *de jure* protections covered by the PRIT, underscores the need to examine the impacts of the *de facto* protections provided by the PRIT. Figure 6.3 presents the results of the staggered DID strategy introduced in Section 5, where we compare the evolution of the probability of experiencing a sale (Panel A), the fraction of Mapuche ownership (Panel B), and the probability of registration in the PRIT (Panel C) between PRIT and non-PRIT inherited properties.

The differences are striking. Panel A shows that, whereas non-PRIT properties experience a large increase of 10 percentage points in the probability of being sold in the year the inheritance is registered (year 1), which remains above 5 percentage points throughout the next four years, PRIT properties experience a modest, non-statistically significant increase in the probability of experiencing a sale, never surpassing 4 percentage points in the five years following the inheritance.

In Panel B, we see that the sales avoided by the PRIT are crucial in preventing territorial losses. While the low probability of sales after inheritance among PRIT properties results in a relatively small, non-statistically significant decline in Mapuche ownership of around 3 percentage points, non-PRIT properties lose, on average, more than 25 percentage points of Mapuche ownership five years after the inheritance.

Panel C shows that inheritance is a key moment when *de jure* protected properties drop out of the PRIT, validating our choice to include only inheritances representing the first transfer of the property after 1993 in the sample. On average, 80% of PRIT properties are removed from the registry after an inheritance. In contrast, non-PRIT properties are unlikely to be introduced into the registry after an inheritance; on average, less than 10% enter the PRIT.[18]

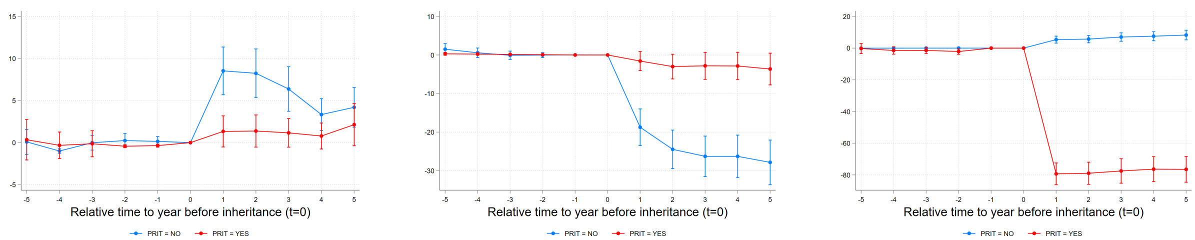
Even after restricting the sample to the first transfer, one may worry that *ex officio* registration into the PRIT was not random. The direction of the bias introduced by this selection is unclear a priori. For example, properties located closer to cities, and thus more exposed to territorial loss

[18] Appendix Figure D1 shows that the trajectories of PRIT and non-PRIT plots are statistically different after an inheritance at the 5% confidence level, using the test proposed and implemented in Stata by de Chaisemartin et al. (2023).

due to urban expansion, may have been more likely to be registered *ex officio* if property registry data was more readily available for them. However, it is also possible that developers exercised their influence to keep these lands out of the registry.

Figure 6.3: Dynamic Effects of Inheritance on Ownership and Registry Outcomes

6.3.A: Purchases and sales | 6.3.B: Mapuche' ownership | 6.3.C: PRIT Inscription



Notes: Panel A shows changes in sale probability after inheritance. Panel B tracks Mapuche ownership loss. Panel C presents registration and deregistration in PRIT. All effects are estimated via staggered DID by PRIT status. Estimates are in percentage points with 95% confidence intervals; clustering at the property level.

Appendix Table C3 shows that PRIT and non-PRIT properties significantly differ across observable characteristics in this selected sample, with PRIT properties being more likely to be rural, be inherited from Mapuche people, and having owners with more plots. To address this potential bias, we estimate the staggered DID model on a subsample of properties where PRIT and non-PRIT properties are balanced across observed characteristics, using a logit-PSM model.[19] The results, presented in Appendix Figure D2, are very similar to those in this section, though noisier due to the reduced sample size. This suggests that while PRIT and non-PRIT properties differ, they do not do so in a systematic way that biases the estimated differential impact of successions on the trajectory of sales, Mapuche ownership, and PRIT registration.

6.4. The impact of *de facto* restrictions on land use

6.4.1. De facto restrictions and within-owner differences in land use

The previous results indicate that the de facto restrictions imposed by the PRIT play a fundamental role in preventing the loss of Mapuche land in ancestral territories protected by the Indigenous Law. However, they also show that these restrictions inhibit property sales after

[19] The table of pre and post PSM balance is presented in Appendix Table C3.

inheritance, suggesting that the law's limitation of potential buyers to individuals within the same ethnicity prolongs the selling process, possibly leading to lower property values. Here, we examine whether these restrictions influence the productive decisions of Indigenous agricultural producers by presenting the results of the same-owner fixed-effects regressions introduced in Section 4, using a sample of individuals who simultaneously own both PRIT and non-PRIT plots.

The results, presented in Table 6.4, show no evidence supporting the hypothesis that PRIT restrictions induce differential production across PRIT and non-PRIT plots owned by the same individual. Columns 1 through 4 of Panel A show that we detect no impact of PRIT, conditional on owner and year fixed effects, on the share of the property devoted to cropland, grassland, forest or development. Columns 5 through 7 of panel A show that we detect no impact of productivity over cropland and grassland, or forest health, conditional on the same fixed effects.

Table 6.4: Estimations on Land Use and Productivity of Same Set of Owner Properties

Dep. Var:	*Land cover*				*Log EVI within*		
	Grassland	*Cropland*	*Forest*	*Dev.*	*Grassland*	*Cropland*	*Forest*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Panel A: No Controls							
PRIT	0.7292	-0.4699	-0.1650	-0.1169	0.0140	0.0130	-0.0019
	(1.307)	(0.3446)	(1.236)	(0.0811)	(0.0088)	(0.0505)	(0.0140)
Panel B: Adding Controls							
PRIT	1.271	-0.4501	-0.7658	-0.0820	0.0127	0.0215	-0.0021
	(1.088)	(0.3398)	(1.024)	(0.0669)	(0.0083)	(0.0319)	(0.0139)
Mean Dep. Var.	84.7515	1.5420	13.1231	0.1758	28.6785	0.3278	0.4872
Obs.	17,276	17,276	17,276	17,276	17,183	1,276	9,708

*Notes: OLS estimates of the PRIT effect on land cover for grassland, cropland, forest, and development (columns 1–4), and EVI for grassland, cropland, and forest (columns 5–7). Models include owner and year fixed effects in panel A, plus additional plot-level controls in panel B. Estimates in percentage points for land cover and log points for EVI. SEs clustered at owner level show in parenthesis below point estimates. Statistical significance is indicated by p-values: * for p <0.1, ** for p <0.05, and *** for p <0.01.*

The results remain robust to the inclusion of property-level controls in Panel B. The addition of controls improves statistical power, allowing us to interpret the null results in terms of modest negative effect sizes that we can reject.[20] For the two most intensive land cover classes—cropland and development—we can reject reductions greater than 0.99 and 0.2 percentage points, respectively, at the 5% confidence level. When considering both land cover classes together, we can also reject reductions greater than 1.1 percentage points (result available upon request). For productivity, we can reject declines greater than 0.17%, 3.1%, and 2.7% over grassland, cropland, and forestland, respectively, at the 5% level. These results largely rule out economically meaningful decreases in productivity on PRIT-protected properties, especially over grassland, which is the largest land cover class in our sample.

In the Appendix (Tables C4 through C7), we test for heterogeneous impacts across several variables of interest. We find no differential effects based on the fraction of female owners or the prices of commodities produced in cropland, grassland, and forest—specifically, crops, meat, and timber.

6.4.2. De facto restrictions and the divergence of land use after successions

To assess whether the restrictions imposed by the PRIT lead to economic losses after the death of a property's owner, we estimate the staggered DID model described in Section 4 using a subsample of georeferenced inheritances.[21] The results, presented in Figures 6.4 and 6.5, indicate no differential impact between PRIT and non-PRIT rural inherited plots located within TDMs in terms of changes in the fraction of the property covered by cropland, grassland, forest, or development, nor in the productivity of the first three land covers as measured by average EVI. All point estimates are close to zero, and confidence intervals are tight, suggesting that inheritances do not significantly reduce productivity in either type of plot and that the absence of detected effects is unlikely to be due to a lack of statistical power. Appendix Figure D3 and D4 shows that the trajectories of PRIT and non-PRIT plots are not statistically different after an

[20] We construct 90% confidence intervals for the point estimates and report the lower bound. Given the asymptotic symmetry of the OLS estimator's distribution, this value is equivalent to the largest effect size for which we can reject the one-sided null hypothesis that the effect of PRIT is smaller, at the 95% confidence level.

[21] Pre- and post-PSM balance is presented in Appendix Table C8. Overall, the balance between PRIT and non-PRIT inheritances improves considerably after matching, although four variables still exhibit standardized mean differences above 0.2: area (0.45), altitude (0.41), potential grass yield (0.21), and erosion (0.37). We do not expect this remaining imbalance to explain the null results presented in this section.

inheritance at the 5% confidence level, using the test proposed and implemented in Stata by de Chaisemartin et al. (2023).

Overall, our null results on the impact of restrictions on land use contrast with the findings of previous studies on Indigenous territories, as reviewed in Section 2. It is important to note, however, that the restrictions analyzed in this paper are considerably less severe than those examined in earlier work. Besley's (1995) conceptual framework provides a useful lens for understanding why more liberal land titles do not necessarily lead to higher productivity in all contexts. If the status quo already ensures sufficient tenure security, marketability, and collateralizability—given prevailing market conditions and available production technologies—then further liberalization of land markets may not generate improvements, as none of the three economically relevant components of formal titles are binding constraints on growth.[22] [23]

In our context, restricted titles already provide strong tenure security, as is also the case in studies conducted in the USA. Marketability is only partially constrained, unlike the much stricter limitations under Trustee status in the USA, which effectively freeze transfers. While collateralizability is fully restricted in our case as well, it is likely that, for the population of poor smallholders we study, access to credit is not significantly limited by the absence of collateral.[24] Thus, the successful innovation of the Chilean model appears to lie in the relaxation of transfer restrictions, which have been shown to impose substantial economic costs in the USA (Dippel et al., 2020).

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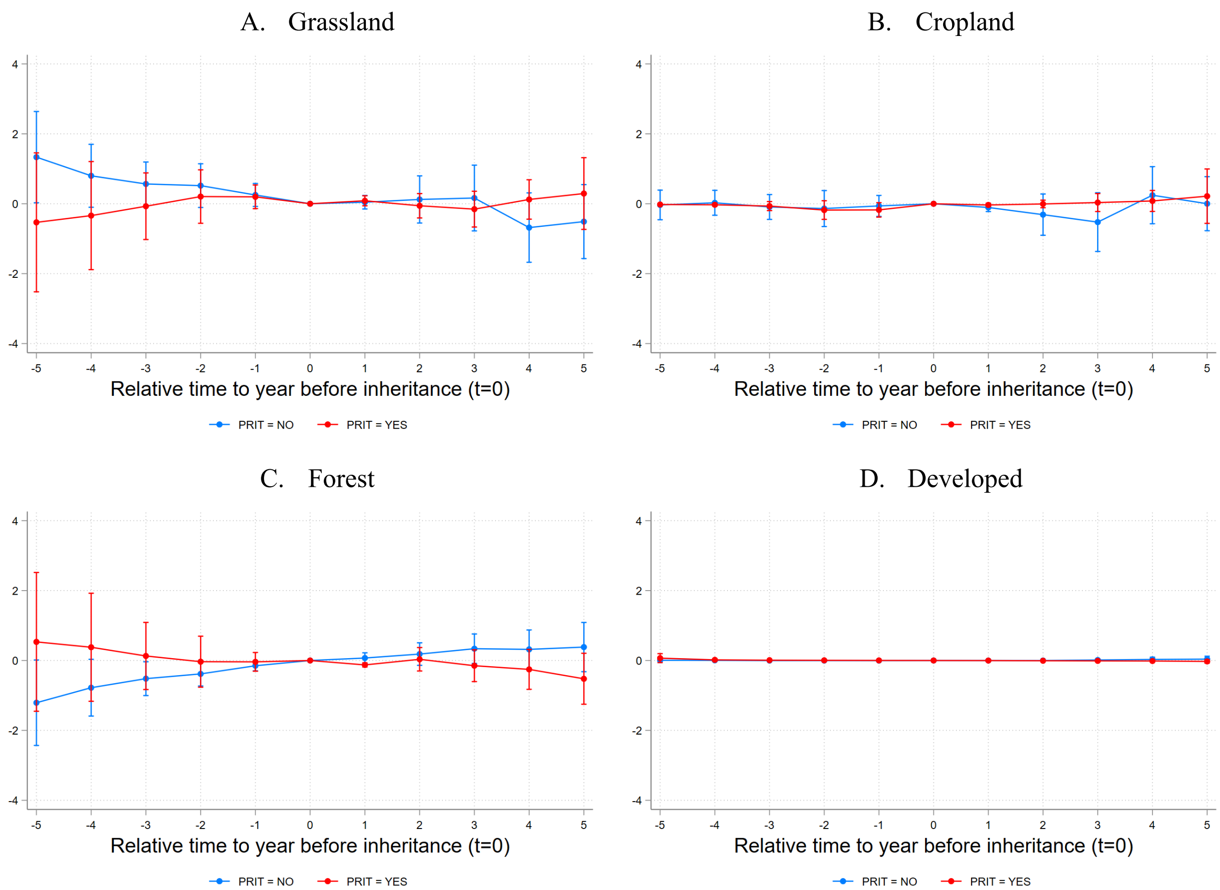
[22] Moreover, liberal tenure reforms may increase the risk of dispossession, as better-informed outsiders take advantage of the reforms to formalize land grabs (Jacoby, 2007; Jordán and Heilmayr, 2024).

[23] While market conditions and available production technologies may respond to the characteristics of land titles across a region (e.g., credit or machinery lease markets may require widespread adoption of formal titles to develop), in our context it is reasonable to treat them as fixed, since the restrictions are imposed on a relatively small fraction of the land market.

[24] Data from the 2007 Agricultural Census reveals that private credit take-up was very low among non-Mapuche agricultural producers in the Araucanía Region (where our study region is located), who face no general restrictions on using their land as collateral. Only 6.3% of producers reported using private credit in the past two years, a figure that drops to just 2.8% among landholders in the first quartile of the landholding distribution (those owning less than 2.2 hectares).

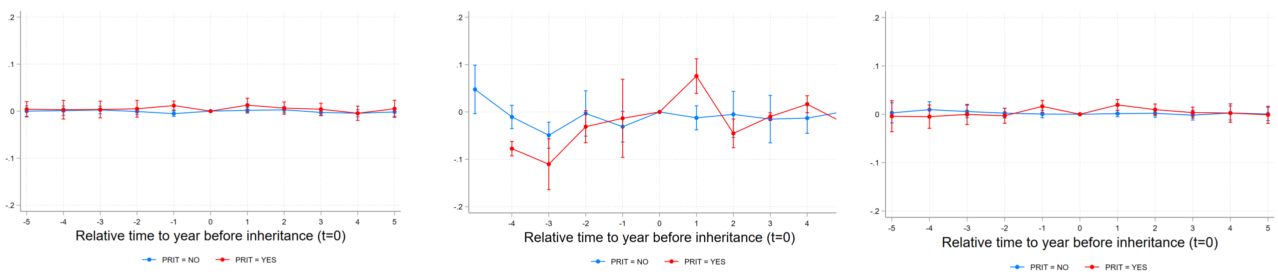
Figure 6.4: Land Cover Changes Following Inheritance by PRIT Status



Notes: Panels A–D display staggered DID estimates of changes in grassland, cropland, forest, and developed land shares. Each panel compares PRIT and non-PRIT inherited plots. Estimates are in percentage points with 95% confidence intervals; clustering at the property level.

Figure 6.5: Productivity Changes Following Inheritance by PRIT Status

A. Grassland B. Cropland C. Forest



Notes: Panels A–C display staggered DID estimates of changes in log of summer average EVI over grassland, cropland, and forest. Each panel compares PRIT and non-PRIT inherited plots. Estimates are in percentage points with 95% confidence intervals; clustering at the property level.

7. Conclusion

Local institutional innovations will be critical to achieve the globally recognized Rights of Indigenous Peoples (ILO, 1989; United Nations, 2007). One important challenge facing national Indigenous policies is the dual objective of protecting traditional territories while simultaneously supporting Indigenous people's capacity to achieve their self-determined development goals. This paper quantifies the impacts of the current model of Indigenous land protection under Chilean law, which permits individual private ownership of Indigenous lands but restricts transfers to members of the same ethnic group, limits leases, and bans mortgages.

Combining administrative property registry data with a novel method that links property deeds over time to estimate historical Indigenous ownership, we find that these restrictions have been instrumental in reducing the loss of Indigenous ownership within historical Indigenous territories in Chile. However, a key enforcement tool, the Public Registry of Indigenous Territories (PRIT), has not been kept up to date, reducing the protective impact of the law in recent years. We find that, when inherited, Indigenous properties protected by the law are more likely to be sold and transferred to non-Indigenous owners if they are not registered in the PRIT. Moreover, most properties listed in the PRIT are removed from the registry upon inheritance.

Policymakers considering reforms to this policy or the adoption of similar measures in other jurisdictions should pay special attention to the design and implementation of registry institutions to ensure the effectiveness of protective provisions for Indigenous territories.

The results of our statistical analyses suggest that PRIT registration does not lead to meaningful losses in agricultural production or reductions in urban development. Thus, the Chilean system of Indigenous land protection appears to achieve effective territorial preservation without compromising these aspects of economic activity in protected areas. This does not imply, however, that PRIT restrictions are costless for the Indigenous people subject to them, as extended succession processes are likely to affect the market value of PRIT-registered properties. Future research should explore these potential costs, ideally through field surveys specifically designed to assess both the pecuniary and non-pecuniary burdens imposed by PRIT on registered property owners.

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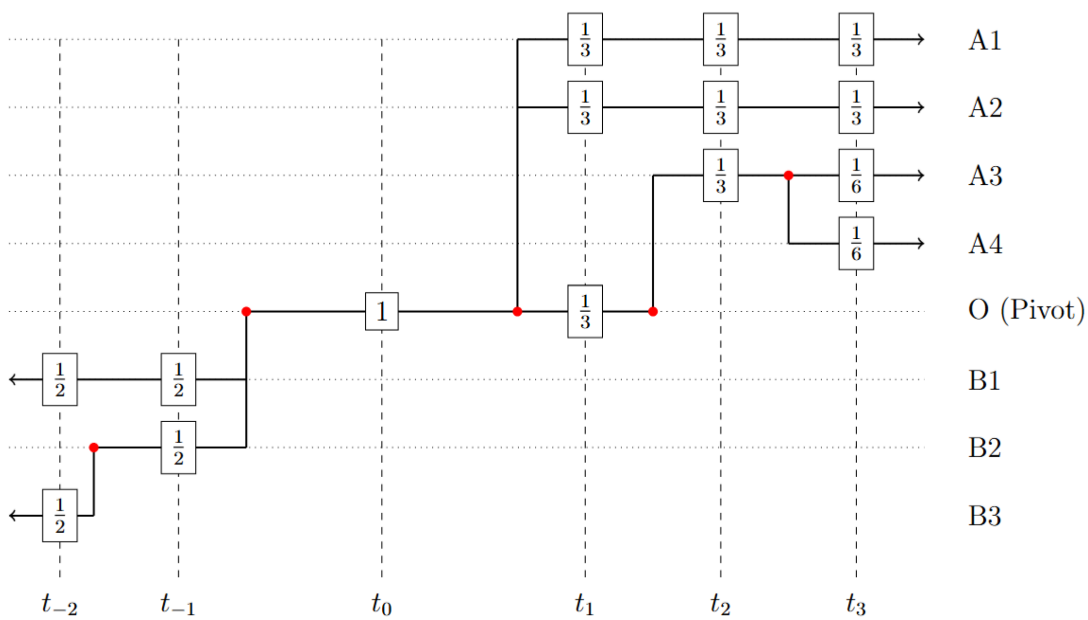
Appendix A. The *time traveling* method

Given a pivotal record, we construct a tree displaying all records linked to its history, both in the future and the past, as illustrated in an artificial example in Figure A1. Each horizontal line represents a record connected to the pivotal record O. Records that follow O are labeled with A (A1, A2, A3, and A4), while records that precede O are labeled with B (B1, B2, B3). A record remains active until it is canceled by the last record in the pivot's tree that supersedes it. The period during which each record is active is shown as a solid line, with left and right arrows indicating that the record is already active at the beginning of the sample period or remains active at the end, respectively. Red dots mark points where one or more records supersede previous records, creating branches in the tree. White boxes above the records' lines indicate the fraction of the pivotal record's property assigned to each record at the times displayed along the bottom of the figure.

Appendi Figure A1: Tree Representation of a Pivotal Record's History



Notes: The figure illustrates a tree constructed around a pivotal record (record O), showing its historical connections to future (A-series) and past (B-series) records. Horizontal lines represent records, with solid segments indicating their active periods. Red dots mark supersession points, creating branches in the tree. The figure also illustrates how the area of the pivotal record is progressively split among related records over time.

After the pivot, each time a record supersedes a previous record (e.g., when records A1 and A2 supersede record O), the algorithm splits the area of the superseded record among the records that supersede it and itself, unless the record is being superseded for the last time, in which case its remaining share is transferred to the others. In the figure, records A1 and A2 supersede the pivotal record O. Since record O is later superseded by record A3, by time t_1, the area of the pivotal record (normalized to 1) is shared equally among records A1, A2, and O. When record A3 supersedes record O, the remaining share of O is transferred to A3, as A3 is the last record in the registry to cancel O. Thus, by period t_2, the area of the pivotal record is equally split among records A1, A2, and A3. Finally, record A4 supersedes record A3. Since A4 is not the last record to cancel A3, the share of A3 is split equally between itself and A4. By period t_3, the area of O is distributed among records A1, A2, A3, and A4 in the ratio 2:2:1:1.

Traveling backwards from the pivot record is more straightforward. In most cases, the history moving backward is linear, meaning that the area of the pivot record is transferred stepwise from one record to the next further into the past. When a record supersedes two or more records, the algorithm splits the area evenly. In the figure, the pivot record supersedes two records, B1 and B2, which split the area of the pivot record equally by period t_{-1}. Moving further back, B2 supersedes record B3. By period t_{-2}, the area of the pivot record is equally divided between B1 and B3.

The fraction of Mapuche ownership in the property associated with the pivotal record at a given point in time is calculated as the weighted average of Mapuche ownership across the records in the pivot's tree that are valid at that time, with the weights determined by the shares assigned using the time traveling method. For example, if by period t_3 records A1, A2, A3 and A4 have 20%, 50%, 0% and 100% of Mapuche owners, the ownership of the pivot's property at that period is imputed to be $\frac{1}{3}20\% + \frac{1}{3}50\% + \frac{1}{6}0\% + \frac{1}{6}100\% = 40\%$.

Time travelling validation

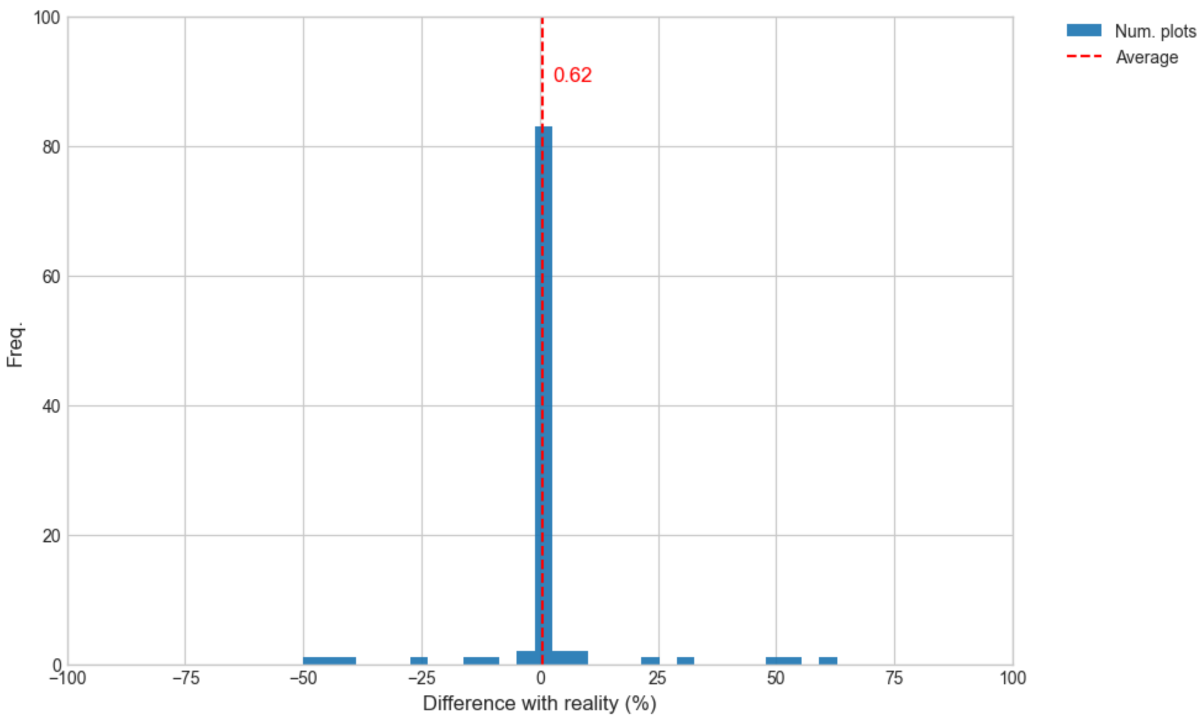
The time travel method is constructed under two assumptions. The first assumption is that, in the case of supersessions occurring within the same period, the distribution of a property remains equal among the records superseding it and the remnant of the pivotal property. To assess the implications of this assumption, we benchmark the method's results against the actual fraction of

Mapuche ownership, calculated using detailed documentation for a sample of 100 properties. First, we randomly selected 100 purchased properties with scanned documentation: 50 were purchases from succession, and 50 were other type of transactions (25 from PRIT and 25 from non-PRIT properties for each case). We then estimated the value assigned by the time travel method to the Mapuche ownership from which our sample of 100 properties originated to the period in which the randomly selected property was recorded (pivoting in the property from which it proceeds). Finally, we observed and reconstructed the actual value of Mapuche ownership using the scanned documents and compared the reality to our methodology.

Our results are presented in Appendix Figure A2. The figure shows that, for 78 of the analyzed properties, there is no difference between the results of our method and the actual values, and the average difference is 0.62 percentage points.

The second assumption is that the last event superseding a property represents the final possible event in that branch—in other words, that the entire property has been transferred and no future changes will occur. To assess the impact of this assumption, we perform an exercise in which we truncate the data at 2010 and compare the estimated fraction of Mapuche ownership using the truncated data to the estimates obtained using the full dataset through 2023. Appendix Figure A3 illustrates how this truncation can affect ownership estimates through an artificial example. If we observe data only up to time t_2, we miss the supersession that occurs between t_2 and t_3, and thus erroneously impute the entire property area to record A1—even though the pivotal record was still active. By truncating the data in 2010, we evaluate how such errors affect the estimation of Mapuche ownership in earlier years. This exercise provides insight into the potential bias introduced by the fact that, today, we cannot observe how the registry will evolve in the future.

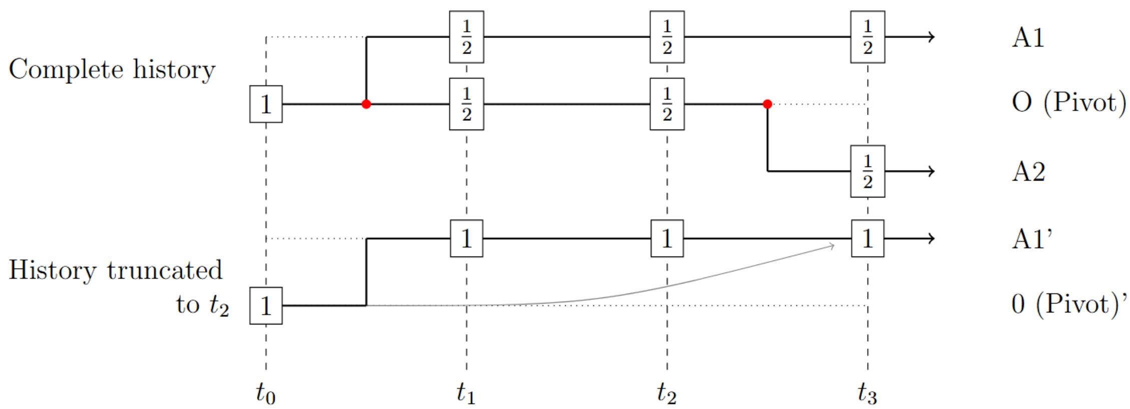
Appendix figure A2: Validation of Time Traveling Method Against Documented Ownership



Notes: The figure shows the distribution of differences between the Mapuche ownership estimated using the time travel method and the actual ownership reconstructed from scanned documentation for a sample of 100 purchased properties. Each bar represents the number of properties falling within a given range of estimation error. The red dotted line marks the average difference across all cases, which is 0.62 percentage points.

Panel A of Appendix Figure A4 shows the fraction of records that had been superseded one or more times before or by 2010—and were therefore considered no longer valid in the 2010-truncated dataset—that were subsequently superseded again after 2010. For each year, the plot reports the fraction of these records that were superseded (considering only the first supersession after 2010, if multiple occur), thus indicating the error rate associated with the truncation. Ten years after the truncation point, during the period 2020–2023, the annual error rate remains consistently below 1 in every 2,000 cases. This suggests that truncating the dataset at 2010 provides a sufficiently long window to approximate the full dataset through 2023 as a reasonable proxy for what would be observed in the absence of truncation—i.e., if the full, infinite time series were available.

Appendix Figure A3: Stylized Illustration of Truncation Bias



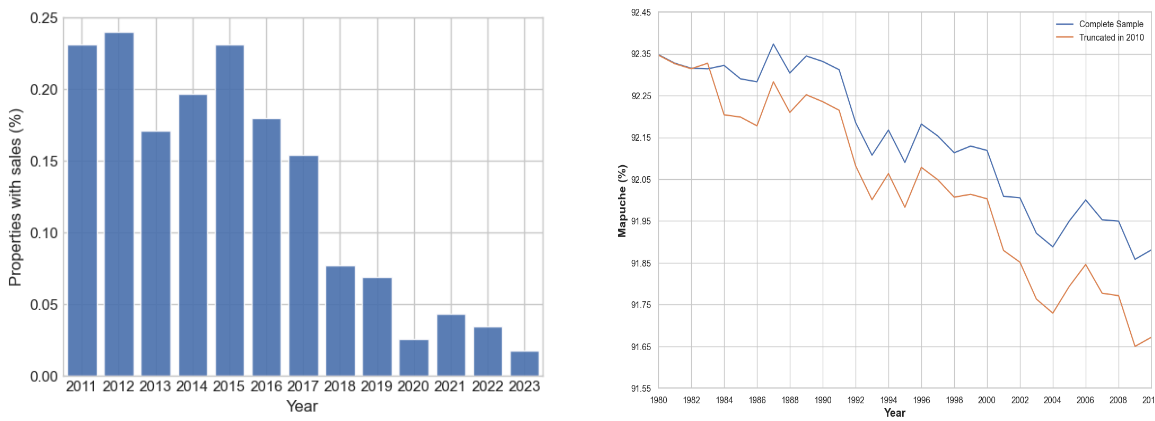
Notes: The figure presents two vertically arranged versions of a property history tree constructed around a pivotal record in period t_0. Each horizontal line represents a property record, with solid segments indicating the period during which the record is active. Supersession events—marked by red dots—create branches as records are replaced by successors. The top panel shows the complete history, while the bottom panel simulates a truncation occurring at t_2, omitting a future branch (A2). This illustrates how missing future events can lead to misclassification of ownership in earlier years. Specifically, if the supersession from A1 to A2 is unobserved, the area is incorrectly attributed entirely to A1, biasing estimates based on truncated data.

The results are presented in Panel B of Appendix Figure A4, which shows that there is a small bias of 0.2 percentage points in the ownership estimates for the last year of the truncated dataset (2010). This bias decreases to 0.1 percentage points when examining ownership estimates 10 years earlier (2000). Thus, truncating the data introduces only a very limited bias in our descriptive analysis, plausibly leading to a slight overestimation of territorial loss by the end of the sample period, assuming that the same pattern holds when truncating at 2023. It is important to note, however, that truncation is not expected to bias the difference-in-differences or owner fixed-effects estimators, as any bias would be present in both the treated and control groups.

Appendix Figure A4: Bias from Truncating Registry Histories

A. Supersession Timing of Properties Incorrectly Classified as Inactive Under 2010-Truncated Data

B. Effect of 13-year truncation on Mapuche ownership estimation



Notes: Panel A shows frequency of records wrongly assumed inactive after truncation. Panel B shows that this misclassification induces minimal bias in ownership estimates over time.

Appendix B. Covariables creation

Index of agricultural outputs

The Crop Price Index was obtained from the FED Soft White Wheat Price Index. This dataset is available on a monthly basis and is indexed to December 2023 prices (U.S. Bureau of Labor Statistics, 2025). Soft white wheat was chosen because the Agricultural Census (2007) indicates that all wheat production from Indigenous producers during this period consisted of white wheat.

For meat prices, we use the price of cattle meat with bones for Chile, from FAO (2024). This database contains information on a variety of prices from different livestock sectors and markets obtained from queastionaries. Prices were on USD nominal dollars, through then deflected to 2023 prices.

For timber prices, we constructed an index using data from the official Chilean Forest Statistics website (INFOR, 2025) and the Agricultural Census (2007). The Timber Price Index weighted eucalyptus and Pinus radiata at 72% and 28%, respectively, reflecting their shares of 70% and 27% of forest land on Mapuche plots, as reported in the 2007 Agricultural Census. We examined the prices of these species for sawing and pulping, as this dataset is the most complete for the Temuco area. This data was originally in nominal Chilean pesos, so it was adjusted by indexing it to 2023 prices and then converted to the average observed exchange rate of the US dollar in 2023, using data from the Central Bank of Chile (Banco Central de Chile, 2025).

Land and weather data

As controls for plot land quality and weather, we use the mean and standard deviation of slope, the mean altitude, the mean potential yield index for grass and wheat, the proportion of land in zones of high erodibility, the annual sum of rainfall, and the annual mean of monthly maximum temperatures. Slope and altitude statistics were calculated using the Copernicus Global Digital Elevation Model, obtained from OpenTopography with a resolution of 30 meters (European Space Agency, 2024). Grass and wheat potential yield data for the period 1981–2010 were obtained from FAO's GAEZ v4 Services (FAO, 2005), considering water supply as rain-fed conditions and low input level, with a resolution of approximately 0.083 degrees (equivalent to approximately 7.3 km at Temuco's latitude).

Erodibility data were obtained from the Centro de Información de Recursos Naturales. This dataset contains four categories of erodibility, ranging from "Low or nonexistent" to "Very severe." For variable construction, we define "Severe" and "Very severe" as high-erodibility levels, while all other categories are classified as low-erodibility levels.

Data on rainfall and maximum temperature were obtained from the Center for Climate and Resilience website (Boisier, 2023). This dataset is available at a monthly temporal resolution and has a spatial resolution of approximately 0.05 degrees (equivalent to approximately 4.3 km at Temuco's latitude). The rainfall variable represents the total annual precipitation for each grid cell. The mean monthly maximum temperature is the average of the monthly maximum temperatures at the year-grid level.

Appendix C. Additional Tables

Appendix Table C1. Summary Statistics on Same-Owners Plot's Sample

	Not-PRIT (N=613)		PRIT (N = 613)		
Variable	Mean	STD	Mean	STD	Std. Mean Diff.
	(1)	(2)	(3)	(4)	(5)
Plot level:					
Slope (mean)	4.73	3.75	4.98	3.75	0.01
Slope (std)	2.42	1.70	2.53	1.70	0.05
Altitude (m.)	130.22	82.14	128.52	81.10	0.02
Potential wheat	1574.44	66.60	1574.52	67.20	0.00
Potential grass	2233.44	56.82	2232.90	56.79	0.01
Erosion	0.11	0.28	0.11	0.27	0.01
Year of Inscription	1997.33	10.06	1990.46	9.87	0.46
Years valid (right censored)	23.74	11.42	30.89	11.67	0.38
Area (ha.)	3.21	3.48	3.52	3.43	0.10
Temuco %	71.02	45.40	76.38	42.51	0.08
Plot-year level:					
Sum of Rain (mm.)	1,302.69	230.94	1,298.47	226.16	0.02
Av. Monthly max temperature (°C)	18.93	0.71	18.94	0.70	0.01

Notes: This table presents statistics for pairs of plots with the same owners. The variables include the mean and standard deviation of the slope, altitude, potential wealth and grass coverage, the percentage of the plot at risk of severe erosion, the year of plot registration, the duration of the plot until the next registration, the plot area (in hectares), the percentage of plots located in Temuco, the year rain sum and the monthly average maximum temperature. Columns 1 and 2 report statistics for non-PRIT plots, while columns 3 and 4 present statistics for PRIT plots. Column 5 displays the standardized mean difference between PRIT and non-PRIT plots.

Appendix Table C2. Summary Description of Plots Active in 1993

	Pre-PSM					Post-PSM				
	Outside TDM (N=38,917)		Inside TDM (N=4,863)			Outside TDM (N=1,303)		Inside TDM (N=4,859)		
Variable	Mean	STD	Mean	STD	Std. Mean Dif.	Mean	STD	Mean	STD	Std. Mean Dif.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mapuche % (1979)	3.43	17.86	12.35	31.67	0.35	11.87	31.54	11.80	31.10	0.00
Area (ha.)	34.76	213.79	12.81	48.76	0.14	21.97	68.77	11.16	45.41	0.19
Number of owners	1.22	1.04	1.21	1.29	0.01	1.34	1.65	1.21	1.25	0.09
Av. Properties per owner	3.72	18.50	2.94	12.84	0.05	3.74	16.07	2.85	12.07	0.06
Year of Inscription	1983.85	8.80	1983.62	7.81	0.03	1983.65	8.07	1983.74	7.82	0.01
Temuco %	72.56	44.62	58.30	49.31	0.30	57.02	49.51	56.15	49.62	0.02

Notes: This table presents statistics for plots that were active in 1993. The variables include the percentage of Mapuche ownership in 1979; the area in hectares; the number of owners; the average number of properties per owner; the year of plot registration; and the percentage of plots located in Temuco. Columns 1 to 4 report pre-PSM statistics, while columns 6 to 9 present statistics for the post-PSM sample. Columns 5 and 10 show standardized mean differences for pre and post-PSM sample.

Appendix Table C3: Staggered DID - Inherited Plots

	Pre-PSM					Post-PSM				
	Not-PRIT (N = 540)		PRIT (N = 241)			Not-PRIT (N = 79)		PRIT (N = 241)		
Variable	Mean	STD	Mean	STD	Std. Mean Diff	Mean	STD	Mean	STD	Std. Mean Diff
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mapuche %	*97.10*	*13.61*	*97.74*	*11.32*	*0.05*	*98.47*	*8.51*	*97.74*	*11.32*	*0.07*
Year of Owner's Death	*2004.33*	*7.14*	*2003.20*	*6.00*	*0.17*	*2003.37*	*6.54*	*2003.20*	*6.00*	*0.03*
Area (ha.)	*11.06*	*30.33*	*8.15*	*25.08*	*0.10*	*5.70*	*11.18*	*8.15*	*25.08*	*0.13*
Number of Owners	*1.57*	*1.99*	*2.83*	*3.18*	*0.48*	*2.48*	*3.01*	*2.83*	*3.18*	*0.11*
Av. Properties per owner	*1.91*	*1.52*	*3.04*	*1.89*	*0.66*	*3.05*	*2.10*	*3.04*	*1.89*	*0.01*
Rural %	*25.65*	*43.71*	*99.17*	*9.09*	*2.33*	*99.17*	*9.09*	*99.17*	*9.09*	*0.00*
Temuco %	*69.70*	*46.00*	*63.49*	*48.25*	*0.13*	*63.49*	*48.25*	*63.49*	*48.25*	*0.00*

Notes: This table presents the statistics of the first inherited properties from registers active in 1993 with at least one Mapuche owner. The variables included are of the property prior to inheritance and displays the percentage of Mapuche ownership; the year of the owner's death; the area in hectares; the number of owners; the average number of properties per owner; and the percentage of plots located in Temuco. Columns 1 to 4 report pre-PSM statistics, while columns 6 to 9 present statistics for the post-PSM sample. Columns 5 and 10 shows standardized mean differences for pre and post-PSM sample.

Appendix Table C4: Estimations on Land Use and Productivity of Same Set of Owner Properties: Interacting with Female

Dep. Var:	*Land cover*				*Log EVI within*		
	Grassland	Cropland	Forest	Dev.	Grassland	Cropland	Forest
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: No Controls							
PRIT	0.7292	-0.4699	-0.1650	-0.1169	0.0140	0.0130	-0.0019
	(1.307)	(0.3446)	(1.236)	(0.0811)	(0.0088)	(0.0505)	(0.0140)
Panel B: Adding female interaction							
PRIT	2.041	-0.4554	-1.601	0.0228	0.0095	0.0359	-0.0151
	(1.263)	(0.4379)	(1.193)	(0.1007)	(0.0103)	(0.0446)	(0.0166)
PRIT X	-2.434	0.0169	2.640	-0.3311	0.0101	-0.0875	0.0465
Female	(2.551)	(0.7692)	(2.401)	(0.3519)	(0.0197)	(0.1206)	(0.0304)
Mean Dep. Var.	84.7515	1.5420	13.1231	0.1758	28.6785	0.3278	0.4872
Obs.	17,276	17,276	17,276	17,276	17,183	1,276	9,708

*Notes: OLS estimates of the PRIT effect, by gender, on land cover for grassland, cropland, forest, and development (columns 1–4), and EVI for grassland, cropland, and forest (columns 5–7). Models include owner and year fixed effects in panel A, plus additional plot-level controls in panel B. Estimates in percentage points for land cover and log points for EVI. SEs clustered at owner level show in parenthesis below point estimates. Statistical significance is indicated by p-values: * for p <0.1, ** for p <0.05, and *** for p <0.01.*

Appendix Table C5: Estimations on Land Use and Productivity of Same Set of Owner Properties: Interacting with Wheat Price

Dep. Var:	*Land cover*				*Log EVI within*		
	Grassland	*Cropland*	*Forest*	*Dev.*	*Grassland*	*Cropland*	*Forest*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: No Controls							
PRIT	0.7292	-0.4699	-0.1650	-0.1169	0.0140	0.0130	-0.0019
	(1.307)	(0.3446)	(1.236)	(0.0811)	(0.0088)	(0.0505)	(0.0140)
Panel B: Adding wheat price interaction							
PRIT	1.271	-0.4501	-0.7657	-0.0820	0.0127	0.0212	-0.0020
	(1.088)	(0.3397)	(1.024)	(0.0668)	(0.0083)	(0.0325)	(0.0139)
PRIT X Wheat Price	0.1286	0.0245	-0.1011	-0.0658	-0.0065.	0.0048	-0.0024
	(0.2663)	(0.1043)	(0.2462)	(0.0499)	(0.0034)	(0.0231)	(0.0044)
Mean Dep. Var.	84.7515	1.5420	13.1231	0.1758	28.6785	0.3278	0.4872
Obs.	17,276	17,276	17,276	17,276	17,183	1,276	9,708

*Notes: OLS estimates of the PRIT effect and its interaction with wheat prices on land cover for grassland, cropland, forest, and development (columns 1–4), and EVI for grassland, cropland, and forest (columns 5–7). Models include owner and year fixed effects in panel A, plus additional plot-level controls in panel B. Estimates in percentage points for land cover and log points for EVI. SEs clustered at owner level show in parenthesis below point estimates. Statistical significance is indicated by p-values: * for p <0.1, ** for p <0.05, and *** for p <0.01.*

Appendix Table C6: Estimations on Land Use and Productivity of Same Set of Owner Properties: Interacting with Meat Price

Dep. Var:	*Land cover*				*Log EVI within*		
	Grassland	*Cropland*	*Forest*	*Dev.*	*Grassland*	*Cropland*	*Forest*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Panel A: No Controls							
PRIT	0.7292	-0.4699	-0.1650	-0.1169	0.0140	0.0130	-0.0019
	(1.307)	(0.3446)	(1.236)	(0.0811)	(0.0088)	(0.0505)	(0.0140)
Panel B: Adding Meat Price Interaction							
PRIT	1.271	-0.4501	-0.7658	-0.0819	0.0127	0.0241	-0.0021
	(1.088)	(0.3397)	(1.024)	(0.0668)	(0.0083)	(0.0343)	(0.0140)
PRIT X	0.0102	-0.0189	-0.0146	-0.0656	-0.0086*	-0.0162	-0.0004
Meat Price	(0.3326)	(0.1313)	(0.3139)	(0.0613)	(0.0037)	(0.0264)	(0.0049)
Mean Dep. Var.	84.7515	1.5420	13.1231	0.1758	28.6785	0.3278	0.4872
Obs.	17,276	17,276	17,276	17,276	17,183	1,276	9,708

*Notes: OLS estimates of the PRIT effect and its interaction with meat prices on land cover for grassland, cropland, forest, and development (columns 1–4), and EVI for grassland, cropland, and forest (columns 5–7). Models include owner and year fixed effects in panel A, plus additional plot-level controls in panel B. Estimates in percentage points for land cover and log points for EVI. SEs clustered at owner level show in parenthesis below point estimates. Statistical significance is indicated by p-values: * for p <0.1, ** for p <0.05, and *** for p <0.01.*

Appendix Table C7: Estimations on Land Use and Productivity of Same Set of Owner Properties: Interacting with Timber Price

Dep. Var:	*Land cover*				*Log EVI within*		
	Grassland	*Cropland*	*Forest*	*Dev.*	*Grassland*	*Cropland*	*Forest*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Panel A: No Controls							
PRIT	0.7292	-0.4699	-0.1650	-0.1169	0.0140	0.0130	-0.0019
	(1.307)	(0.3446)	(1.236)	(0.0811)	(0.0088)	(0.0505)	(0.0140)
Panel B: Adding Timber Price Interaction							
PRIT	1.271	-0.4501	-0.7660	-0.0819	0.0127	0.0215	-0.0021
	(1.088)	(0.3397)	(1.024)	(0.0668)	(0.0083)	(0.0345)	(0.0140)
PRIT X	-0.1457	-0.0030	0.1410	-0.0754	-0.0073	0.00	0.0002
Timber Price	(0.3542)	(0.1408)	(0.3327)	(0.0654)	(0.0038)	(0.0261)	(0.0052)
Mean Dep. Var.	84.7515	1.5420	13.1231	0.1758	28.6785	0.3278	0.4872
Obs.	17,276	17,276	17,276	17,276	17,183	1,276	9,708

*Notes: OLS estimates of the PRIT effect and its interaction with timber prices on land cover for grassland, cropland, forest, and development (columns 1–4), and EVI for grassland, cropland, and forest (columns 5–7). Models include owner and year fixed effects in panel A, plus additional plot-level controls in panel B. Estimates in percentage points for land cover and log points for EVI. SEs clustered at owner level show in parenthesis below point estimates. Statistical significance is indicated by p-values: * for p <0.1, ** for p <0.05, and *** for p <0.01.*

Appendix Table C8. Summary Statistics on Inherited Plots by PRIT Status

	Pre-PSM					Post-PSM				
	Not-PRIT		PRIT			Not-PRIT		PRIT		
	(N=599)		(N=1,847)			(N=355)		(N=132)		
Variable	*Mean*	*Std*	*Mean*	*Std*	*Std. Mean Dif.*	*Mean*	*Std*	*Mean*	*Std*	*Std. Mean Dif.*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mapuche %	96.16	14.30	99.64	4.29	0.33	96.64	13.02	94.73	15.37	0.13
Year of Owner's Death	2012.33	5.41	2009.29	6.00	0.53	2012.57	5.21	2013.35	5.34	0.15
Area (ha.)	5.93	20.81	5.87	17.72	0.00	4.40	5.05	8.29	11.27	0.45
Number of Owners	5.32	5.63	1.56	1.99	0.89	5.07	4.45	5.32	3.90	0.06
Av. Properties per owner	5.35	4.13	3.46	2.83	0.54	5.37	4.09	4.62	3.39	0.20
Year of Inscription	2004.26	12.86	1986.66	6.50	1.73	2004.75	11.85	2004.06	11.28	0.06
Temuco %	95.00	21.82	86.75	33.92	0.29	95.43	20.92	95.39	21.00	0.00
TDM's creation	1979.69	12.95	1983.03	7.06	0.32	1981.47	10.31	1980.68	11.44	0.07
TDM's division after 1979	0.13	0.33	0.03	0.16	0.38	0.08	0.27	0.10	0.30	0.06
Slope (mean)						5.37	3.68	5.09	4.07	0.07
Slope (std)						2.65	1.70	2.99	1.82	0.19
Altitude (m.)						117.11	53.45	155.25	121.49	0.41

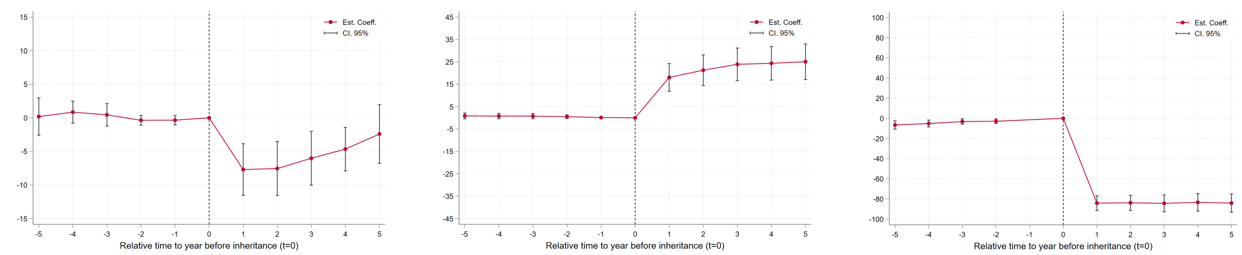
Potential wheat	2244.08	56.26	2241.23	67.63	0.05
Potential grass	6802.36	92.66	6869.31	438.47	0.21
Erosion	0.18	0.34	0.07	0.20	0.37
Annual precipitation (mm.)	1252.60	186.58	1277.09	217.58	0.12
Av. Monthly Max Temperature (°C)	19.07	0.60	18.98	0.84	0.13

Notes: This table presents statistics for inherited properties by PRIT status. The variables include the percentage of Mapuche ownership of the inherited property; the area in hectares; the number of owners; the average number of properties per owner; the year of property registration; the percentage of properties located in Temuco; the year of the owners' death; and the properties' TDMs' settlement and allotment years. Additionally, for PSM-Matched plots that were georeferenced, the table reports statistics on properties' slope, altitude, potential wheat and grass yield, erosion, annual precipitation, and average of monthly max temperature. Columns 1 to 4 report pre-PSM statistics, while columns 6 to 9 present statistics for the post-PSM sample. Columns 5 and 10 show standardized mean differences for pre and post-PSM sample.

Appendix D. Additional Figures

Appendix Figure D1: Heterogeneous Effects of Inheritance on Ownership and Registry Outcomes by PRIT Status

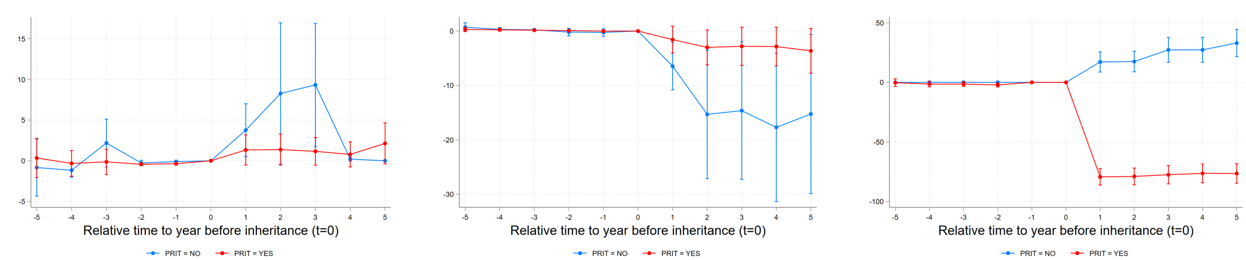
A. Purchases and sales | B. Mapuche' ownership | C. PRIT Inscription



Notes: Each coefficient represents the difference in post-inheritance and placebo effects between PRIT and non-PRIT plots in percentage points, for property sale (A), Mapuche ownership (B), and inscription in the PRIT (C), using the test developed and implemented in Stata by staggered DID by de Chaisemartin et al. (2023). Vertical bars represent 95% confidence intervals; clustering at the property level.

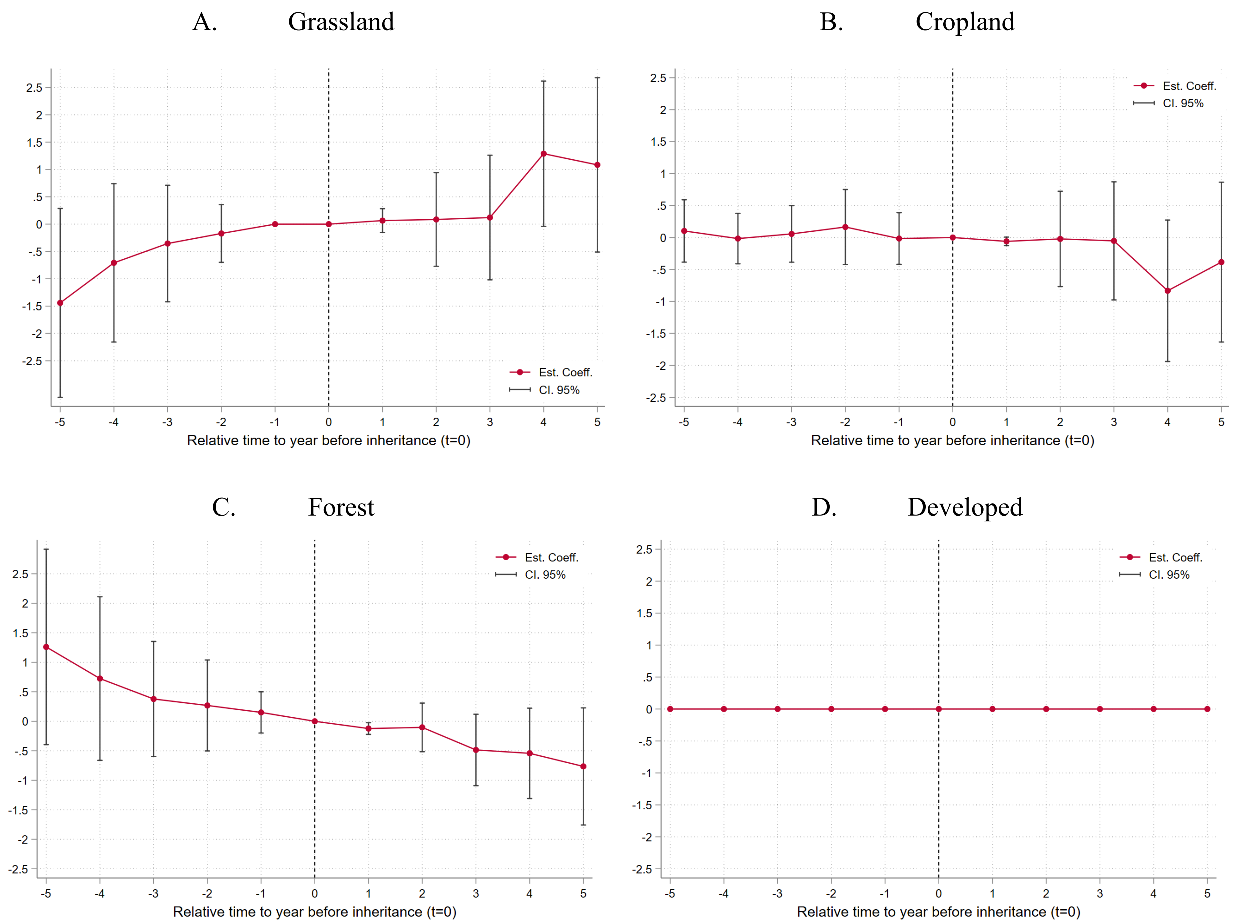
Appendix Figure D2: Dynamic Effects of Inheritance on Ownership and Registry Outcomes using PSM sample

A. Purchases and sales | B. Mapuche' ownership | C. PRIT Inscription



Notes: Panel A shows changes in sale probability after inheritance. Panel B tracks Mapuche ownership loss. Panel C presents registration and deregistration in PRIT. All effects are estimated via staggered DID by PRIT status. Estimates are in percentage points with 95% confidence intervals; clustering at the property level. Estimates based on PSM-matched sample.

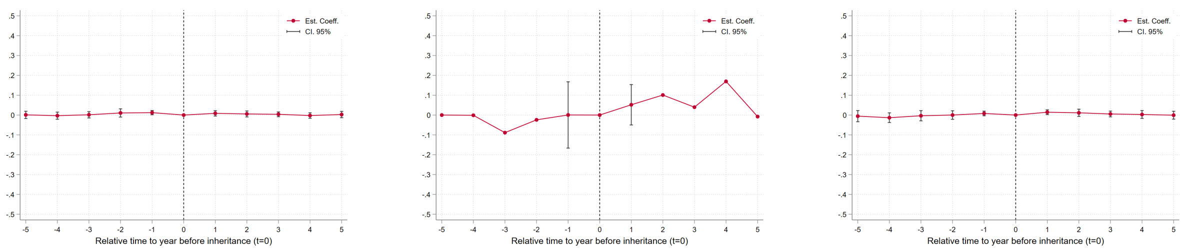
Appendix Figure D3: Heterogeneous Effects of Inheritance on Land Cover by PRIT Status



Notes: Each coefficient represents the difference in post-inheritance and placebo effects between PRIT and non-PRIT plots in percentage points, for the fraction of the property covered by grassland (A), cropland (B), forest (C), and development (D), using the test developed and implemented in Stata by staggered DID by de Chaisemartin et al. (2023). Vertical bars represent 95% confidence intervals; clustering at the property level. Estimates based on PSM-matched sample.

Appendix Figure D4: Heterogeneous Effects of Inheritance on Productivity by PRIT Status

A. Grassland B. Cropland C. Forest



Notes: Each coefficient represents the difference in post-inheritance and placebo effects between PRIT and non-PRIT plots in percentage points, for log of summer average EVI over grassland (A), cropland (B), and forest (C), using the test developed and implemented in Stata by staggered DID by de Chaisemartin et al. (2023). Vertical bars represent 95% confidence intervals; clustering at the property level. Estimates based on PSM-matched sample.