Property rights on First Nations' reserve land[*]

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November 2018

Abstract

This paper examines the economic effects of existing private property rights on First Nations' reserves. We focus on three regimes of land tenure: lawful possession, designated land, and permits. These land regimes have been used to create individual landholdings and grant secure and transferable rights of use of reserve land. Using confidential Census micro-data and rich administrative data, we find evidence of a positive relationship between the use of these tenure regimes and homeownership rates, housing conditions, and band's public spending. We also observe a positive relationship with average income. However, this last result is driven by the inflow of a non-Indigenous population, not by improvements in Indigenous households' income or on-reserve employment. Our findings thus suggest that while reforms to individual property rights on reserve have some positive effects, their scope remains limited and they are unlikely to constitute a transformative tool to alleviate poverty on reserve

Keywords: property rights, institutions, economic development, First Nations.
JEL classification: O12, O43, P48, R14

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1 Introduction

Having well-defined and strongly protected rights to personal property is widely recognized to be a key element in reducing poverty and improving standards of living.[1] The link between a lack of prosperity and the absence of property rights may be particularly salient in indigenous communities around the world where the notion of private land rights is frequently absent (De Soto, 2001; Flanagan and Alcantara, 2003; Anderson and Parker, 2009). Canada's First Nations are no exception: reserve land is not owned by individuals but held in trust for the benefit of band members, and many observers have pointed to the communal nature of reserve land as a major contributor to the economic challenges faced by First Nation communities.[2] Indeed, the concern of weak property rights on reserve has motivated calls from academics (Alcantara, 2003; Baxter and Trebilcock, 2009; Flanagan et al., 2010; Flanagan and Beauregard, 2013) and policy proposals, such as the *First Nations Property Ownership Initiative*, to reform the current land tenure regime.

The absence of fee simple property rights does not imply that all land is held communally or in informal customary holdings, however. The *Indian Act* (R.S.C., 1985), which is the principal statute defining the relations between First Nations and the Federal government, contains several provisions for forms of land tenure that grant private property rights over land. First, bands can formally allocate individual landholdings to their members. These landholdings are termed *lawful possessions* and evidenced by "Certificates of Possession". Second, bands can issue permits or designate land to be leased out. Although these tenure regimes are not the same as fee simple, they do create individual interests over reserve land which are secure, excludable, and transferable. The purpose of this paper is to empirically investigate the extent to which creation of these private property rights on First Nation reserve lands has spurred economic activity.

There are several channels through which private property rights can promote investment and affect economic outcomes (De Soto, 2001; Besley and Ghatak, 2010a). First, secure property rights reduce expropriation risk as well as the costs of protecting property. Second, well-defined property rights facilitate the use of assets by those who can do so most productively through trade or rental. Finally, property rights enable borrowers to pledge their assets as collateral, and thereby relax credit constraints. This last mechanism is at the core of de Soto's argument in favor of individuals property rights. De Soto viewed assets that could not easily be bought, sold, valued or used an investment as "dead capital" that fails to create value for the poor.

With this framework in mind, we investigate the effect of private property rights on (observable) measures of investment and well-being, such as housing conditions, household income, and employ-

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[1] See Besley and Ghatak (2010a) for an overview and additional references on the connection between property rights and economic development.

[2] We use the term 'reserve' to denote land that has been set apart for the use and benefit of a First Nations Band, as defined in Section 2(1) of the federal *Indian Act*, R.S.C. 1985, c. I- 5, the legal title to which is vested in the federal government (under Canadian law).

ment.[3] We use confidential micro-data from the Canadian Census (years 1991-2011) and administrative records on land management from the Indian Lands Registry System (ILRS). As our primary measures of private interests over parcels of reserve land, we use two indicators: the share of land under lawful possession, and the share of designated land and land with permits.

The main empirical challenge is dealing with omitted variables that may affect both economic outcomes and the use of private property: bands that already employ private forms of land tenure may arguably be different in unobserved ways from those that do not. Similarly, bands that have steadily increased their land under private possession may be different from those that chose not to do so. We address this identification concern in two ways. First, we restrict the analysis to First Nation communities which are already using forms of land tenure granting individual property rights, i.e, we exploit variation in the intensive margin only. Second, we include band fixed effects, thus effectively controlling for time-invariant differences between bands.

Our first set of results is encouraging in that we find use of lawful possession to have a positive (albeit moderate) effect on new construction and housing quality: for a given band, an increase in the share of land under lawful possession is associated with a decreases in the likelihood that an individual lives in a dwelling in need of majors repairs, and with a growing number of recently built houses. These findings are consistent with the notion that private property rights give homeowners an incentive to invest into their dwelling.

Our second set of results investigates the effects of private property on income and labour market outcomes on reserve. The picture that emerges is not similarly positive, however. Specifically, while we do find a small effect on household income, further investigation shows that the increase is primarily driven by non-band members. The income of band members, in contrast, seems to be unrelated to previous increases in any form of private land tenure on First Nations' communities. The same is true for labour market outcomes. These findings suggest that private property rights have not substantially improved income nor labour market prospects for the original indigenous population. Rather, they point to increased opportunities for the on-reserve population: as we show, use of certificates of possession is linked to substantial growth in the non-indigenous population. This finding is consistent, for example, with new housing or commercial developments that primarily benefit outsiders.

Finally, we use data from bands' financial statements and water risk assessments to explore the effect of private land tenure on public spending and public services. Band governments are major recipients of rents generated by leases and permits, constituting funds that may be used to provide better services and develop local capacity. We thus look at two key service indicators, water quality, and sanitation, as well as total spending and chief remuneration. In line with the idea that land management generates increased revenues benefiting the community at large, we find a positive and significant correlation

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[3]Unfortunately, we cannot consider complementary indicators of well-being, e.g. health, leisure time, happiness and life satisfaction etc., due to a lack of available data. Other measures capturing economic activity such as night luminosity data are available but since they suffer from systematic measurement errors in regions that are relatively unpopulated and have a low-light density, do not constitute a good alternative when better data are available (as is the case here).

between the use of communally held but designated (usually leased) land and a band's per capita public spending, chief's remuneration, and water quality.

In sum, our analysis corroborates the notion that private forms of land tenure have a modest economic impact on housing quality and development, and can help communities to raise public funds through leases and permits on communal land. We do not find evidence, however, of a prospective 'de Soto' effect on First Nations reserves: private property rights do not seem to have led to sizable improvements in income or employment opportunities. These results are consistent with other studies, such as Field (2005) and Galiani and Schargrodsky (2010), who also find that residential property rights incentivize investment (in physical and human capital) but have much smaller effects on income and poverty reduction. Band members may still benefit, though, as improvements in housing quality and public spending, while not increasing income, can translate into better living standards.

As mentioned above, there exists an extensive literature on how property rights affect economic activity and development, a full review of which is beyond the scope of the present paper. Instead, we refer the reader to Besley and Ghatak (2010a) who provide a comprehensive survey of the previous literature, and the main empirical and theoretical ideas. To our knowledge, this paper is the first to empirically analyze the impact of existing forms of land tenure on First Nations reserves. Some recent contributions to the literature on indigenous property rights and development that are most closely related to ours are Brinkhurst and Kessler (2013), Aragón (2015), and Pendakur and Pendakur (2017).[4]

Brinkhurst and Kessler (2013) carry out the first empirical analysis of land management on First Nation reserves under the *Indian Act*. The authors provide a range of descriptive statistics regarding the variability of lawful possessions across First Nations and, using regression analysis, assess which socioeconomic, demographic, and locational variables influence the use of lawful possessions instead of communal land or other customary landholding systems. They document that uptake of the lawful possession system among bands is surprisingly low, uneven, and concentrated in relatively educated communities who benefit from favourable geographic locations and experience comparatively low poverty rates. Overall, their results lend support to the view that First Nation bands do not generally see private property as an instrument to foster economic development.

Aragón (2015) studies the effect of comprehensive land agreements, or modern treaties, on First Nations communities. He finds evidence that treaties increase real income on reserves located in Canada's Pacific Northwest. The primary mechanism seems to be the increase in extractive industries facilitated by the clarification of property rights in off-reserve land. Using a larger updated sample, Pendakur and Pendakur (2017) look at a broader range of agreements and find similar effects for comprehensive land agreements. For other types of legislation, notably the *First Nation Land Management Act*, which allows bands to opt out of the Indian Act and instead develop their own land codes, the effect

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[4]See Leonard et al. (2018) for a recent contribution on the link between indigenous property rights and growth in the American Indian context.

on incomes is much smaller. In particular, and in line with our findings, the authors show that there is no measurable impact of FNLMAs on incomes of indigenous households but a statistically significant and sizable effect on the incomes of non-indigenous households.

The rest of the paper is organized as follows. Section 2 provides a background of land tenure regimes on First Nations' reserves. Section 3 describes the data sources and empirical strategy. Section 4 presents the results, while section 5 discuss the findings and concludes with some final remarks.

2 Background

2.1 Land tenure systems of First Nations reserves

Nearly 40% of First Nations, or more than 300,000 people, live on reserve. Reserves are tracts of land set apart "for the collective use and benefit" of a First Nations band. A band is typically governed by a band council as structured in the *Indian Act* or according to a customary governance arrangement as negotiated with the federal government. According to the Ministry of Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC),[5] there are currently more than 3,000 reserves with a combined area of over 3.8 million hectares (Geomatics Services INAC, 2012). The overwhelming majority of reserve lands – nearly 3.3 million ha – is managed under the *Indian Act* land tenure regime. Those parcels are registered in the Indian Lands Registry System (ILRS) which is a database of instruments relating to Reserve Lands and Crown Lands.[6] The rest fall into regimes established through the First Nation Land Management Act (FNLMA), through modern treaties or self-government agreements, or through custom arrangements (Ballantyne et al., 2001).

In this paper, we focus on property rights defined by the *Indian Act*. Under the *Indian Act*, reserve land differs from other types of land in several dimensions. First, although bands have the right of exclusive use and occupation of their reserve lands, the legal title belongs to the Crown and the lands are held in trust for bands by the federal government; any formal land transaction has to be approved by the Band council and the appropriate federal Ministry. Second, the interest on reserve land is communal and inalienable. Reserve land has to be used in a way deemed to benefit the whole First Nation band, and cannot be transferred to other parties. In particular, this provision implies that reserve land cannot be seized by legal process, mortgaged or pledged to non-band members. It is worth noting that despite the communal nature of the land, bands can – and often do – allot 'traditional holdings' to particular families or individuals. Customary allotments are not formally registered with

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[5]In 2017, the Department of Indigenous and Northern Affairs Canada (INAC) was dissolved and two new departments were created, Indigenous Services Canada (ISC) and Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC), the latter being responsible for all previous INAC data collection and processing services.

[6]An Instrument is a formal legal document dealing with transactions relating to interests in Indian land: the document specifies the type of transaction, the parcel of land, the parties to the transaction, and any legal details and specifications required.

the federal government, however, and thus offer no legal protection or tenure security if the band council decides to change the allotment or direct the use of that land.

These institutional features resemble communal forms of property rights found in less developed countries, such as the *ejidos* in Mexico, customary lands in Ghana, and *comunidades campesinas* in Peru. They have given rise to concerns that weak property rights may be hindering economic development in First Nation communities and have motivated policy initiatives like the *Indigenous Land Title Initiative (ILTI)*. This initiative proposes federal legislation that will return ownership of current reserve lands to First Nations and confirm their jurisdiction over those lands. One important objective of this initiative and a proposed *First Nations Property Ownership Act* is that a transfer of title to First Nations would enable all types of land tenure, including individual ownership of land.[7]

2.2 Private property rights under the *Indian Act* land tenure system

The *Indian Act* has various provisions for land tenure that allow both band members and non-band members to obtain private interests in parcels of reserve land. These forms of formal land tenure have some features of fee simple regarding rights to occupation and use and expropriation risk, but differ in the important dimension of transferability.

First, the band council can allot individual parcels of reserve land to band members through Certificates of Possession (CPs), which are issued by CIRNAC. Once approved, the individual allotment holder has "lawful possession" of a parcel of land. The CP system was introduced by the federal government in 1951 to replace earlier instruments for registering individual holdings (Location Ticket, Notice of Entitlement, and Cardex holdings) and to increase individuals' legal rights to their existing land allotments. Indeed, band members who have informal property rights by way of a customary holding will often apply to formalize their ownership through the lawful possession process. In this sense, the CP system is connected to the de Soto idea of land titling as a means to formalize and secure ownership rights. In 2012, IRLS had 40,841 current lawful possessions registered (Brinkhurst and Kessler, 2013). Lawful possession rights are similar to fee simple property rights in that:

1. they grant permanent and exclusive right of use and possession, i.e., once an individual has a lawful possession, she can use the land exclusively and as she chooses provided that uses do not conflict with local land regulations that may exist and provided that Ministerial approval is granted where required (such as for a lease),

2. CPs can be transferred, through sale, pledge, or bequest, from one band member to another,

3. they can be enforced in court, and – once granted – cannot be retraced by the Band.

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[7]See http://ilti.ca for further details.

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However, they also differ in some important respects: a) all transactions need to be approved by the band council and CIRNAC, which can add non-negligible transaction costs; b) CP allotments are exempt from legal seizure and taxation (except for Band taxes), and c) CP allotments cannot be transferred to non-band members. The latter precludes selling, pledging or bequeathing allotments to individuals who do not have band membership.[8] Despite these drawbacks, CPs have allowed for the development of a local land market and have enabled band members to use the land as collateral through specialized band-backed mortgages or housing loans as well as to lease their land for revenue generating purposes (Alcantara, 2003, 2005; Baxter and Trebilcock, 2009). This type CP-based lease is called a locatee lease.

Second, bands can lease out communally held, un-allotted reserve lands. In order to be leased, un-alloted land must first be 'designated'. A designation provides for specific terms relating to how the land must be used and may set out conditions which will apply to the lease. Unlike locatee leases, this procedure is more time-consuming since designations require the consent of the band through a referendum.

Leases are generally directed at non-band members[9] and intended to produce an appropriate economic return to the leaseholder, which for designated land is the First Nation and for lawful possession land are (groups of) individual CP holders. In practice, leases thus grant some property rights over land to non-band members and facilitate commercial investments such as casinos, shopping centres, industrial parks, golf courses as well as residential developments.

Finally, the Minister, with the approval of the band, can issue permits to use reserve land. Similar to leases, permits can be issued to any person, regardless of band membership. Permits are more limited than leases since they have a shorter duration, and do not allow exclusive possession of land, but only right of use for a limited, specific purpose. Permits have been commonly issued for the purpose of granting rights to graze livestock or extracting of items such as sand, gravel, clay, and other non-metallic material from reserve land. Permits are also used for access rights or for utilities' rights-of-way ancillary to a development.

To sum up, lawful possession, designated land, and permits are forms of land tenure that are not equivalent to fee simple because they only grant rights of use and possession, impose restrictions on

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[8]CP holders are also required to sell their right if they become a non-band member or if they are a non-member who inherits a CP. A CP can also be cancelled with consent in the case of an error or without consent in the case of fraud, a band surrender of the land, or an expropriation by the Minister (Alcantara, 2003). See Indigenous and Northern Affairs Canada (2006) and Indigenous and Northern Affairs Canada (2014b) for more information on land tenure under the Indian Act. It is interesting to note that a similar instrument, known as 'allotted trust', exists on Native American reservations. These are parcels of land that were allotted to individual tribe members under the Dawes Act, but had not transferred to fee simple by the time of the Indian Reorganization Act in 1934, either because the allottee had not yet been declared 'competent' to hold a fee simple or because the 25 years of required federal government trusteeship had not yet elapsed. The Indian Reorganization Act left allotted reservations with a mix of tribal, allotted trust, and fee simple tenures (Leonard et al., 2018).

[9]In this context, "non-member" includes a corporation owned and controlled by a First Nation, which is not legally considered to have First Nation status, even if all of its shareholders are First Nation members. However, a First Nation member can lease designated land.

to whom the land can be transferred, and generally have higher transaction costs. At the same time, however, they allow individuals to legally exclude others from using land. This is a key feature of private property rights and paramount to their role in economic development (Besley and Ghatak, 2010a). Among these three tenure systems, certificates of possession confer a form of individual property right which is closest to fee simple ownership: a CP grants exclusive use of land, which is permanent, transferable, and can be leased out to non-band members the revenue of which accrues to the individual holder(s). In this sense, a CP interest performs many functions similar to a fee simple title, and for this reason, our analysis below will put a special focus on the effects of CP.

To measure the extent to which these private property rights are being used on First Nations' reserves, we employ the (relative) area of reserve land under the three tenure regimes (individual allotments under lawful possession, designated land, and permits). Table 1 below presents the corresponding numbers for bands under the *Indian Act* land management system in 2011. Several observations are relevant for our empirical analysis that follows. First, individual allotments and designated land are the most important forms of private property rights on reserve. Second, the use of these land regimes is still quite limited. In total, they represent less than 8% of band land. Moreover, only half of all bands have allotted any land and only 40% have designated lands or permits. Indeed, around 25% of all bands do not make use any of these tenure regimes at all.

Naturally, an important concern regarding what can be learned from the data is that bands with and without private property rights may be systematically different. Specifically, use of Certificates of Possession is concentrated among urban, better educated, and wealthier bands as Brinkhurst and Kessler (2013) document. These systematic differences suggest that a simple cross-sectional comparison of both types of bands may suffer from omitted variable bias and be unlikely to inform on the effect of private property rights on economic outcomes. Any meaningful empirical analysis should take account of this concern, and we lay out several approaches to address the issue below.

Table 1: Use of land tenure regimes in 2011

Land tenure regime	Total area (000s ha)	% of total band land	% bands use tenure regime
Lawful possession (CPs)	152.6	4.0	50.6
Designated land	119.5	3.2	38.9
Permits	12.6	0.3	40.7
Total band land	3768.0	100.0	

Note: Data source is Geomatics Services INAC (2012). Data are only from bands with land managed under the Indian Act tenure system (n=573).

3 Methods

3.1 Data sources

Our empirical analysis draws on data from two main sources, which we complement with information on geographic location (from Google Earth and CIRNAC), and band governance from CIRNAC's First Nations Profiles.

First, we use micro-data from four rounds of the long-form Canadian Census (years 1991, 1996, 2001 and 2006) and its successor, the 2011 National Household Survey (NHS). Both the long form census and the NHS are distributed to every household on reserve.[10] The data contain detailed household– and individual– level data including income, band membership, education, and other socioeconomic characteristics.[11] Some of the results that follow will distinguish between those households where at least one person is a band member and those where no one has band membership. For ease of exposition, we will occasionally refer to the former loosely as 'indigenous' households.[12] Further, we will often use the terms 'First Nation' and 'indigenous' interchangeably although the latter, which entrenched in the Constitution Act 1982, properly refers to all three indigenous groups in Canada, namely First Nations, Inuit, and Métis.

Importantly, the census also includes place of residency at the level of Census Sub-Divisions (CSDs). A CSD is the general term for municipalities or areas equivalent to municipalities for statistical purposes such as Indian reserves, Indian settlements, and unorganized territories. This geographical variable allows us to identify the population living on First Nation Communities. In order to match households to First Nation bands over time, we use geographical concordance and linkage tables from Statistics Canada (2015) and CIRNAC that provide details of the changes of CSDs over time as well as a mapping of bands to Indian reserves and CSDs.[13]

To obtain measures of real income and real wages, we deflate nominal values using a band- specific consumer price index (CPI). This local CPI allows for non-housing prices to vary across provinces and for housing costs to vary across reserves held by different bands. The main concern here is that if strengthened individual property rights led to substantial improvements in the value or quality of

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[10]The response rates in most indigenous communities rates are generally quite high, in excess of 90 per cent for the Census and over 80 per cent for the NHS. However, not all reserves are enumerated in the past, partly because some reserves, including a few very large ones (e.g., Six Nations 40 in Ontario) refuse entry of statistical enumerators as part of a political decision. Unlike the mandatory census, the NHS was a voluntary survey.

[11]The Census microdata is confidential and use is subject to Stats Canada confidentiality standards. As part of those standards, all the statistics and regression estimates use sample weights provided in the microdata file. In addition, summary statistics (like means and number of observations) are rounded. There is, however, no rounding of regression estimates.

[12]Band membership and Indian status are distinct legal concepts. While the Indian Act entitles and defines persons with Indian status, bands are in control of their own membership.

[13]We use the term Indian reserve broadly to refer to several types of CSDs affiliated to First Nation bands, following the definition of reserve population used by Statistics Canada. More detailed information on types of CDSs associated with on-reserve population as well as a list of changes in the 2011 Census can be found at http://www12.statcan.gc.ca/census-recensement/2011/ref/dict/geo012-eng.cfm.

houses, the local cost of living may have increased, and thus using nominal income would not account for localized inflation.[14]

Second, we obtained administrative data on Indian land management from the Geomatics Services Office of CIRNAC. These data are based on records in the Indian Lands Registry System (ILRS) and the Canada Lands Survey System. They contain information on reserve lands and the surveyed parcels on reserves, as well as the interest, collective or individual, in each parcel and the date at which the evidence of title, if any, was issued. The data are only available for those 573 bands that manage their lands within the framework of the Indian Act.[15] We use these administrative data to construct measures of the area of land under different tenure regimes (i.e., lawful possession, designated land, and permits) in a given year for all the reserves held by a given band. Figure 1 depicts the total area under these regimes for the period 1971 to 2011.

Figure 1: Total reserve land under private property rights, in 000s ha
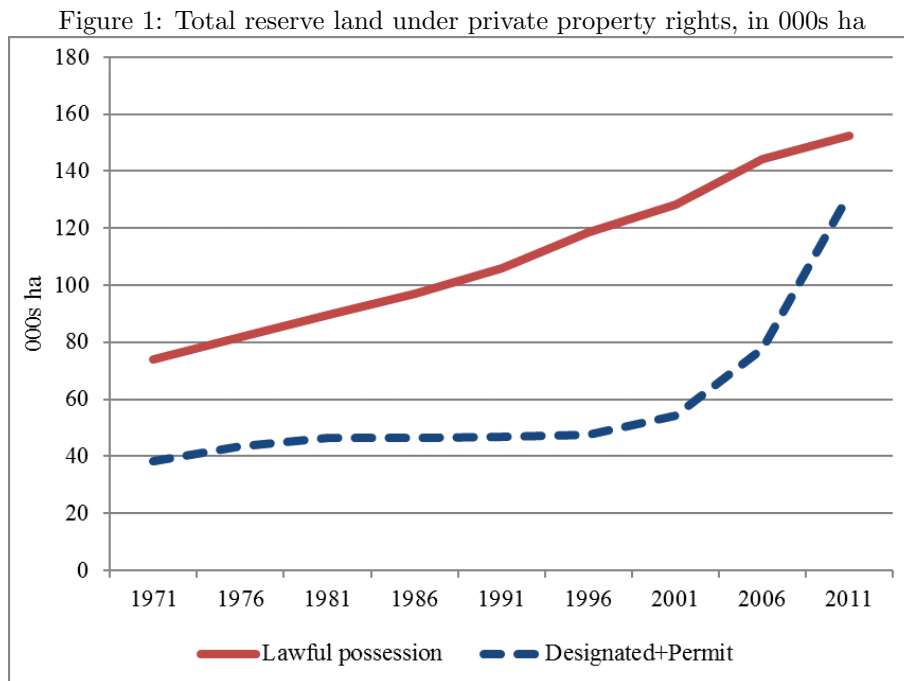
As the figure shows, there has been a sizable increase in the use of private property rights over the past 30 years, doubling the area held under Certificates of Possession and tripling the (band-held) land with permits or designated for a specific purpose. The figure masks, however, the considerable

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[14]The index corresponds to a weighted average of housing and non-housing costs, using local rents and provincial price indexes. The methodology follows Moretti (2013). See Aragón (2015) for further details on the construction of the dataset and the local CPI. None of our results below is qualitatively affected if we use nominal incomes and wages instead.

[15]The land management data do not include information on bands operating under the First Nations Land Management Act, bands that have signed modern treaties, bands in the Yukon, and most bands in the Northwest Territories. We drop this latter territory from our sample given the small sample size (only 2 bands).

variation in use across communities. Recall from Table 1 that about half of the bands we have data on do not have any of their reserve land registered under lawful possession. For reasons laid out in detail below, we confine our analysis to bands that have been actively using land tenure regimes that grant individual property rights, i.e., certificates of possession, designate land, or permits.

Combining the Census (respectively, NHS) data with the land use data from IRLS, we build a dataset consisting of a repeated cross-section of all households and individuals 15 years and older living on CSDs classified as Indian reserves, regardless of Indian status or band membership, covering the years 1991, 1996, 2001, 2006 and 2011. As mentioned above, we exclude all reserves belonging to First Nations with no record of having granted lawful possession rights or no record of designated land and permits. Our final dataset covers reserves of 103 First Nation bands that manage their reserve lands under the Indian Act, and make active use of individual property rights. Table 2 gives descriptive statistics for our band level land use data and household-level (respectively, individual) Census and NHS microdata.[16] It presents weighted sample means for all our dependent variables and control variables, both in the entire sample and broken down by band membership.

3.2 Empirical strategy

The primary goal of our empirical analysis is to shed light on how much individual property rights on First Nations' reserves in Canada have contributed to the well-being of the respective community and its inhabitants. A major constraint is the lack of detailed data on several important measures of living standards such as health status, food security, or other measures of poverty. Given these data limitation, we focus on three outcomes available in the Canadian Census: housing characteristics, household income, and employment.[17]

The reason for choosing these outcomes is threefold. First, all three variables capture some important dimensions of economic development and well-being. Second, since dwelling conditions are affected by maintenance and renovations decisions, they can also be informative of housing investment (Galiani and Schargrodsky, 2010). Finally, labour outcomes can reflect improvements in local economic activity, such as increased employment opportunities or higher wages, that may not always translate into observable changes in household income

The main empirical challenge we face is one of comparability and self-selection. As mentioned previously, bands which have adopted individual land tenure regimes are likely to be systematically different from bands that do no use them (Brinkhurst and Kessler, 2013). Among other socioeconomic differences, bands in the latter group are less likely to be located in a metropolitan area, exhibit lower incomes and educational achievement, and worse housing conditions (see Table A.2 in the online ap-

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[16]Table A.1 in the online appendix provides additional summary statistics at band level.

[17]It is also important to note that people living on reserve or in rural communities may not report income, or may have significant non-monetary sources of income, such as food from farming, hunting, etc., that is not captured in census data. We would like to thank an anonymous referee for pointing this caveat out to us.

pendix). While we can control for these observable characteristics, there might be several unobserved factors– such as band leadership or opportunities for economic development – that affect both the extent to which bands use private property rights and their economic outcomes. For this reason, a simple comparison of bands with different use of land tenure regimes would not be informative: we could wrongly attribute the effect of property rights on First Nation communities to effects actually driven by these omitted variables.

We address this issue in two ways. First, we include in our econometric model band fixed effects, i.e., indicator variables for each band. This allows us to control for any time-invariant band characteristics, such as location, history, and initial socioeconomic conditions, and identifies the effect of an increases in use of individual land rights on outcome through the variation over time within, rather than across, bands: our model is thus informative on how increased use of individual property rights, in a given band, is associated with changes in household income in the same band over time. Second, one important condition for this approach to remove any omitted variable bias is that all bands are on the same time trend, i.e., there is no systematic correlation between the idiosyncratic error terms and the regressors. Since we are worried bands that have actively used individual land rights may be on a different time trend than bands who decided against such rights, we drop the latter. In particular, in our main specification, we only include bands that have at least one parcel under lawful possession and at least one parcel of designated land or with a permit. This reduces the number of bands in the sample to just over 100, which arguably could reduce statistical power and increase the margin of error. For completeness, therefore, we also show that our results hold up using the whole sample of over 500 bands in Table 7 below.[18]

Our observational units are households, though, not bands. Therefore, we include a number of co-variates that factor into our outcomes of interest such as age of household head, education, household size, homeownership, and dwelling characteristics. In order to differentiate between indigenous and non-indigenous households on reserve, we will often additionally control for (self-reported) band membership of at least one individual in the household, or allow for the possibility that the parameter estimates are heterogeneous across band and non-band member households by splitting the sample accordingly.[19] On the band level, we additionally account for changes in band population over time. Finally, we capture general time trends through year fixed effects.

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[18]Most bands that use lawful possession have been using this instrument since its inception, so the sample is relatively split between bands who never used private land tenure and bands who (over our time frame) always have, further strengthening the argument that those two groups may be fundamentally different. The most sensible way to proceed is thus to employ variations in the intensive margin.

[19]In contrast to most previous studies on the success of indigenous populations in Canada who use self-reported single-origin or multiple-origin Aboriginal ancestry (Kuhn and Sweetman, 2002; Pendakur and Pendakur, 2017)] or Indian status (Hull, 2004) as the relevant grouping category, we focus on band membership because this defines an individual's ability to hold a CP. We verified that our results are not sensitive to this specification (See Table A.12 in the online appendix).

Specifically, we run the following regression,

$$y_{ijt} = \alpha_j + \beta_1 \ln CP_{j,t-10} + \beta_2 \ln nonCP_{j,t-10} + \gamma X_{ijt} + \sigma_t + \epsilon_{ijt}, \tag{1}$$

where the unit of observation is individual or household i, in band j in year t. y is the outcome of interest, such as a log of household income or dwelling conditions, X_{ijt} is a vector of individual, household and band controls, while α_j and σ_t are band and time fixed effects respectively. We use sample weights, and cluster the standard errors at band level.

Our preferred measures of the extent of individual property rights on reserve is the log of total land area with certificates of possession ($\ln CP$) and log total area of designated land and permits ($\ln nonCP$). Note that due to the band fixed effects, a change in the (log of) the total area under a particular land tenure regime is equivalent to an area change *relative* to the total reserve land. We distinguish between CP and non-CP forms of individual property rights because both tenure regimes have substantial institutional differences. As discussed in Section 2, CPs are closer to fee simple: they allow transfers of individual interest to band and non-band members (via locatee leases), allow for a more flexible use of land, are permanent, and face lower transaction costs. We lag those values 10 years to allow sufficient time for any investment to mature and be reflected in outcomes.[20] Note that although we focus on the total area under different regimes, by using logs and including band fixed effects we are effectively estimating the effect of changes on the intensive margin, i.e., changes in the *relative* area under these land regimes for each band. The parameters of interested are β_1 and β_2, which – to the extent that our explanatory variables are conditionally uncorrelated to other determinants of income and housing outcomes – will produces unbiased estimates on the effect of individual property rights. One should also note that both measures of individual property rights (as well as our outcome variables) are positively serially correlated: use of CPs, permits, and land designations remains constant over time for a number of bands, and never declines. The uncorrected standard errors may thus severely overestimate the statistical significance levels for β_1 and β_2. As Bertrand et al. (2004) document, however, allowing for systematic correlation of the error term within a given band by using cluster-robust standard errors is suitable correction method in practice as long as the number of groups is not too small. We thus report standard errors at the band level.[21] In addition, true standard errors that are in fact larger than our estimates would not be detrimental to our main conclusions as will become below.

Throughout our analysis, it is important to keep in mind that the sample we employ is not repre-

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[20]We checked the robustness of our results below against alternative specifications with different time lags. See Figure 2 in the online appendix for details.

[21]Intuitively, since inclusion of band-specific fixed effects may not fully control for correlation within bands (and/or heteroskedasticity), default standard errors that assume errors to be i.i.d. may be invalid. Clustering at the band (group) level is a solution. Note that clustering at the intersection of band and year would be inadequate because it would impose the restriction that observations are independent if they are in the same band but in different years. We also considered two–way clustering along the band and year level (Cameron et al., 2011), but our dataset only spans 4 years, and it is well known that variance-covariance matrix corrections do not perform well when the number of groups becomes small.

sentative of all bands since we exclude bands that do not use CPs or designated land and permits. Consequently, the reader should be cautious when interpreting our results below, as they are not informative about the effect of property rights for the *average* First Nation band, but only for those bands who have been making active use of those property rights.[22] Table A.2 in the online appendix gives the means of some of our control variables for households or individuals who live on reserves of bands in the former and the latter group, respectively. The difference in means is everywhere significant at the 1 per cent confidence level, illustrating that the demographics of reserves where bands have used individual property rights under the Indian Act land regime in the past are markedly different from those who have not in several dimensions. Households earn more, are better educated and more likely to be employed in the former group. Notably, the corresponding reserves are also closer to metropolitan areas. This should come as no surprise, as one would expect bands who either are already more prosperous or in a better position to take advantage of individual ownership to be more likely to employ land use regimes that support it.

Given the voluntary nature of these land regimes, it seems likely that bands belonging to the former group would expect to benefit most from adopting them. Bands who chose never to use any of the available land management regimes, in contrast, presumably made that decision because they saw little benefit from doing so. In this sense, we would expect our estimates to provide an upper bound on the estimated effect of private property rights on the average First Nation band.

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[22]In other words, we estimate the average treatment on the treated effect (ATT) $\ln CP$, not the average treatment effect (ATE).

Table 2: Summary statistics

Variable	Whole sample	Band members	Non-band members
A. Band level in 2001			
Band land (000's m^2/pop.)	79.630		
Certificate of Possession area (000's m^2/pop.)	10.224		
Designated and permit area (000's m^2/pop.)	2.593		
Average no. of households	304.5	186.0	118.5
Average population	832.3	592.0	240.3
B. Household head			
Is band member	0.581		
Is registered Indian	0.579	0.947	0.002
Age	50.4	46.2	57.0
Is female	0.472	0.515	0.406
Education above high school	0.488	0.454	0.541
Is employed	0.470	0.483	0.450
C. Employed individuals			
Hours worked	35.7	35.7	35.7
Real hourly wage (CAD)	12.3	10.6	15.1
Industry = primary	0.056	0.071	0.028
Industry = services	0.724	0.790	0.715
Industry = other	0.220	0.200	0.057
D. Households			
Real household income (CAD)	32,343	27,691	38,826
Real employment income (CAD)	20,185	19,001	21,836
Household size	2.8	3.3	2.0
Reside for less than 5 years	0.189	0.110	0.314
Dwelling is band housing	0.225	0.366	0.006
Dwelling owned by HH member	0.605	0.488	0.786
Dwelling is rented	0.170	0.146	0.208
Dwelling built in last 10 years	0.303	0.304	0.301
Dwelling in need of mayor repairs	0.225	0.321	0.075
No. obs.	122,160	74,585	47,575
No. bands	90	90	81

Note: Mean values are weighted using sample weights and rounded according to Stats Canada confidentiality procedures. Real income and wage measured in 1991 CAD. Other industries include manufacturing, transportation and construction. No. observations and bands refer to sample used in income regressions. HH = household

4 Results

4.1 Housing

We start out by considering the effect of property ownership on outcome measures where we would expect the link to be most salient, namely, on the ownership and quality of housing. As band members with a Certificate of Possession have secure and long-term property rights to the land (and any structure thereon) named under the certificate, it is natural to presume that CP holders are willing to invest into a dwelling that stands on their plot of land. This should be evident in the data as increased likelihood of homeownership and improved quality of houses in bands where more land area is privately held under the CP regime. The respective results are presented in Table 3 which uses indicators of ownership and dwelling characteristics as outcome variables.

The first specifications consider homeownership. We find that increased use of certificates of possession (CP) has a positive effect on homeownership: Column (1) shows that CPs reduce the likelihood that any given household we observe lives in band housing. At the same time, they increase the likelihood that a member of the household own the dwelling they live in, as evident from column (2). Of course, this latter result is somewhat mechanical since, by definition, CPs grant individual property rights. However, it is a useful check of our specification. Not finding any effect on homeownership would raise a red flag, suggesting either data issues or a severe misspecification. A second set of regressions look at whether more prominent use of private property rights subsequently lead to measurable improvements in the quality of housing. We can see from columns (4) that as bands increase the area under CP on the reserve, the likelihood that the household lives in a dwelling in need of majors repairs 10 years ahead falls. As expected, both the effect of lawful possession on homeownership and its effect on quality of housing are significantly stronger for indigenous households; after all, only band members can hold CPs.[23] This result underscores the notion that private property rights give house owners an incentive to invest into improvements and upgrades of their home. We also find that lawful possession rights have positive effect on number of recently built houses (column 6). Band members are presumably more likely to consider building a new house if they hold a CP than if the house would have to be built on communal property.

Turning to designated land and permits, we see that there is no measurable effect on homeownership, which is not surprising. The effect on reducing the need for major repairs is smaller but still statistically significant. Interestingly, designated land and permits are not positively correlated with improvements in housing quality of band members – despite the fact that they are strongly correlated with new construction (column 6). This suggests that an important objective of designating land may have been to build new housing units, which are primarily inhabited by non-member households. We will come back to this observation in Section 4.2.1 below.

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[23]Indeed, an analogous regressions with only non-indigenous households shows no correlation between CPs and non-band member housing outcomes.

Generally speaking, our findings suggest that CPs are more important to improving housing conditions than alternative existing forms of individual property rights on reserve, especially for band members. At the same time, one should note that our estimates of the corresponding coefficients, although positive and statistically significant, are relatively modest in size – and perhaps surprisingly so. For instance, for the average band in our sample, doubling the size of reserve area under CP is associated with a subsequent reduction of 8.2 percentage points in the proportion of band members living in dwellings in need of major repairs (see column 5). The drop represents around a quarter of the mean value (32.1%).

Table 3: Effect on housing outcomes

| | Dwelling is band housing | Household owns dwelling | | Needs major repairs | | ln(no. houses built in last 10 years) |
| | | All households | Band members | All households | Band members | |
	(1)	(2)	(3)	(4)	(5)	(6)
ln(CP area)	-0.050***	0.035**	0.065**	-0.055***	-0.082***	0.124
	(0.019)	(0.017)	(0.029)	(0.019)	(0.030)	(0.223)
ln(non-CP area)	0.001	-0.004	-0.003	-0.014**	-0.012	0.160***
	(0.008)	(0.009)	(0.025)	(0.006)	(0.015)	(0.057)
R-squared	0.471	0.368	0.279	0.166	0.086	0.13
No. obs.	122,160	122,160	74,585	122,160	74,585	418
No. bands	103	103	103	103	103	103

Notes: Robust standard errors in parentheses. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All specifications include band and year fixed effects. The number of bands in the sample is 103. Columns (1) to (3) have the following covariates: age of household head and its square, indicator of having completed more than secondary education, gender, indicator of a band member in the household, household size, and log of band population. Column (4) and (5) add as controls indicators of homeownership, number of rooms and its square, and an indicator of being built in last 10 years. Column (6) uses data aggregated at band-year level and includes only band and year fixed effects.

4.2 Household Income

We next turn our attention to the effect on reported household income. As discussed in more detail in the introduction, there are several channels through which private property rights may affect economic activity and, hence, real income. Better property rights can generate revenue if the property is sold or leased out to someone who can make better use of the asset. They also improve access to credit grant security of tenure, and lower transaction costs (Besley and Ghatak, 2010a), which can lead to additional investment and a growing number of transactions. This link between property rights and

income is at the core of the so-called "de Soto" effect of property rights. All those factors benefit local economic activity and, ultimately, result in higher local income.

The results of the corresponding regressions are gathered in Table 4. Consider first the regression in column (1), our most parsimonious specification. It shows the estimated effect of the (10 year lagged) changes in area under private ownership on household income as the outcome of interest. As before, we include band and year fixed effects as well as controls head of household characteristics (age, gender, education, and employment status), and household size. Both coefficients on the CP area and the non-CP area are positive and statistically significant at the 10 and 5 per cent level, respectively, suggesting that enhanced private property rights have a measurable effect on (future) incomes. As the specification in column (2) shows, however, this finding is not fully robust to controlling for band membership – allowing the intercept of the estimated relationship to vary across indigenous and non-indigenous households results in lower and insignificant estimates, pointing to an important heterogeneity in the population under consideration, namely the distinction between band and non-band members.[24]

When we split the sample between these two groups in columns (3) and (4), we find that the coefficient is much smaller and imprecisely measured for band members: there is no significant effect of increased private property rights on the log of indigenous household income. The picture is markedly different for non-indigenous households. Contrary to band members, the estimated coefficient for the effect of CPs on non-band members' income is almost 3 times as large, and more precisely measured. We also observe that, as before, non-CP use is less important for outcomes. It is not strongly associated with subsequent increases in household incomes in either the pooled regression or in the split-sample regressions.

In summary, the results in Table 4 do not show strong evidence for a positive impact of individual property rights on real incomes of the local indigenous population. One concern here could be that the 'zero' effect with respect to total income obscures desirable shifts in the composition of income. For example, increased investment activity may have led to a rise in wages or employment, with a corresponding drop in transfer income. To investigate this possibility, we also look at variations across sources of income. Table 5 shows specifications analogous to (2) and (3) in Table 4, where we have decomposed total household income into employment and non-employment income. In our sample, the latter represents roughly 40 per cent of total income. For indigenous households, the primary source of non-employment income are government transfers. For non-indigenous households, important sources of non-employment income are pensions and welfare benefits.[25]

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[24]We code the indicator variable 'band membership' as equal to one if at least one individual in the household is a member of the band. Our results are similar when we include full interactions terms with an indicator of band membership and when we use registered Indian status instead of band membership.

[25]Through comprehensive funding arrangements between the government (through CIRNAC) and individual bands, band members living on reserve are eligible for a host of social assistance programs based on an established level of need, most notably the *Income Assistance Program*. In 2005-2006, transfers in this program totalled $682 million, about 90% of which was spent for basic services to approximately 150,000 individuals in 630 First Nation communities. The average dependency rate in the on-reserve population was roughly 30%. The proportion of income from government

Table 4: Effect on household income

| | ln(real household income) | | | |
	(1)	(2)	(3)	(4)
ln(CP area)	0.114*	0.092	0.050	0.152*
	(0.058)	(0.057)	(0.069)	(0.082)
ln(non-CP area)	0.040**	0.031	0.043	0.015
	(0.020)	(0.020)	(0.035)	(0.023)
Sample	All households	All households	Band members	Non-band members
Band Member Control	No	Yes	–	–
R-squared	0.308	0.321	0.333	0.215
No. Obs.	112,385	112,385	65,505	46,880
No. bands	90	90	81	81

Notes: Robust standard errors in parentheses. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All regressions include band and year fixed effects. The number of bands is 103. Columns (1) to (3) include as covariates household head characteristics (age, age^2, indicator of having completed more than secondary education, gender, and employment status), and household size. Column (2) adds an indicator of one if at least one individual in the household is a band member. Columns (3) and (4) split the sample between households with and without band members.

From the estimated coefficient of CP area on band member income, we see that the absence of an effect on total income is not due to counteracting effects on employment and non-employment income. Instead, neither employment nor non-employment income of indigenous households are correlated with how much a band has increased its area under CP in the past within a given band. Again, the difference to non-indigenous households is striking. Here, the measured effect of CP use on employment income of non-band members is positive and substantial: doubling the area under CP in a given band is associated with a 20 per cent rise in the employment income of non-indigenous, on average. We conclude that the observed effect of CPs on household income is driven almost entirely by the increase in employment income of non-band members. There is no significant change in other sources of income such as government transfers or welfare benefits.

We interpret our findings as evidence that increased use of private property rights on reserves have not led to a measurable and statistically significant subsequent increase in real income for the local

transfers for a typical band member in our data is between 37 (men) and 26 (women) per cent. For further details, see Indigenous and Northern Affairs Canada (2007).

Table 5: Effect on employment and non-employment income

| Source of income: | ln(real household income) | | | |
	Employment	Non-employment	Employment	Non-employment
	(1)	(2)	(3)	(4)
ln(CP area)	-0.025	-0.001	0.204**	-0.013
	(0.086)	(0.061)	(0.093)	(0.068)
ln(non-CP area)	0.026	0.049	-0.050	0.003
	(0.056)	(0.030)	(0.033)	(0.017)
Sample	Band members		Non-band members	
R-squared	0.199	0.347	0.344	0.463
No. obs.	47,020	64,165	29,020	43,590
No. bands	90	90	81	81

Notes: Robust standard errors in parenthesis. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All specifications include the same covariates as baseline regression in Table 4, year and band fixed effects. We split the sample between households with and without band members.

indigenous population. Rather, increased land acreage under CP seems to be associated with increased incomes of the non-indigenous population. These somewhat disappointing results, while surprising at first glance, are similar to what Pendakur and Pendakur (2017) find on the effects of First Nation Land Management Agreements (FNLMAs). FNLMAs provide a means for First Nations to opt out of the land-related sections of the Indian Act, and take responsibility for the management and control of their reserve lands and resources in order to foster economic development on reserve and business partnerships with the private sector.[26] In some ways, one can think of FNLMAs as a natural extension of CPs and designated lands or permits: First Nations whose reserve lands are increasingly being developed will have a rising need of individual property rights and, eventually, may want to manage land and resources under their own land codes. Pendakur and Pendakur (2017) show, among other things, that the there is no measurable impact of FNLMAs on incomes of indigenous households but a statistically significant and sizable effect on the incomes of non-indigenous households.

4.2.1   Level versus Composition Effects

The robustness of the latter finding raises an important question: why would use of Certificates of Possession (or FNLMAs, as in Pendakur and Pendakur (2017)'s case) increase income of non-band members? The large and significant coefficient on non-member income seems particularly puzzling in light of the fact that these households are not entitled to hold CPs and also cannot become beneficiaries of any revenue generated by land leases. One plausible explanation is that, rather than *causing* existing incomes of non-member to rise, private land tenure on reserve has facilitated the *inflow of a non-band population with higher income.* In other words, the measured impact stems from a composition effect. This could happen, for instance, if band members use their Certificates of Possession to create new residential housing targeted to non-indigenous populations, or if general advances in the development of reserve lands (associated with, but not necessarily caused by, more CPs) result in an inflow of non-indigenous workers who live on reserve. Since non-indigenous income is on average higher than indigenous incomes, any such change in composition will cause total income on reserve to rise, ceteris paribus, and thus could explain the observed increments in income.[27]

To investigate this possibility, we can look at how private property rights impact the size of the band and non-band population, respectively. We ran a series of regressions using aggregated data at the band-year level for all the bands in our baseline sample (i.e. bands that have used both CP and non-CP land regimes). The outcomes we consider are the logs of population size (broken down by band and non-band population) as well as the log of newly built housing units occupied by band and non-band households.

The corresponding results, shown in Table 6, support the above interpretation. In particular, we find

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[26]See https://www.aadnc-aandc.gc.ca/eng/1327090675492/1327090738973, accessed 22-11-2017.

[27]See George and Kuhn (1994) and Pendakur and Pendakur (1998) for more details on the aboriginal-white wage differential in Canada.

that while within-band spurs in private property rights are, on average, followed by a subsequent increase in population-size of non-indigenous households (column 2), there are no such gains for non-indigenous households (column 1). This is particularly true for CPs. From column (2), for instance, we see that doubling the reserve area under CP for the average band is associated with an increase in the size of the non-band population by almost 40%. The number of band members, in contrast, is largely unaffected. Moreover, a comparison of columns (3) and (4) in Table 6 suggests that the newly built housing units we observed as a result of increased CP use (recall column 6 in Table 3) are entirely occupied by non-indigenous households.[28]

Table 6: Effect on population size and composition

	ln(population)		ln(no. houses built in 10 years)		ln(real household income) excl. new residents	
	band members	non-band members	band members	non-band members	band members	non-band members
	(1)	(2)	(3)	(4)	(5)	(6)
ln(CP area)	-0.026	0.433*	-0.160	0.576**	0.069	0.085
	(0.045)	(0.246)	(0.172)	(0.277)	(0.069)	(0.090)
ln(non-CP area)	0.023	0.099	0.095*	0.126*	0.036	0.020
	(0.019)	(0.072)	(0.054)	(0.07)	(0.037)	(0.021)
Data	aggregated at band level				household level	
R-squared	0.343	0.251	0.130	0.116	0.342	0.251
No. obs.	417	410	418	418	58,115	32,205
No. bands	103	103	103	103	103	103

Notes: Robust standard errors in parentheses. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Regressions (1) – (4) use data aggregated at band-year level for all the bands in our baseline sample and include only year fixed effects. The outcomes are logs of the total number of households with and without a band member and the log (number of housing units built in the last 10 years + 1). Regressions (5) and (6) use our original panel dataset and run the same specification with respect to the natural log of (real) income at the household level as those in Table 4.

Finally, columns (5) and (6) re-consider the original household-level regressions from Table 4, but exclude from the sample households which had resided on reserve less than 5 years. This allows us to ignore changes in local income driven by the inflow of new migrants, and focus instead on the effect on original residents. Comparing columns (5) and (6) in Table 6 with their counterparts (3) and (4) in

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[28]These results are robust to allowing for non-parametric time trends depending on province and location of reserve (whether the reserve is close to larger or midsize cities), the exclusion of outliers (top 10% of bands in terms of area under CP), and measuring use property rights in alternative ways (e.g., using the relative share of total reserve area that is under CP).

Table 4, we see that after excluding new residents, the magnitude of the effect on real income becomes smaller and statistically insignificant for both band and non-band members. The finding is consistent with the notion that the observed increase in non-indigenous household income was driven primarily by the inflow of new, higher income, households.[29]

4.2.2   Additional Robustness Checks

We proceed by running a number of additional regressions to see whether our estimates above are sensitive to several alternative specifications. Those are summarized in Table 7. The first set of regressions removes the top 10 per cent of bands with the largest areas under CP in 2011 in order to check whether the findings above are driven by a small subset of (mostly urban) bands that have a significant part of their reserve area privately held, and have built larger residential or business and retail developments in the past decade. Those bands may be more successful or have better economic opportunities than others, and the projects may have resulted in a comparatively large influx of non-indigenous households. As we can see from columns (1) and (2), however, the results are qualitatively unaffected. The coefficient measuring the effect of CPs on non-band members income remains large and significant, albeit reduced in magnitude. We again find no effect of CPs on band member incomes.[30]

A second concern is the presence of time-varying omitted variables. For instance, bands closer to cities may have faster growth of CP land and also follow different income trends. We address this problem by including a rich set of time-varying controls such as province-by-year fixed effects and non-parametric trends by proximity to cities (columns 3 and 4). As we see, trends do not add explanatory power to our property rights measure. Interestingly, this is now true for non-indigenous households as well, supporting the idea that the effect we observed in previous regressions can be explained by an inflow of non-band households to the reserve associated with more recent developments on reserve land (residential, business, retail) which are in turn correlated with (preceding) increases in private forms of land tenure. Since these developments are likely to be concentrated in reserves closer to urban centres, allowing those reserves to be on a different time trend removes (part of) the correlation.

Columns (5) and (6) show the results from regressions that include the full sample, i.e., we no longer restrict the analysis to those bands that have used both CPs and designated lands and permits in the

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[29]We also check the robustness of these results using only the sample of new residents. Results are available upon request.

[30]A related concern would be that we fail to identify a positive effect of private property rights because their impact is non-linear; for instance, one could think of measurable gains only occurring above a critical minimum area of land under private tenure. While we cannot look the top 10 per cent of bands separately due to an insufficient sample size, we did run a series of regressions where we split the sample into bands whose average CPs over the period 1981-2006 was below the median growth rate and bands where CPs grew faster than the median. We found no sizeable and statistically difference in the effect of CP on household income. If anything, the effect seems smaller for bands with faster growth. The results are available upon request. We also looked at alternative ways of measuring the extent to which bands use property rights, e.g., by using acreage *per capita* that is under lawful possession, designated, or has a permit attached to it. None of our results was qualitatively affected.

Table 7: Effect on household income - robustness checks

				ln(real household income)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(CP area)	0.020	0.186**	0.038	0.059	-0.001	0.047	-0.018*	-0.010
	(0.062)	(0.089)	(0.023)	(0.037)	(0.051)	(0.036)	(0.010)	(0.026)
ln(non-CP area)	0.053	0.009	-0.006	0.019	0.027	-0.017	0.005	0.028
	(0.033)	(0.022)	(0.016)	(0.022)	(0.029)	(0.025)	(0.010)	(0.024)
Specification	removing bands with large CP area		Using data from all bands		Adding non-parametric trends		Dropping band fixed effects	
Sample	Band members	Non-band members	Band members	Non-band members	Band members	Non-band members	Band members	Non-band members
R-squared	0.343	0.226	0.367	0.247	0.350	0.231	0.302	0.184
No. obs.	47,425	35,530	279,460	72,640	65,505	46,880	65,505	46,880

Notes: Robust standard errors in parenthesis. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All specifications include the same covariates as baseline regression in Table 4, year fixed effects, and − with the exception of columns (7) and (8), band fixed effects. We split the sample between households with and without band members. Columns (1) and (2) drop 10% of bands with the largest CP area. Columns (3) and (4) employ data from all bands, using log of area plus one as explanatory variable. Columns (5) and (6) add year-by-census division (CD) fixed effects and interaction of year dummies with indicators of being near a large or medium size city. Columns (7) and (8) include province fixed effects and add an indicator of urban reserves and geographical coordinates (latitude and longitude) as additional controls.

past. Expanding the sample to bands that have used only one form of private land tenure, or none at all, brings the number of bands from 103 to over 500, thereby significantly increasing the number of observations.[31] Not surprisingly, including all bands introduces additional noise. As is evident from columns (3) and (4), however, increased CP use is again not measurably associated with any increased income. Here, this is true irrespective of whether we look at band members or non-band members.

The specification in the final two columns (7) and (8) drop the band fixed effects, replacing them with province fixed effects. This specification is arguably less demanding, but may suffer from omitted variable bias: there is no presumption that the selection into using private forms of property is random and uncorrelated with our main variables of interested. The corresponding coefficient on the effect of band member's income is now negative: in the cross-section of bands, increased use of CPs is associated with *lower* household income.[32]

We close this section by briefly illustrating that our findings are robust to allowing for different time lags for the effect of private property to become measurable. This is shown in Figure 2, which depicts point estimates and 95% confidence intervals for our main parameter estimate of interest, the coefficient β_1 measuring the effect of (lagged) use of CP. For each estimate, the regression model identical to column (2) in Table 4, which is our baseline specification with a band-member indicator, but employ different lags of $\ln CP$ from no lag up to 20 years lag. We see that all of the parameter estimates are in a similar range and none of them is statistically different from zero.[33]

In summary, we interpret our robustness checks as lending additional credibility to our earlier conclusion. In all cases, we find that the effect of both lawful possession (CPs) and other forms of private land tenure (non-CPs) on indigenous households' incomes is small and statistically insignificant, or even negative. This finding stands in contrast to our observed improvements in housing ownership and conditions for band-members documented in Section 4.1, and sheds doubt on the notion that private property rights can spur investments on reserve that will a sufficiently substantial impact on economic development to lift band-members incomes.

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[31]To construct the explanatory variables $\ln CP$ and $\ln nonCP$, we use log of area plus one

[32]This result is in line with Brinkhurst and Kessler (2013)'s finding that indigenous communities whose relative acreage under lawful possession is above average are not more wealthy on average. The authors find that controlling for other community characteristics (most notably geographic location and population characteristics), members of First Nation communities with higher median income are less likely to hold a Certificate of Possession: in the cross–section, an increase in median income by one standard deviation reduces the share of land held under lawful possession by on average 1.5 percentage points, all else equal.

[33]We present similar figures for housing outcomes (ownership and need of major repairs) in Figures A.1 and A.2 in the online appendix.

Figure 2: Effect of CP on real income using different time lags
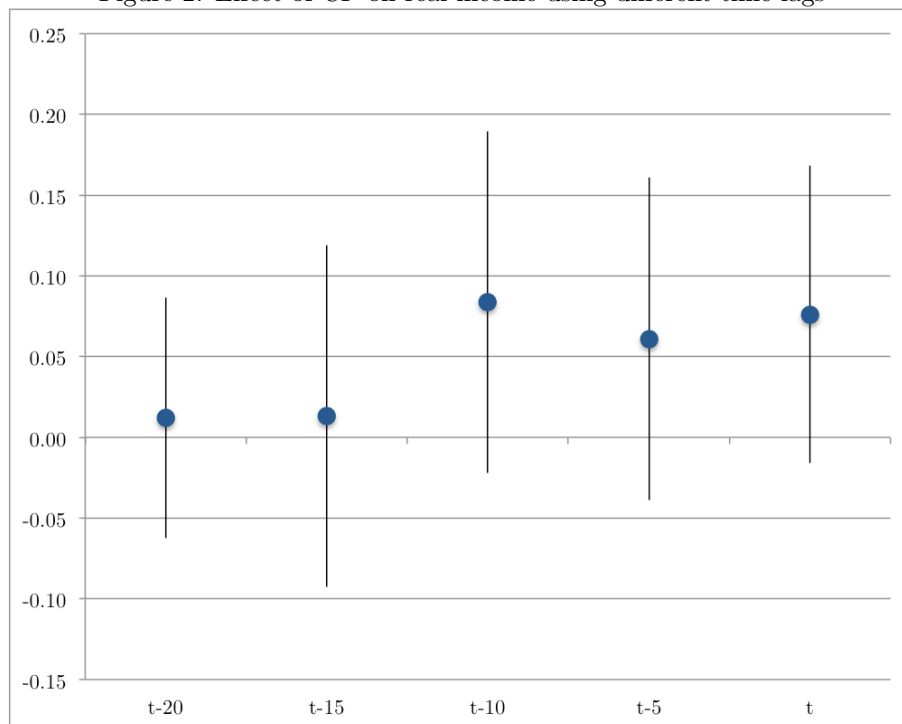
Notes: Figure depicts point estimates and 95% confidence interval of β_1 from separate regressions. Model specification is similar to Column (2) in Table 4 but uses different lags of $\ln CP$.

4.3 Alternative Outcomes

4.3.1 Labour Market

In light of the fact that we fail to find a positive association between private property rights on reserve and local income, it is useful to additionally consider alternative outcomes that would point towards some kind of progress, economic or otherwise. We consider labour market outcomes for two reasons. First, we would expect spurs in investment and local economic activity to be at least partly mirrored by increased demand for local labour. This would translate into higher employment, but not necessarily higher wages given that unemployment rates on reserve are high, thereby softening any upward pressure on wages. Second, as mentioned above, even if real wages were positively impacted, measured income could rise only by a small amount if people substitute income assistance or other benefits with employment income. In both scenarios, a band that, say, leased land for a new business or residential development may not experience significant income growth although labour force participation rates have increased. To examine these possible effects, we estimate equation (1)

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using individual-level data and three labour market outcomes: employment status, number of hours worked, and real wages. Similar to the income regressions, we split the sample between band and non-band members. Table 8 presents the results, which paint a similar picture to our earlier findings. Specifically, we find no evidence that any of the labour market outcomes we consider is positively related to the use of private forms of land tenure in a way that is precisely enough measured to be indistinguishable from zero.[34] Even disregarding statistical significance, the magnitude of the estimates is quite small, lending further credibility to our previous result that the economic effect of private property rights on reserve is limited.

Table 8: Effect on labour outcomes

	Is employed		ln(hours worked)		ln(real hourly wage)	
	(1)	(2)	(3)	(4)	(5)	(6)
ln(CP area)	0.016	0.019	-0.029*	0.012	0.038	0.099*
	(0.018)	(0.030)	(0.016)	(0.024)	(0.080)	(0.058)
ln(non-CP area)	0.006	-0.010	0.013	0.002	0.034	0.018
	(0.012)	(0.011)	(0.010)	(0.009)	(0.046)	(0.020)
Sample	Band members	Non-band members	Band members	Non-band members	Band members	Non-band members
R-squared	0.113	0.142	0.081	0.124	0.153	0.173
No. obs.	104,165	58,505	61,320	41,240	45,535	34,120
No. bands	90	81	90	81	90	81

Notes: Robust standard errors in parenthesis. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All specifications include band and year fixed effects and the following covariates: individual characteristics (age, age^2, gender, indicator of having tertiary education, indicator of being principal maintainer), and household size. Regressions split the sample between band and non-band members. Columns (1) and (2) use the sample of all individuals of working age. Columns (3) to (6) restrict the sample to employed individuals.

Note from column (6) that there appears to be some detectable increase in real wage for non-band members, which is consistent with the observed gains in real income for non-band members, and the change in population composition we illustrated earlier. In order to check whether there were corresponding changes in occupations, we also considered industry composition, i.e., the probability of working in a given sector, as an outcome. The results, which are statistically significant at the 5 per cent confidence level, are gathered in Table A.8 in the online appendix. Our findings show that, among band members, an increase in CPs led to a *relative* increase in employment in manufacturing,

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[34]See Table A.11 in the online appendix confirms these estimates with additional robustness checks.

construction, and transportation, at the expense of in services. The opposite is true for non-band members, where employment in services increased if the band made extensive use of CPs, while employment in manufacturing, construction, and transportation declined. These effects may well be partly composition effects: it is conceivable that those non-band members who moved to the reserve more recently are more educated, on average, and thus more likely to be white-collar workers. In either event, it is remarkable that for the (relatively stable) indigenous population, increased use of CP in a given band was accompanied by more blue-collar and fewer white-collar jobs. Interestingly, we do not find a change in the probability of working in the primary sector, e.g., extractive industries, for either group.

4.3.2 Public Spending and Services

As discussed in Section 2, lawful possession and other forms of private land tenure on reserve can be used to rent out land to third parties. These transactions generate revenue that either accrues to individual band members or the band council through lease payments or permit fees. In the case of locatee leases, which are based on individually held CPs, the payee is the CP holder, although the band government might also receive part of the lease payments. In the case of leases using designated land and permits, the band government is the main payee. The additional revenue could be used to increase a band's public spending and improve the provision of public goods and services. Through this channel then, private forms of land tenure (in particular, designated lands and permits) could indirectly benefit the local population.[35]

In our last section, we investigate whether there is a measurable impact of the use of private property on indicators of band spending and the local provision of public services. One way to think about these sets of outcomes is that they are related to 'capacity building'. To this end, we collected data on total spending, the remuneration of the band chief, as well as the quality of water and wastewater on reserve. The former data are obtained from the financial and remuneration statements of First Nation bands, available in CIRNAC's First Nations profiles [Indigenous and Northern Affairs Canada (2014a)]. These statements have been published under the First Nation Transparency Act and are available only since the fiscal year 2013-2014. As measures of quality of water and wastewater, we use the risk index from the national assessment carried on 2009-2011 (Indigenous and Northern Affairs Canada, 2011).[36] We chose water quality as our primary indicator of public good provision because the relevant data are readily available, and because drinking water provision is a serious issue for many reserves, which is, with the exception of British Columbia, a shared responsibility of First Nations communities and the Government of Canada.[37], and c) the lack of clean water on reserve is a serious

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[35]The overwhelming majority of band funding comes from the federal government, however. The government establishes each First Nation band as an autonomous entity and, therefore, provides separate program funding to each one. The primary method to fund services is through so-called "contribution agreements", which are renewed on annual basis.

[36]These data comes from Tables E1 and E2 of the regional reports.

[37]This is true for communities south of the 60th parallel, which constitute most of our sample. In British Columbia,

problem that affects many rural First Nation communities.

Since we do not have observations of the same bands over time, our specification uses data from a cross-section of bands. Hence, we can no longer employ band fixed effects to control for time-invariant unobserved heterogeneity across bands, and we cannot exploit within-band changes in the area with different forms of land tenure. Instead, we estimate the impact of private forms of land tenure comparing bands with and without private property rights (i.e., CP, designated land or permits). In particular, we estimate the following model:

$$y_j = \beta_1 \text{CP}_j + \beta_2 \text{nonCP}_j + \gamma W_j + \varepsilon_j, \tag{2}$$

where y_j is the outcome of interest for band j. CP is an indicator equal to 1 if the band has some area under lawful possession, while $nonCP$ is an indicator equal to 1 if the band has designated or permit land.[38] To take account of the fact that bands with reserve in rural and remote areas will tend to be poorer and more likely to be affected by a lack of clean water, we include a rich set of covariates W_j that include province fixed effects, log of on-reserve population, distance to the nearest city, and the reserve location (latitude and longitude). Of course, despite the inclusion of several covariates, there might still be relevant omitted variables that are correlated with the use of private land tenure and the outcomes we consider. One could easily imagine, for example, that bands which are better governed (e.g. by entrepreneurial councils and chiefs) are more likely to use private property rights, and also enjoy higher local spending and better water quality. A further caveat is that some bands have not reported their financial and remuneration statements. To the extent that this under-reporting is systematic, our sample will not be representative of all bands and our estimates might be biased. For these reasons, the estimates should be interpreted with caution. A conservative interpretation is that they provide suggestive correlations between the use of private property on reserve and the observed outcomes of interest.

Table 9 presents our results. Looking across the different outcomes, we do not see a significant effect of individual CP holdings. However, we do find that bands with non-CP forms of land tenure (designated land or permits on collectively owned land) exhibit higher spending per capita, pay higher remuneration to their chiefs, and have higher quality drinking water systems. The magnitude of these differences is sizable: per capita spending and chief's remuneration are almost 15% higher in bands with non-CP land relative to bands without these forms of land tenure. There is, however, no significant difference in these outcomes between bands with or without CP.

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the First Nation Health Authority is charged - together with local communities – with oversight and management of drinking water. Generally, the chief and council are responsible for planning and developing basic infrastructure, including drinking water facilities. Funding and advice regarding planning, construction, operation and maintenance of water treatment facilities on First Nations reserves, as well as financial support for the training and certification of operators were formerly provided by INAC, and has recently been shifted to the newly created Indigenous Services Canada. The community manages the day-to-day operation of water and wastewater systems on reserves, including sampling and testing drinking water.

[38]We use the area under different land tenure regimes in 2006, however, the results are similar if we use data from previous years.

Table 9: Effect on band spending, and water quality

	ln(band spending) (1)	ln(chief remuneration) (2)	Drink water risk index (3)	Waste water risk index (4)
Has CP area	-0.121	-0.009	-0.126	-0.408
	(0.100)	(0.096)	(0.265)	(0.249)
Has non-CP area	0.148*	0.159*	-0.503**	-0.189
	(0.080)	(0.082)	(0.248)	(0.224)
Mean outcome	31,785.9	66,628.2	5.5	5.2
No. obs.	317	314	368	279
R-squared	0.615	0.139	0.125	0.209

Notes: Robust standard errors in parenthesis. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All regressions include province fixed effects, log of on-reserve population, log of distance to nearest city and geographical coordinates.

We interpret these findings as suggestive evidence that existing forms of property rights *on collectively owned* land might have helped bands to increase their budgets and improve the provision of some public services.

5 Discussion and final remarks

This paper investigates the economic effects of existing property rights on First Nation reserves. Our empirical strategy uses the acreages of land under different forms of private tenure as our main explanatory variables and exploits within-band variation.

We find that the use of lawful possession has measurably improved housing outcomes on reserve, while the use of designated land and permits is associated with markedly higher band spending and better water quality. However, we do not find evidence that existing forms of private land tenure have led to significant increases in Indigenous incomes or employment outcomes on reserve. We interpret these findings as evidence that the economic benefits of property rights reforms on First Nations reserves may be limited: they may improve housing conditions but may not be a transformative tool for poverty alleviation.

Our study has two important limitations that may reduce its external validity or weaken a causal interpretation. However, in our opinion, these caveats do not invalidate our findings and in some

sense can rather be seen as reaffirming the notion of a limited effect of private property rights on reserve.

First, our results are not representative of all First Nation communities. Our sample uses only bands that are actively using private tenure regimes on their land. Since implementing these land tenure regimes is costly[39], these bands are presumably the ones that either have the means (financial and political) to support this reform or expect to obtain higher net benefits from it. This observation suggests that our estimates constitute an upper bound of the potential benefits of private property rights.

Second, we do not have a plausibly exogenous source of variation in the use of private property rights. Our identification relies on the assumption that after including a rich set of controls and fixed effects, there are no more omitted time-varying variables that affect both the use of private property rights and economic outcomes. This assumption would plausibly be violated, for instance, in the case of positive economic shocks in the proximity of reserves, such as a new mine or rise in tourism (as was the case for some bands in the Okanagan Valley in British Columbia). The accompanying surge in economic opportunities could foster adoption of private property rights and also improve local economic outcomes, thus confounding our estimates. Note, however, that we would be over-estimating the true benefits of private property rights in this scenario.

In sum, although caution is warranted, we have sufficient confidence in the validity of our results to conclude that strong evidence in favour of a positive impact of existing forms of private property on on-reserve Indigenous income and employment is lacking Put differently, if there was a strong and measurable effect, it is difficult to imagine a scenario in which our estimation procedure would fail to detect it.

A reasonable question is thus, why do existing forms of private property rights have such a limited impact on incomes? There are at least three possible explanations. First, although the existing Indian Act private land tenure provisions create secure and transferable property rights, they are not comparable to fee simple. In particular, issuing and transferring rights over land involve substantial 'red tape'. These transaction costs are likely a major deterrent to the use of land as collateral for loans and mortgages and may hinder an efficient allocation across different land uses. A recent paper by Leonard et al. (2018) sheds further light on this issue in the U.S. context. The authors study the relationship between incomes and property rights on Native American reservations, using variations in land tenure that emerged under the 1887 Dawes Act privatization wave. Their results show that transaction costs and the forced fractionalization associated with the constraints imposed by trust land (comparable to CP) actually reduced income per capita relative to communal land under tribal tenure. The findings also suggest that full privatization (fee simple) would have increased today's average reserve incomes by over 10 %, albeit at the expense of over 60 % loss of native population on

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[39]They require a lengthy ministerial and band approval process, as well as a fair amount of paperwork before they can officially be granted.

reserve and a corresponding (further) erosion of the Indian land base.

Second, the returns to investment on reserve may be low. Theoretically, a mechanism through which property rights can affect income is by promoting investment (Besley and Ghatak, 2010b). This can occur by reducing the risk of expropriation, increasing gains from trade, or facilitating access to credit. However, this argument presumes that there are profitable investment opportunities. This may not be the case for many First Nation Communities located in remote, rural, reserves far away from markets, that are lacking populations large enough to exploit economies of scale, or with limited complementary inputs, such as human capital or public goods.

Third, our results may fail to pick up long-term effects or off-reserve spillovers. Many Indigenous communities have been using alternative forms of (private) property management systems only for the past few decades.[40] If the economic effects require a long term to mature, we are not (yet) in a position to capture them. Similarly, we cannot dismiss the possibility that the subset of band members who benefit most from formal property rights are individuals who lease their land to non-band members and then leave the reserve. The Census data do not allow us to track migrating household over time, and urban migration may thus be a factor.[41]

A relevant clarification is that our results should not be interpreted as evidence that all property, or institutional, reforms on First Nations communities are ineffective. There is supportive evidence that self-government agreements (SGAs) and comprehensive land claims agreements (CLCAs) raise income on reserve, even in the short term (Aragón, 2015; Pendakur and Pendakur, 2017). The former agreements give greater autonomy to First Nations governments in terms of law-making powers and fiscal responsibilities. The latter, often called 'modern treaties', define and clarify the *collective* rights held by indigenous communities over parts of their traditional territories, thereby resolving ownership ambiguity over vast tracts of land rich in natural resources.[42] As so often, the impact depends on the forms of intervention used, as well as the circumstances of the local environment.

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[40]According to the ILRS data, 414 of the roughly 3000 First Nation reserves had at least one plot of land under lawful possession in 2011, and about 25% of those reserves added plots only in the decade before (Brinkhurst and Kessler, 2013).

[41]We wish to thank an anonymous referee for alerting us to this possibility. We do know that mobility rates are higher than average among Canada's indigenous population. Interestingly, though, the migration patterns of Registered Indians between urban areas and reserves have been skewed towards reserves: from the late 1960s to 2001, reserves were net gainers of migrants (Clatworthy and Norris, 2007).

[42]CLCAs often go hand-in-hand with SGAs, that is, the treaties usually involve a range of institutional changes, such as a transfer of fee simple ownership of reserve land to the band, provisions for self-government and taxation, and increased participation of the local government on land use decisions, management of natural resources, and provision of local public services. Both types of agreements have been on the rise in the past decades, as an increasing number of First Nation communities have sought paths that allow them to work outside the Indian Act and rebuild their nations. We would expect this trend to continue, and with it the nature of property ownership on reserve.

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ONLINE APPENDIX - NOT FOR PUBLICATION

A   Additional tables and figures

Table A.1: Additional summary statistics at band level for year 2001

Variable	Mean	Percentile	
		10th	90th
Band land (000's m^2/pop.)	79.630	4.462	163.700
Certificate of Possession area (000's m2/pop.)	10.224	0.086	29.227
Designated and permit area (000's m2/pop.)	2.593	0.020	4.835
No. households	304.5	27.0	639.0
No. households (band members)	186.0	30.1	363.0
No. households (non-band members)	118.5	0.0	268.2
Population	832.3	131.0	1862.0
Population (band members)	592.0	81.5	1247.2
Population (non-band members)	240.3	0.0	661.0

Notes: Table presents summary statistics at band levels evaluated in year 2001.

Table A.2: Comparison of bands in and out of sample

Variables	Sample	non-sample	Mean comparison Diff.	Mean comparison S.E.
A. Household head				
Is band member	0.581	0.866	-0.284	(0.003)
Is registered Indian	0.579	0.864	-0.285	(0.003)
Age	50.4	45.3	5.2	(0.091)
Is female	0.472	0.441	0.031	(0.003)
Education above high school	0.488	0.400	0.105	(0.003)
Is employed	0.470	0.478	-0.008	(0.003)
B. Employed individuals				
Hours worked	35.7	36.8	-1.1	(0.092)
Real hourly wage (CAD)	12.3	11.0	1.3	(0.159)
Industry = primary	0.056	0.086	-0.030	(0.001)
Industry = services	0.724	0.741	-0.017	(0.003)
Industry = other	0.220	0.173	0.047	(0.003)
C. Households				
Real household income (CAD)	32343.18	29550.66	2792.52	(203.4)
Real employment income (CAD)	20185.1	19896.4	288.79	(186.8)
Household size	2.775	3.754	-0.979	(0.009)
Reside in metropolitan area	0.614	0.125	0.489	(002)
Reside for less than 5 years	0.189			
Dwelling is band housing	0.225	0.556	-0.331	(0.002)
Dwelling owned by HH member	0.605	0.299	0.306	(0.003)
Dwelling is rented	0.170	0.145	0.025	(0.002)
Dwelling built in last 10 years	0.121	0.143	-0.022	(0.002)
Dwelling in need of mayor repairs	0.225	0.370	-0.145	(0.002)
No. bands	103	514		

Notes: Observations are pooled across all years. All differences in mean are significant at the 1% level.

Table A.3: Extended Table 3 - displaying covariates' estimates

	Dwelling is band housing	Household owns dwelling		Needs major repairs	
		All households	Band members	All households	Band members
	(1)	(2)	(3)	(4)	(5)
ln(CP area)	-0.050***	0.035**	0.065**	-0.055***	-0.082***
	(0.019)	(0.017)	(0.029)	(0.019)	(0.030)
ln(non-CP area)	0.001	-0.004	-0.003	-0.014**	-0.012
	(0.008)	(0.009)	(0.025)	(0.006)	(0.015)
Age		0.015***	0.012***	0.003***	0.001
		(0.002)	(0.002)	(0.001)	(0.001)
Age^2		-0.000***	-0.000***	-0.000***	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)
Education above		0.021**	0.043***	0.003	0.009
high school		(0.009)	(0.008)	(0.005)	(0.006)
Household size		0.008***	0.006**	0.012***	0.012***
		(0.003)	(0.003)	(0.002)	(0.002)
Is female		0.028***	0.041***	-0.022***	-0.023***
		(0.006)	(0.005)	(0.003)	(0.004)
Is band member		-0.076		0.163***	
		(0.053)		(0.017)	
Ln(band pop.)		-0.017	-0.013	0.025	0.001
		(0.043)	(0.063)	(0.032)	(0.049)
Dwelling built in				-0.198***	-0.271***
last 10 years				(0.019)	(0.012)
No. rooms				-0.012*	-0.018**
				(0.007)	(0.008)
No. rooms^2				0.000	0.000
				(0.000)	(0.000)
Household				0.001	0.027**
owns dwelling				(0.012)	(0.013)
Dwelling is rented				-0.027	-0.020
				(0.018)	(0.013)
R-squared	0.471	0.368	0.279	0.166	0.086
No. obs.	122,160	122,160	74,585	122,160	74,585
No. bands	103	103	103	103	103

Notes: Robust standard errors in parentheses. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. See notes in Table 3

Table A.4: Extended Table 4 - displaying covariates' estimates

| | ln(real household income) | | | |
	(1)	(2)	(3)	(4)
ln(CP area)	0.114*	0.092	0.050	0.152*
	(0.058)	(0.057)	(0.069)	(0.082)
ln(non-CP area)	0.040**	0.031	0.043	0.015
	(0.020)	(0.020)	(0.035)	(0.023)
Age	-0.001	0.001	-0.010***	0.014**
	(0.004)	(0.003)	(0.003)	(0.005)
Age^2	0.000***	0.000***	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Education above	0.206***	0.191***	0.209***	0.137***
high school	(0.020)	(0.017)	(0.016)	(0.024)
Is female	0.083***	0.068***	0.012	0.154***
	(0.019)	(0.018)	(0.015)	(0.019)
Household size	0.244***	0.259***	0.256***	0.267***
	(0.008)	(0.007)	(0.007)	(0.016)
HoH is employed	0.644***	0.634***	0.700***	0.487***
	(0.036)	(0.035)	(0.018)	(0.066)
Is band member		-0.420***		
		(0.041)		
Sample	All households	All households	Band members	Non-band members
R-squared	0.308	0.321	0.333	0.215
No. Obs.	112385	112385	65505	46880

Notes: Robust standard errors in parentheses. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. See notes in Table 4. HoH=household head.

Table A.5: Effect on household income using quantile regressions

	ln(real household income)				
	(1)	(2)	(3)	(4)	(5)
ln(CP area)	0.252*	0.065	0.035	0.011	0.014
	(0.147)	(0.066)	(0.097)	(0.071)	(0.073)
ln(non-CP area)	0.017	0.026	0.026	0.027	0.044
	(0.050)	(0.034)	(0.032)	(0.031)	(0.031)
Age	-0.037***	-0.005	0.012***	0.023***	0.029***
	(0.007)	(0.004)	(0.002)	(0.002)	(0.003)
Age^2	0.001***	0.000***	0.000	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education above high school	0.198***	0.191***	0.205***	0.204***	0.178***
	(0.022)	(0.021)	(0.018)	(0.020)	(0.022)
Education above high school	0.121***	0.004	-0.053***	-0.099***	-0.093***
	(0.035)	(0.019)	(0.014)	(0.010)	(0.013)
Household size	0.312***	0.235***	0.201***	0.180***	0.151***
	(0.015)	(0.007)	(0.005)	(0.005)	(0.005)
HoH is employed	0.753***	0.688***	0.659***	0.562***	0.462***
	(0.025)	(0.021)	(0.018)	(0.017)	(0.022)
Quantile	0.10	0.25	0.50	0.75	0.90
No. obs	65,505	65,505	65,505	65,505	65,505
No. bands	90	90	90	90	90

Notes: Standard errors in parentheses. Standard errors are obtained using non-parametric bootstrapping (n=50) and clustering at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All regressions are estimated using quantile regressions (implemented using STATA command *qreg*). All variables are expressed as deviations from the band average. Regressions include year fixed effects and use sample of band members only. HoH = household head.

Table A.6: Effect on household income - controlling for CD income

	ln(real household income)			
	(1)	(2)	(3)	(4)
ln(CP area) rural	0.045	0.140	0.071	0.119
	(0.070)	(0.091)	(0.067)	(0.093)
ln(non-CP area) rural	0.026	0.014	-0.001	-0.041
	(0.030)	(0.031)	(0.056)	(0.044)
ln(CP area) urban	0.0589	0.157*	0.0279	0.159*
	(0.070)	(0.081)	(0.072)	(0.082)
ln(non-CP area) urban	0.0731**	0.0244	0.0603*	0.0193
	(0.033)	(0.022)	(0.034)	(0.023)
Indicator of urban reserve	urban CSD	urban CSD	CMA	CMA
Sample	Band	Non-band	Band	Non-band
	members	members	members	members
R-squared	0.334	0.215	0.334	0.215
No. obs.	65,505	46,880	65,505	46,880

Notes: Robust standard errors in parenthesis. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All specifications include the same covariates as baseline regression in Table 4, band and year fixed effects. Columns 3 and 4 also include interactions of year dummies with province indicators and indicators of being near a large or medium size city. CD = census division.

Table A.7: Effect on housing outcomes - robustness checks

	Dwelling is band housing (1)	Household owns dwelling (2)	Needs major repairs (3)	ln(no. houses built in last 10 years) (4)
A. Removing bands with large CP area				
ln(CP area)	-0.055**	0.030	-0.057***	-0.148
	(0.022)	(0.020)	(0.020)	(0.171)
ln(non-CP area)	0.005	-0.009	-0.013**	0.107*
	(0.009)	(0.010)	(0.006)	(0.055)
B. Using data from all bands				
ln(CP area)	-0.008	0.004	-0.043***	-0.089
	(0.016)	(0.011)	(0.007)	(0.057)
ln(non-CP area)	0.002	-0.004	-0.004	0.034
	(0.005)	(0.004)	(0.003)	(0.027)
C. Adding non-parametric trends				
ln(CP area)	-0.033**	0.016	-0.037**	0.109
	(0.016)	(0.020)	(0.016)	(0.234)
ln(non-CP area)	0.005	-0.012	-0.016**	0.204***
	(0.007)	(0.010)	(0.007)	(0.058)
D. Dropping band fixed effects				
ln(CP area)	-0.014***	0.034**	-0.002	0.140**
	(0.004)	(0.013)	(0.003)	(0.056)
ln(non-CP area)	0.001	-0.011	0.001	-0.002
	(0.005)	(0.011)	(0.003)	(0.047)

Notes: Robust standard errors in parentheses. Standard errors are clustered at band level. *Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All regressions include year fixed effects and use similar covariates as in Table 3. The sample includes all households regardless of having or not a band member. Panel A drops 10% of bands with the largest CP area. Panel B uses data from all bands. Panel C adds year-by-province fixed effects and interaction of year dummies with indicators of being near a large or medium size city. Panel D includes province fixed effects and adds an indicator of urban reserves and geographical coordinates (latitude and longitude) as additional controls.

Table A.8: Effect on industry of occupation

	Industry of occupation					
	Primary	Manuf., transp. and construct.	Services	Primary	Manuf., transp. and construct.	Services
	(1)	(2)	(3)	(4)	(5)	(6)
ln(CP area)	-0.001	0.033**	-0.032*	-0.013	-0.036*	0.049**
	(0.012)	(0.013)	(0.018)	(0.010)	(0.019)	(0.020)
ln(non-CP area)	0.005	-0.011	0.006	0.000	-0.017**	0.016**
	(0.005)	(0.008)	(0.008)	(0.004)	(0.007)	(0.007)
Sample	Band members			Non-band members		
R-squared	0.081	0.141	0.509	0.044	0.179	0.432
No. obs.	53025	53025	53025	36180	36180	36180

Notes: Robust standard errors in parenthesis. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All specifications include year and band fixed effects and similar covariates as in Table 8. Sample includes only employed individuals.

Table A.9: Effect on band members' characteristics

	Is working age	ln(age)	Is female	Education > high school
	(1)	(2)	(3)	(4)
ln(CP area)	-0.014*	0.005	0.004	0.045**
	(0.008)	(0.013)	(0.006)	(0.022)
ln(non-CP area)	0.001	0.001	0.002	-0.002
	(0.004)	(0.008)	(0.002)	(0.008)
R-squared	0.008	0.025	0.002	0.055
No. obs.	228,685	223,990	228,685	117,400

Notes: Robust standard errors in parenthesis. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All specifications include band and year fixed effects. Sample includes only band members. The unit of observation is an individual. Column 4 uses only individuals age 25 or more. Working age = 14-65 years.

Table A.10: Effect on household income - heterogeneous effects by urban vs. rural reserves

	ln(real household income)			
	(1)	(2)	(3)	(4)
ln(CP area) rural	0.045	0.140	0.071	0.119
	(0.070)	(0.091)	(0.067)	(0.093)
ln(non-CP area) rural	0.026	0.014	-0.001	-0.041
	(0.030)	(0.031)	(0.056)	(0.044)
ln(CP area) urban	0.0589	0.157*	0.0279	0.159*
	(0.070)	(0.081)	(0.072)	(0.082)
ln(non-CP area) urban	0.0731**	0.0244	0.0603*	0.0193
	(0.033)	(0.022)	(0.034)	(0.023)
Indicator of urban reserve	urban CSD	urban CSD	CMA	CMA
Sample	Band members	Non-band members	Band members	Non-band members
R-squared	0.334	0.215	0.334	0.215
No. obs.	65,505	46,880	65,505	46,880

Notes: Robust standard errors in parenthesis. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All specifications include the same covariates as baseline regression in Table 4, as well as band and year fixed effects. specification includes interaction of ln(CP area) and ln(non-CP area) with an indicator of urban reserve. Estimates for urban reserves (rows 3 and 4) obtained by adding the estimate of the omitted category (i.e., non-urban reserve) plus the estaimate of the interaction term. CMA = census metropolitan area. CSD = Census subdivision.

Table A.11: Effect on labor outcomes - robustness checks

	Is employed		ln(hours worked)		ln(real hourly wage)	
	(1)	(2)	(3)	(4)	(5)	(6)

A. Removing bands with large CP area

ln(CP area)	0.010	0.016	-0.027*	0.020	0.061	0.113*
	(0.018)	(0.031)	(0.015)	(0.021)	(0.074)	(0.059)
ln(non-CP area)	0.006	-0.017**	0.024***	-0.003	0.021	0.004
	(0.013)	(0.008)	(0.007)	(0.008)	(0.045)	(0.017)

B. Using data from all bands

ln(CP area)	0.008	0.011	-0.004	0.022	-0.007	0.037
	(0.009)	(0.013)	(0.007)	(0.022)	(0.027)	(0.050)
ln(non-CP area)	-0.002	-0.007	0.002	-0.002	0.002	0.016
	(0.004)	(0.008)	(0.003)	(0.007)	(0.012)	(0.016)

C. Adding non-parametric trends

ln(CP area)	-0.012	0.004	-0.016	-0.010	0.045	0.027
	(0.013)	(0.027)	(0.013)	(0.027)	(0.054)	(0.043)
ln(non-CP area)	0.010	-0.010	0.016*	-0.005	0.007	-0.017
	(0.011)	(0.012)	(0.009)	(0.009)	(0.045)	(0.017)

D. Dropping band fixed effects

| ln(CP area) | -0.001 | -0.004 | 0.002 | -0.005 | -0.018 | -0.038* |
	(0.003)	(0.004)	(0.002)	(0.006)	(0.012)	(0.020)
ln(non-CP area)	-0.003	-0.005	0.003	-0.005	-0.003	0.014
	(0.003)	(0.005)	(0.002)	(0.005)	(0.011)	(0.023)
Sample	Band members	Non-band members	Band members	Non-band members	Band members	Non-band members

Notes: Robust standard errors in parenthesis. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. All specifications include year fixed effects and use similar covariates and sample definition as in Table 8. Panel A drops 10% of bands with the largest CP area. Panel B uses data from all bands. Panel C adds year-by-province fixed effects and interaction of year dummies with indicators of being near a large or medium size city. Panel D includes province fixed effects and adds an indicator of urban reserves and geographical coordinates (latitude and longitude) as additional controls.

Table A.12: Robustness of Table 4's results to alternative indicators of Aboriginal status

|	ln(real household income)					
	(1)	(2)	(3)	(4)	(4)	(4)
ln(CP area)	0.094	0.051	0.152*	0.098*	0.058	0.159*
	(0.057)	(0.068)	(0.082)	(0.058)	(0.065)	(0.086)
ln(non-CP area)	0.032	0.044	0.014	0.033	0.045	0.018
	(0.020)	(0.035)	(0.023)	(0.020)	(0.034)	(0.024)
Age	0.001	-0.010***	0.015***	0.001	-0.009***	0.015**
	(0.003)	(0.003)	(0.006)	(0.003)	(0.003)	(0.006)
Age^2	0.000***	0.000***	0.000	0.000***	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education above	0.192***	0.206***	0.142***	0.192***	0.213***	0.135***
high school	(0.017)	(0.016)	(0.024)	(0.017)	(0.016)	(0.026)
Is female	0.068***	0.010	0.154***	0.071***	0.018	0.151***
	(0.018)	(0.015)	(0.019)	(0.019)	(0.016)	(0.018)
Household size	0.259***	0.256***	0.268***	0.258***	0.254***	0.272***
	(0.007)	(0.007)	(0.017)	(0.007)	(0.007)	(0.018)
HoH is employed	0.635***	0.703***	0.488***	0.636***	0.691***	0.498***
	(0.035)	(0.018)	(0.066)	(0.035)	(0.018)	(0.069)
Registered	-0.410***					
Indian= 1	(0.040)					
Aboriginal				-0.378***		
identity= 1				(0.041)		
Sample	All households	Aboriginal	Non-aboriginal	All households	Aboriginal	Non-aboriginal
Aborig. Indicator	registered Indian status			Aboriginal identity (imputed)		
R-squared	0.320	0.334	0.216	0.319	0.331	0.217
No. obs.	112385	65250	47135	112385	67530	44855

Notes: Robust standard errors in parentheses. Standard errors are clustered at band level. Superscripts *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. See notes in Table 4. HoH=household head.

Figure A.1: Effect of CP on homeownership using different time lags
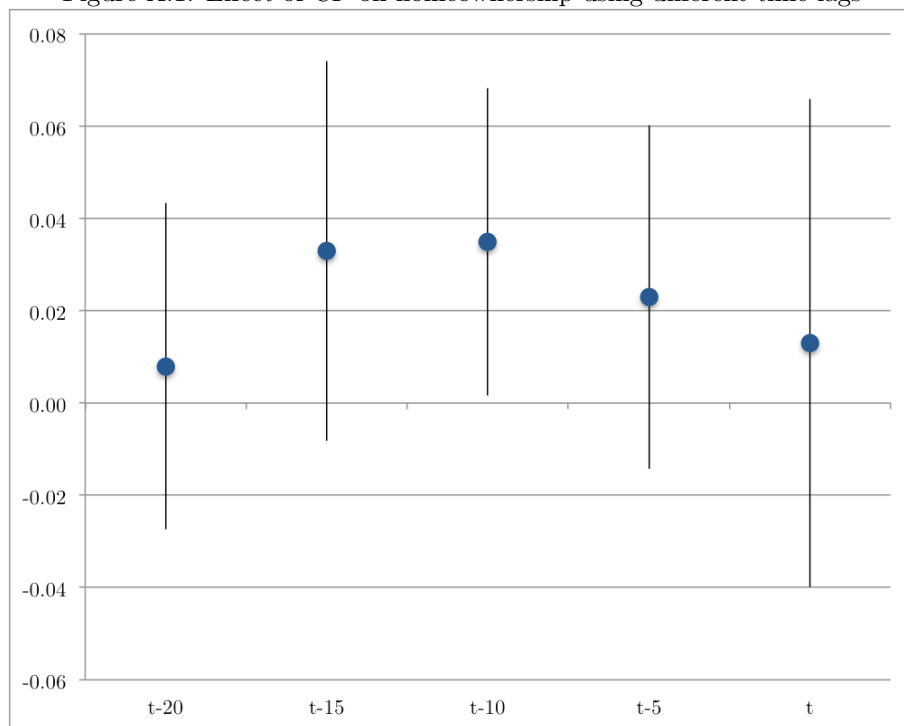
Notes: Figure depicts point estimates and 95% confidence interval of β_1 from separate regressions. Model specification is similar to Column (2) in Table 3 but uses different lags of $\ln CP$.

Figure A.2: Effect of CP on need of major repairs using different time lags
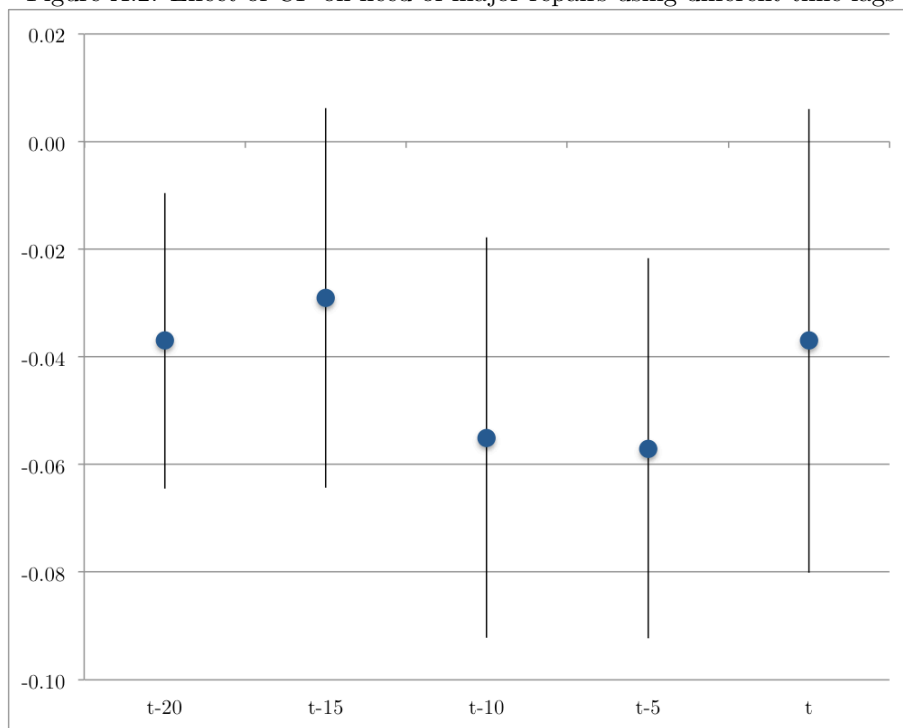
Notes: Figure depicts point estimates and 95% confidence interval of β_1 from separate regressions. Model specification is similar to Column (4) in Table 3 but uses different lags of $\ln CP$.