The Economic Benefits of a Major Canadian Forestry Contribution Program for Indigenous Peoples

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ABSTRACT

This paper evaluates whether the First Nations Forestry Program (FNFP), a contribution program for Indigenous Peoples in Canada, had a statistically measurable effect on the well-being of participating reserves' inhabitants. Funding data from 1,078 projects was paired with reserve inhabitant profiles from two Statistics Canada censuses. Multiple regression models were then used to test for the statistical significance of project-funding treatments. The results suggest that from 2006 to 2010, the FNFP significantly affected the after-tax incomes of reserve inhabitants who had worked in forestry, as well as a lesser effect on the after-tax incomes of reserve families.

KEYWORDS: Evaluation, forestry, economics, well-being, censuses

According to a host of socioeconomic indicators, Canada's Indigenous population[1] ranks well below the general Canadian population: studies of social and economic conditions, such as the ones by Cooke et al. (2007) and Parkins et al. (2006), reveal a persistent gap between Indigenous and non-Indigenous populations. With almost 80% of First Nations located within Canada's vast forests (Gysbers & Lee, 2003), programs promoting greater participation in the forest sector would offer a means to help improve First Nations' social and economic well-being and lessen this gap. Indeed, forestry is seen as a key economic opportunity for many First Nations, with opportunities driven by

major boreal forestry development projects across Canada, an expanding First Nations forestry land base, and a youthful First Nations labour force (Audit and Evaluation Branch, 2006). Although the forest industry is currently a relatively minor employer of Indigenous Peoples in Canada, typically employing less than 2% of the Indigenous workforce, its potential is much greater (Cahill, 2018). That said, access to the forestland base is problematic given that the provinces and territories have jurisdiction over most forestlands in Canada; the reserve land base is too small to be economically viable (White-Harvey, 1994). Because of this, the most common arrangement is First Nations forestry service companies engaging in contracts with larger companies (Wyatt, 2008).

The First Nations Forestry Program (FNFP) was intended to bolster the participation of First Nations people in the forest sector by enhancing their ability and capacity to engage in economic opportunities. The FNFP was jointly administered by First Nations representatives, the Canadian Forest Service (CFS) of Natural Resources Canada, and Indian and Northern Affairs Canada (INAC).[2] Over its 15-year duration, the FNFP funded over 2,400 projects in more than 680 First Nations communities, tribal councils, businesses, and organizations across the nation. Twelve thousand First Nations and non-First Nations people gained workforce experience that improved their skills in sustainable forest management and their ability to participate in the forest sector. Direct FNFP funding totalled $58 million, which represented 29% of the total project costs (First Nations Forestry, 2012).

Rather than presenting numbers representing money spent or the number of individuals employed, the research questions we seek to answer are (a) whether First Nations communities with forestry workers receiving FNFP support experienced an increase in their well-being, measured in terms of increased reserve income, and (b) whether the FNFP benefited First Nations reserve inhabitants employed across a broader range of economic sectors. To answer these questions, we first present an overview of the appropriateness of assuming economic development programs will improve the well-being of Indigenous Peoples given the challenges forestry presents and the holistic objectives and visions for forestlands held by Indigenous Peoples. Then we provide an overview of the FNFP and describe its data and the non-program data we used in this work. Next, we outline the modelling variables and models we employed. Finally, the report closes with a discussion of our results and conclusions.

Indigenous Well-Being and Economic Development: A Brief Review

Whilst widely used by policymakers and academics, well-being is a poorly defined term, with little agreement on its meaning (Carey, 2013; Dodge, Daly, Huyton, & Sanders, 2012; Seligman, 2011, as cited in Yap & Yu, 2016). The term is often used interchangeably and complementarily with notions of health, quality of life, and happiness (Yap & Yu, 2016). For example, a social determinants of health view theorizes well-being in terms of benefits to physical and mental health status, derived from access to favourable conditions such as adequate income, education, housing, health, and secure and well-paid employment (Commission on the Social Determinants of Health, 2008; Fisher, 2019, as cited in Mackean et al., 2022).

What becomes apparent in the well-being literature is that this term covers an amalgam of domains, dimensions, and themes, with the foci varying depending on the purposes at hand. This carries over to Indigenous understandings of the concept—which is hardly surprising considering the great cultural diversity among Indigenous nations. For example, a 2023 study by Tsuji et al. identified four consistent themes important for cultural well-being. In contrast, Kant et al.'s 2013 study identified seven domains: education, employment, health, housing, income, socio-cultural, and land use.[3] Likewise, Salmon et al. (2018) reviewed literature from Australia, Canada, New Zealand, and the USA and identified six dimensions of Indigenous cultures essential for wellbeing: connection to country; Indigenous beliefs and knowledge; Indigenous language; family, kinship and community; cultural expression and continuity; and self-determination and leadership.

Looking at well-being's origins may provide some clarity. The term originated in social psychology and development economics. In social psychology, the concept arose as part of the shift from treating psychological problems to examining the conditions under which humans flourish; in development economics, the term reflected the desire to move beyond narrow utility-based assumptions about individual rationality and mono-dimensional poverty indicators (Armitage et al., 2012). The social approach to understanding well-being is a three-dimensional concept that includes subjective and relational aspects in addition to the more traditional material dimension of well-being (Zurba & Bullock, 2020). The subjective dimension of well-being incorporates cultural values, norms, and belief systems while the relational component emphasizes social interactions, collective actions, and the relationships involved in the generation and maintenance of social, political, and cultural identities (Armitage et al., 2012). This approach is similar to Sen's (1985) capability approach based on the concepts of functionings and capabilities: the former are dimensions of well-being that make up well-being's entirety (however defined or determined), while the latter represent an individual's or group's opportunity to achieve the desired functionings. Implicit in the concept of capabilities are the elements of autonomy and self-determination, elements that encompass all aspects of Indigenous wellbeing (Yap & Yu, 2016). Importantly, autonomy and agency extend beyond the individual to the collective regarding the responsibility to care for and manage the collective's lands or country. For example, in their study of the conceptualization of well-being by the Yawuru people of Western Australia, Yap and Yu concluded that the recognition of individual and collective agency was an essential element of Yawuru wellbeing, consistent with a right to self-determination (Mackean et al., 2022).

However, the material and economic aspects of well-being are also important. Indigenous leadership in economic development and social enterprise are important areas of growth and change in Indigenous communities across Canada (Calliou, 2021). An important characteristic of many Indigenous enterprises is that they are collectively owned and more closely resemble a social enterprise whose profits are put towards social purposes (Calliou, 2021). And, while Indigenous peoples are open to participating in economic enterprises, they do so to improve their social and economic circumstances and to rebuild their communities on a traditional and culturally grounded foundation

(Calliou, 2021). For example, Indigenous business leaders indicated the importance of creating opportunities for prosperity through employment and development of infrastructure, as seen in Zurba and Bullock's 2020 study on the socio-economic benefits and risks of bioenergy development. These business leaders also noted that building relationships with industry could help communities build capacity. However, they expressed reservations about social problems that become more prevalent with increased incomes, with the caveat that creating a good work environment and teaching responsibility could diminish negative outcomes on well-being. Finally, in keeping with the their holistic and culturally linked objectives for forestlands, the Indigenous business leaders expressed relational concerns about taking too much from the land. Ultimately, Zurba and Bullock's work presented material and relational dimensions as discrete objective dimensions of well-being, with the connection to culture (a subjective dimension of well-being) emerging as a cross-cutting subtheme: the importance of and demand for economic development within communities make bioenergy projects attractive but such developments cannot override environmental stewardship roles and responsibilities.

The importance of economic development is also seen in Wuttunee's work on nine Indigenous community case studies (2004). Wuttunee explains that "economic development strategies taken by decision-makers in Aboriginal communities are based on the need to improve employment, training and development initiatives in order to improve the quality of life enjoyed by their members. Community history, leadership, and connection to tradition affects the choice of appropriate and effective economic development approaches" (p. 183). This work is continued in Nikolakis and Nelson's 2015 article, which saw First Nations in British Columbia list employment and economy as the second highest of four long-term goals—and even the lowest ranked long-term goal, community development, was indirectly related to economics, as forestry revenues facilitate public infrastructure. Conversely, these authors noted that many interviewees acutely felt the trade-offs in forestry between economic benefits and environmental impacts. One interviewee describes his own community as "lost in the fog of need," depending on revenue from forestry but still seeking to preserve their way of life. Forestry can also be contested within communities, with interviewees describing tensions between community needs, values, and business activities (Nikolakis & Nelson, 2015).

As these tensions suggest, while forestry is one of the few potential sources of employment and outside income for many First Nations communities, many barriers need to be overcome for forestry to be a sustainable source of economic well-being. Pun (2016) summarized that opportunities to engage in forestry are constrained by the conflict between traditional and new governance systems, existing forest policy frameworks, revenue-sharing opportunities and resource allocation, community-level consultation, community capacity building, and external and internal relationship building. The most important factor in Indigenous engagement in forestry is the conceptual approach taken toward economic development. Economic development approaches were first explored in Cornell and Kalt's (1998) seminal work investigating why some Indian reservations in the United States were outstandingly successful while others languished. Their

contrasting models are termed the jobs and income approach and the nation-building approach: the jobs and income approach emphasizes starting businesses for short-term payoffs, while the nation-building approach emphasizes creating an environment with lasting businesses that sustain community well-being. Perhaps most importantly, the former model treats development as an economic problem, while the latter model treats economic development as a political problem.

And yet another barrier, specific to Canadian Indigenous Peoples, arises from the jurisdictional tangle created by two conflicting pieces of legislation (the 1867 British North America Act and Canada's 1982 Constitution), in which provinces claim that "Indians" are the federal government's responsibility, while the federal government when asked to represent First Nations' interests, claimed that natural resource management was a provincial responsibility. (Smith, 2015). Compounding the tangle, the complex interplay between government and industry roles when engaging with Indigenous Peoples slows the process of building successful relationships between Indigenous, government, and industry groups (Robitaille et al., 2017). Ultimately, as Smith (2015) contends, ensuring that Indigenous and treaty rights are incorporated fully into government forest policy regimes is the only path that can lead to the meaningful reconciliation of Indigenous and non-Indigenous interests in forest management. This includes having a say at the table during policy formulation rather than adopting ill-suited policies through the top-down approaches of provincial and national governments. Despite legal obligations stemming from court decisions to consult with First Nations whenever proposed development activities could impact Indigenous and treaty rights, First Nations view consultations as bureaucratic status quo formalities that fail to address challenges and concerns with respect to resource developments (Pun, 2016). Indigenous community members find existing policy frameworks entrenched with rigid, complicated rules that are incompatible with First Nations' holistic approach to resource management and community decision-making practices (Pun, 2016).

Perhaps because of the complex interplay of federal and provincial governments, industrial leaseholders, and Indigenous reserves, political and economic collaboration among these four actor groups is first and foremost rooted in social contexts. As noted by Robitaille et al. (2017),

> Because collaboration within the forest sector is, at its core, a social phenomenon (Wyatt et al., 2013), it follows that building respectful relationships between Indigenous communities, government policy makers and industrial forest managers, who are charged with implementing provincial forest management regulations on-the-ground while concurrently respecting and incorporating the wishes of collaborating Indigenous partners, must serve as a prerequisite for any type of collaborative arrangement or partnership to be successful over the long term. (p. 46)

The Indian Act constrains bands' choice of governments, which then restricts their access to capital, meaning that First Nations do not generally enjoy the same degree

of autonomy in managing their resources as do American tribes (Trosper et al., 2008). This further creates systemic power imbalances that hinder the formation of respectful partnerships within the forest sector.

Despite these challenges, forestry still represents a desirable economic opportunity to First Nations because of factors such as the proximity and multi-use nature of the resource. However, provincial governments have allocated long-term access to commercial forests to forest companies—although this could be offset by the trend toward increased Indigenous tenure as advocated by Passelac-Ross and Smith (2013). Most First Nations cannot, however, gain access to forest resources unless it is through a formal agreement with the provincial government or an arrangement with an industrial partner who has a provincial licence (Trosper et al., 2008). Encouragingly, non-Indigenous forest companies have shown a willingness to engage in collaborative business arrangements, outlined in such works as Wyatt (2008) and Fortier et al. (2013). Ultimately, though, the lack of long-term tenure discourages investments in value-added manufacturing, as communities lack the technical expertise to meet the demands of provincial forestry regulations and the education and training to conduct these activities.

Because of this, capacity building is key to advancing the forest interests of Aboriginal Peoples and enabling their effective engagement in the forest sector (Bombay, 2010). Capacity is loosely defined as possessing necessary education and training and developing skills, and Aboriginal capacity in natural resources management is a broad and multi-faceted concept, encompassing Aboriginal governance, institutional arrangements with other levels of government, and human resource development (Bombay, 2010). The lack of adequate capacity prevents Indigenous communities from effectively engaging in forestry consultations: for example, limited access to high-quality timber volumes coupled with the high capital investment and capacity requirements required to compete with larger forest licensees prevent First Nations communities from taking advantage of opportunities available to them (Pun, 2016). However, internal capacity building must be largely supported by economic development, which is hindered by the lack of politically independent institutional mechanisms for governance and a cultural match for the successful establishment of First Nations businesses (Trosper et al., 2008). This is why federal programs such as the FNFP impacted forestry practices by supporting capacity building and Aboriginal participation in forest management (Fortier et al., 2013), as a lack of capacity and the lack of secure, long-term tenures (which affects access to capital) motivates some First Nations to sell portions of their timber allocations on-the-stump to non-Indigenous firms (Pun, 2016).

But, as previously mentioned, while economic development and opportunities are important, First Nations also prefer economic pursuits that are consistent with community needs and objectives, cultural sensitivities, and ecological concerns—no easy feat. For example, the Pikangikum First Nation in Ontario started the Whitefeather Forest Initiative as a base from which to develop a commercial forest tenure but ran into challenges integrating the concerns of their Elders, particularly over the protection of wildlife and the incorporation of traditional stewardship approaches within their forest plans: this demonstrates the difficulty of meshing these concerns with industrial forestry

demands (O'Flaherty et al., 2008). Likewise, in their case study of an Indigenous community forest in British Columbia, authors Booth and Muir (2013) noted that while economic opportunities are a given, specific operational requirements by First Nations contributed to the maintenance of key cultural values. But because cultural values are not necessarily harmonious with one another, these authors concluded that "rather than taking a pick one or the other approach to solving challenges" (p. 164), leading to the implementation of a static framework, that "the future essence of aboriginal forestry in Canada likely rests within and appreciates an 'in progress' adaptable approach of balancing the values" (p. 164).

Compounding the many challenges and issues facing Indigenous involvement in forestry, communities often lack a clear vision of what they want from forestry (Nikolakis & Nelson, 2015). Indigenous communities are often ambivalent towards resource development on their lands because it involves trade-offs between income and traditional cultural values (Vining & Richards, 2016). What is evident in the substantial literature on Indigenous relations with forestry is that Indigenous Peoples have a more holistic approach to their objectives and visions for forestry (and economic development generally) that emphasizes a balance between social, cultural, ecological, and economic concerns and values.

A more direct look at the relationship between well-being and income from economic activity was embodied in Vining and Richards's 2016 study. These authors conducted several regression analyses exploring the relationship between well-being and income arising from Indigenous economic development corporations (plus a few other independent variables), with well-being represented by the Community Well-Being Index (CWB) determined by INAC after each national census. Interestingly, two of the four components that make up the CWB are themselves economic measures, namely per capita income and labour force activity.[4] Their study has been criticized for this composite index because it overlooks cultural factors (Tsuji et al., 2023); Vining and Richards believe that the CWB is more informative than an index based on subjective well-being. However, Tsuji et al. (2023) addressed the issue of cultural factors in their work, which focuses on answering what well-being—and, subsequently, what cultural well-being—is. These authors identified four concordant regional and national themes regarding what was important for cultural wellbeing: (a) land and water, sustainability, and inherent obligations; (b) being on the land and Indigenous languages and knowledge systems; (c) sustainable development; and (d) meaningful involvement in decision-making and free, prior, and informed consent. The latter theme and the dimension concerning self-determination outlined in Salmon et al. (2019) are embedded in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). Many Indigenous communities expect governments and third parties (such as corporations) to create relationships with them in accordance with the principles found in UNDRIP, as noted by Borrows (2021), who stresses that the development of wise practices for dealing with Indigenous Peoples should highlight the importance of developing good relationships.[5] The importance of relationships cannot be overstated as this is implicit in good-faith negotiations between the Crown and Indigenous Peoples that seek to balance the former's duty to consult on natural resource dispositions with the

latter's concerns regarding right to title over traditional territories. Conflicting interests of Aboriginal and Native title holders, on the one hand, and Crown and private natural resource companies, on the other, have led to pressing legal challenges addressing the imbalance of bargaining power between parties (Taylor, 2021).

As a conclusion to this overview section, a simple but more implicit or indirect measure of well-being is the FNFP's 2012 final evaluation report featured a review of the program's four business lines during the program's three five-year periods. This review highlighted the program's achievements, such as the number of projects funded (2,400) and the number of people who gained experience that improved their forestry-related skills (12,000). Recommendations were also offered, such as the need for a greater focus on qualitative assessments and impacts (such as capacity) and less focus on the number of case studies as indicators of success (Audit and Evaluation Branch, 2006). While all aspects of the social-conceptual framework of well-being must be present to raise the level of social well-being in Indigenous communities, the present study focuses on the economic dimensions of well-being. The other dimensions are no less important, but they fall outside our scope and present opportunities for future research. We chose to focus on the economic dimensions of well-being after noticing that the evaluative literature on the FNFP lacked any mention of the program's broader impact on the economic well-being of participating reserves, a shortcoming this study is meant to address.

An Overview of the FNFP

The FNFP was introduced in 1996 to improve economic conditions in status Indian communities by providing opportunities for First Nations to work with federal, provincial, and territorial governments, as well as private forest-related industries, in on- and off-reserve forest-based economic activities (Smyth, 1998). The FNFP's two-tiered management structure consisted of a National Management Committee (NMC) that was tasked with providing overall administration to the program and allocation of funds to the second-tier Provincial and Territorial Management Committees (PTMCs). The NMC had representatives from First Nations, the CFS, and INAC. The PTMCs (which also had representatives from First Nations, the CFS, and INAC) assumed general program management, project approval, project implementation, and project-funding allocation in their province or territory. Representatives from provincial governments and the forest industry participated in their respective PTMC on a case-by-case basis. Although project proposals were submitted by First Nations communities, groups of bands, or First Nations businesses for PTMC approval, preparatory work was generally done in conjunction with provincial or industrial partners prior to submission.

All projects had to meet the criteria of one of four business lines, facilitating the FNFP's goal of improving economic conditions in Indigenous communities. These business lines were Forest Management Activities (e.g., forest management plans and silvicultural prescriptions), Forest-Based Business Development (e.g., business plans or feasibility studies), Training and Capacity Building (e.g., training in logging machine operation), and Access to Forest Resources (e.g., tenure or co-management negotiations). Nationally, 40% of all projects fell under Forest-Based Business

Development, while Forest Management Activities had the second largest percentage of projects (26%). For illustration, a typical example of a Forest-Based Business Development project was a 2009 British Columbia project with total funding of $32,560 "to complete the planning and development of a pellet plant to ensure that the Upper Nicola Band can knowledgeably and confidently move forward with the plant business venture and further their vision of participating in value-added specialty forest products markets."[6] In contrast, a typical project in the Forest Management business line was a 2008 Ontario project that sought "to develop a woodlot management plan that will assist Sheshegwaning First Nation with respect to maintaining their woodlot property, including timber management, inventory determination and reforestation of designated areas identified within the plan,"[7] with $55,538 in total funding. Many projects, however, have considerable overlap between business lines.

A per-project database with funding and employment information was maintained by CFS personnel over the course of the program.[8] The total value of a project was broken down among three source components: FNFP direct federal cash funding, cash and/or in-kind contributions from the First Nations proponent, and cash and/or in-kind contributions from other federal, provincial, territorial, or industrial partners. No project could receive more than 80% of its total value from the FNFP direct component. Another condition was that all projects would be funded for one fiscal year only, although some projects spanned more than one year. These projects had to be reapproved with new project codes from one year to the next. Funding across all projects over the course of the program totalled $87.6 million. Source components of funding by province and territory from the FNFP database are shown in Appendix A.

From 2003 to 2010, 2,078 projects were submitted to the FNFP, out of which 1,173 were approved for funding. Of the approved projects, 1,078 projects formed the core of the two datasets used for the statistical analyses in this paper. The other 95 projects were omitted for a variety of reasons, with most of them being funded symposia and workshops that could not be referenced to First Nations reserves.

Developing the Study Datasets

Several factors complicated the development of the two datasets used for this study. A major factor was that many of the FNFP's projects were not referenced to a reserve(s) where the project proponents resided. Because populated First Nations reserves are distinct census subdivisions (CSDs) in Statistics Canada censuses[9] and the socioeconomic information about inhabitants of First Nations reserves is essential to answering our research questions, clear links had to be made between project proponents and their constituent reserves. Creating these links was not a straightforward task because project proponents had to be linked with their component First Nations bands, whose members were often distributed among more than one reserve. Project proponents were sometimes a single band, but often the proponents were tribal councils or First Nations businesses whose constituent bands had to be identified before their constituent reserves could be determined using information sourced from Statistics Canada and INAC databases, as well as the internet.

This work found that on average there were four bands per First Nations organization across Canada. Just under a third of FNFP projects were conducted by First Nations organizations, with an average of four reserves per project. There were 463 bands that successfully participated in the FNFP during our eight-year study period. As there are 618 bands across Canada, this study represents 75% of all bands across the country.[10] Seven hundred sixty-eight reserves were estimated to have been involved in approved projects, representing 80% of the 961 populated reserves in Canada (based on the 2011 National Household Survey).[11] There were 47 instances where project proponents had two projects underway in a given year and 10 instances where three projects were underway in a given year.

Another complicating factor was the need to account for concordances among CSDs between the 2006 census and the 2011 National Household Survey.[12] There were numerous instances where reserves were amalgamated into one reserve between one census and the next or were renumbered between censuses.

Because FNFP funding was to be spent by project proponents whose members may reside among multiple reserves, a rationale had to be adopted to apportion each project's funding among its constituent reserves. Two methods were used to apportion project funding among participating reserves, resulting in the two separate datasets. The method used for the first dataset was based on the number of persons in participating reserves who were employed in forestry according to the 2006 census, while the method used to create the second dataset was based on the total 2011 population of constituent reserves.

A vital step was pairing the estimated project funding spent in each reserve with socioeconomic variables hypothesized to explain the FNFP's influence on reserve inhabitants' well-being. However, these socioeconomic variables were not available for all of the 768 CSDs estimated to have received FNFP funding. This was because of confidentiality concerns due to the small population of some reserves, as well as the unavailability of reserve inhabitants during the week of the censuses because they were engaged in traditional uses of the land or were evacuated due to forest fires. Additionally, some reserves refused to participate in the censuses for cultural or political concerns. Despite these challenges, the pairing of FNFP funding estimated to have been spent in each reserve with the censuses' socioeconomic information resulted in a net down of our sample datasets to 555 CSDs for each dataset.

The present study involves the summing of per-year FNFP project funding into two periods per reserve and the determination of averages per reserve for the outcome and control variables selected by the authors for use in statistical modelling. There were no aggregations to the provincial or national levels. The use of averages to represent CSD characteristics, or the change in characteristics (as in the case of our outcome variables chosen to represent well-being), is a standard practice when comparing social groups. It would not have been possible to conduct statistical analyses based on datasets composed of individual census respondents as individuals are not identified across the censuses. The data for the outcome and control variables used in the two datasets was sourced from a local Regional Data Centre (RDC) of Statistics Canada. The RDC acts

as a repository and point of access for census micro-data, which are data at the level of the individual or family census respondents.

Outcome, Treatment, and Control Variables in the Study Datasets

The Canadian Royal Commission on Aboriginal Peoples (Indian and Northern Affairs, 1996) concluded that a concerted effort by provincial, territorial, and federal governments in Aboriginal economic development would regenerate social fabric and redress economic inequity. As poor social conditions are related to poor economic conditions, economic initiatives focus on creating jobs, businesses, and local economies and not on the social conditions themselves (Booth & Skelton, 2011). Additionally, because the FNFP intended to improve economic conditions, we chose to represent the well-being of reserve inhabitants in terms of staple economic variables, namely, the difference in average CSD incomes reported in the 2006 and 2011 censuses.

The two income difference variables selected as outcome variables for our modelling work were the mean after-tax income of those employed in forestry (Forest Income Change, Appendix B) and mean after-tax family income (Family Income Change, Appendix B). The latter variable was chosen address our second research question about whether the FNFP also benefited individuals in the same reserve who were employed across a broader range of economic sectors. After-tax income of those employed in forestry is defined as the total money income received by individuals 15 years of age or older in the calendar year before the census year minus all income taxes, whereas family after-tax income is a derived variable defined as the sum of the after-tax income of all members of a census family. Because some CSDs saw increases in the outcome variables while others saw decreases, we present summary statistics in Appendix B for each change category.

As our study's primary research question is whether First Nations communities receiving FNFP support experienced an increase in their well-being due to the program, our models' treatment variable is the funding estimated to have been spent in participating reserves. Because our outcome variables are based on differences between two censuses, treatment funding (the 2006 to 2010 program timeframe we term Period 2) approximately corresponds to the period between the censuses. Period 1 funding (that is, FNFP funding from 2003 to 2005) is utilized as a control variable to determine whether this spending influenced reserve inhabitants' well-being and to ensure that the effect of Period 2 funding is not due to correlation with earlier period funding. We also used additional control variables, based on previously published works examining the factors contributing to socioeconomic variation in Indigenous communities. For example, Buffalo (1997) examined the influence of community size and the geographic location of socioeconomic status, and Parkins et al. (2006) employed population size, metropolitan influence zone, the percentages of the population between zero and 14 years of age, and the percentage of the population with less than grade nine education in their study of forest sector contributions to Aboriginal communities in Canada. Appendix C provides the descriptions, variable names, and descriptive statistics of the treatment and control variables used in our analysis models.

One of the control variables predicted to significantly influence reserve well-being was the population of a reserve's labour force (Labour Force '06). Reserves with higher labour force populations were expected to receive a commensurately higher benefit from the FNFP because their larger labour pool would be more likely to have persons with experience in forestry and thus undertake more projects. Other labour-related control variables we investigated were the number of persons employed in the forestry labour force in relation to the labour force as a whole in 2006 (titled Forest Labour Ratio '06) and the number of persons employed in forestry in relation to the employed labour force in 2006 (Forest Employment Ratio '06).[13] We hypothesized that reserves with higher ratios of forest workers in 2006 would benefit more from the FNFP, as forest workers would be inclined towards securing greater forest employment.

We also investigated two monetary control variables, Forest Worker Income '06 and Family Income '06, which represent the average 2006 levels of the income types used as outcome variables (see Appendix B). Their levels were hypothesized to act as a reference point to account for differences among reserves in terms of economic history, including any non-FNFP funding. Another control variable we thought would play a role in the relationship between treatment spending and average incomes or levels of employment of reserve inhabitants was the number of weeks worked in 2005 (Weeks Worked '06).[14] Our reasoning was that higher levels of employment before Period 2 would act as a source of reference for any path dependence from which well-being gains in Period 2 could be better explained. The number of weeks worked could be in any economic sector.

We also looked at several socioeconomic control variables. The level of educational attainment acts as an indicator of well-being through its effect on income and other aspects of well-being. Variables of educational attainment that were hypothesized to influence well-being are the ratio of persons with high school graduation and beyond (High School Ratio '06), the ratio of persons with a certificate of education beyond high school (Post Secondary '06), and the ratio of persons with a trade certification (Trade Ratio '06). Another socioeconomic control variable we thought would be relevant was the ratio of persons who were married, living common-law, or separated in relation to the total population in 2006 (Married Ratio '06). Our rationale stems from the expectation that reserves with a higher proportion of married individuals would have a positive influence on average family after-tax incomes across our sample. We also expected that average age (Mean Age '06) and age squared (Mean Age '06 Squared) would be relevant because higher age tends to be associated with higher incomes (although the strength of this association lessens as age increases).

The only categorical variable employed in our models was the province or territory a reserve was located in. This categorical variable was represented by 12 dummy variables; we chose Ontario as the comparison or reference region. We hypothesized that a given province or territory would have a significant influence on the well-being of reserve populations because of the diversity of economic and forestry policies across the country.

Results and Discussion

The two models presenting the overall results of our statistical hypothesis testing are shown in Tables D1 and D2: they were used to determine the likelihood of relationships among variables in our study dataset being due to random chance. Appendix D also outlines the reasoning behind our choice of multiple linear regression (MLR) statistical models to test the relationships between the study variables.

First Model: Modelling Differences in Average After-Tax Income of Forest Workers

In terms of the highest goodness-of-fit, the best overall model explaining changes in reserve well-being is shown in Table D1. This first model's outcome variable is the difference in average after-tax income of forest workers between the censuses (see Forest Income Change, Appendix B) and was based on the forest worker-apportioned dataset. We also investigated models that used changes in average family after-tax income based on forest worker apportioning, but these proved to be inferior.

The FNFP Period 2 Spending treatment variable had a significant influence on our outcome variable. As anticipated, the injection of project monies into reserves created employment opportunities beyond the status quo and improved the well-being of residents employed in forestry, at least to some degree. However, its wide range by a median smaller than the mean, as illustrated in Appendix C, prompted us to investigate using this variable's logarithm, with the expectation that its linearization would lead to a better model. This was borne out as the t-statistic of this variable's logarithm increased substantially from the non-logarithmic version's value. A 10% increase in Period 2 funding,[15] holding all other independent variables constant, would, for example, result in a $55.62 increase in the average after-tax incomes of forest workers (583.54 * loge(1.1) = $55.62). Placing this increase in a broader context, the average number of workers per reserve that could benefit would be 17.06, based on Labour Force '06 and Forest Employment Ratio '06 from Appendix C (487.51 * 0.035 = 17.06). And the average total increase in the mean after-tax incomes of forest workers per reserve between 2006 and 2011 would be $948.88 (17.06 * $55.62).

Although spending an average of $7,000 in per reserve funding by all source components in Period 2 for an increase of $949 in average per reserve after-tax income does not represent a good rate of return on investment, it's worth pointing out that 29.5% of this funding would stem from the federal government (see the Total FNFP Funding Component, Appendix A). This equates to $2,071 per reserve ($70,196.32/10 * 0.295) resulting in a $949 per reserve increase in after-tax forest worker income, representing a -54% rate of return (949/2071 – 1). However, this is only a partial rate of return, as there would likely be spillover benefits to non-forest workers not captured here.

The FNFP Period 1 Spending control variable was not significant in initial modelling, suggesting that it had little bearing on FNFP well-being outcomes in Period 2. However, because its median was also smaller than its mean (Appendix C), we investigated using the variable's logarithm as well: in this case, the FNFP Period 1 Spending control

variable became strongly significant (Table D1, Appendix D), indicating that the level of Period 1 funding had a strong effect on changes in the after-tax incomes of forest workers between 2006 and 2010. On average, a 10% increase in Period 1 funding would result in a $60.21 difference in total forest worker after-tax income, an increase greater than that of Period 2 funding. This was probably due to increases in human and physical capital that funding in Period 1 afforded (including the direct or indirect continuation of projects from one period to the next): this reflects a strong path dependency effect on funding in Period 2 as 316 of our 555 reserve samples saw program funding in both periods.

The highly significant control variable Forest Worker Income ’06 indicates that, as hypothesized, this quantity’s level acts as a reference point for differences in the mean after-tax incomes of forest workers between the 2006 and 2011 censuses. Its negative sign indicates that the average difference in mean after-tax incomes of forest workers declined between the censuses as Forest Worker Income ’06 increased, possibly displaying a flattening effect of lessening changes in marginal income as the level of absolute income increases.

Forest Labour Ratio ’06 was another significant reference control variable in our model (Table D1, Appendix D). The designation of a forest worker is based on a census respondent’s sector of employment[16] during the census week, or, failing that, the dominant sector of employment during the period from the start of the year before the census year up to the census day.[17] The control variable’s positive sign indicates that as the number of persons employed in forestry in relation to the labour force in 2006 increases, so too does the outcome variable Forest Income Change. A wider range of income among forest workers (including those seeking employment) than those employed in other fields may have been a key contributing factor in this result.[18] Importantly, the significance of Forest Labour Ratio ’06 was in spite of the 90 reserves that had no inhabitants who drew income from forestry (Appendix B): typically, this number of reserves would render the Forest Labour Ratio ’06 insignificant. All of these reserves were nonetheless deemed to have received FNFP funding in the forest worker-apportioned dataset. The significance of the Forest Labour Ratio ’06 variable may have been to some extent an artifact of apportioning funding among the 555 reserves in our sample thought to have been participants in FNFP projects, when in fact a portion of the reserves may have received no funding because of project non-involvement. An additional explanation of why these reserves had no inhabitants who drew income from forestry but had forest workers may be that income was not reported because income tax payment is not required from on-reserve employment: most projects occurred in non-census years and therefore income arising from off-reserve projects would not have been recorded.

Mean Age ’06 and its square proved to be significant in our models, as expected. These characteristics have been shown to explain socioeconomic phenomena in many studies, with increasing age (and the effects of accumulated experience) correlated to higher incomes—but with declining income increases as age approaches the retirement years.

The only provincial dummy variable that proved significant was the one for British Columbia, with this variable reflecting an average per reserve increase of $3,356 in forest worker income between the censuses relative to the average per reserve forest worker income change in Ontario. This likely reflects the impact regional policies have on socio-economic aspects such as access to forests and support for business opportunities.

The last control variable in our model was the dummy variable Forest Employed. This variable was not anticipated to be part of the study dataset but was employed to account for the heteroscedastic effect of the 90 reserves with no reported after-tax incomes of forest workers in either census (Appendix B).

One of the variables expected to significantly influence the well-being of reserve inhabitants was Labour Force ’06; however, it was not significant in our model. Clearly, the population of a reserve’s labour force does not significantly influence income-based well-being gains among forest workers through the FNFP. Our hypothesis that reserves with higher labour force populations (and therefore more likely to have persons with experience in forestry and thus attract more FNFP project funding) would receive a commensurately higher benefit from the FNFP does not appear to be supportable. The lack of significance of Labour Force ’06 may be due to the distributive influence of First Nations businesses and organizations whose composition is not aligned with reserve forest worker populations. Our approach of using reserve forest worker population and total reserve population to apportion project funding among reserves is only an estimation of how FNFP funding was distributed among component CSDs, allowing us to pair funding with the reserve socioeconomic data used to explain well-being gains through our models.

Another surprise was that none of the education-related control variables outlined in Appendix C (High School Ratio ’06 and Post Secondary Ratio ’06) were significant in our model. Perhaps there were too few inhabitants working in forestry with sufficient variation in education across our sample of reserves to make a detectable difference in income. Indeed, in their study of the contributions of forestry and other resource sectors to the socio-economic status of Aboriginal communities, authors Parkins et al. (2006) found that their education control variable (the percentage of the population with less than grade 9 education) became insignificant in its effect on median family income in the latter three census periods of the four examined.

Second Model: Modelling Changes in After-Tax Family Income

Our second model in Table D2 focuses on whether the FNFP benefited the wider reserve population. This does seem to be the case, as the logarithm of Period 2 spending was significant, indicating that this treatment variable improved well-being across wider reserve populations—if to a lesser extent when compared to well-being expressed in terms of the Forest Income Change outcome variable in our first model (see Table D1). A 10% increase in Period 2 funding, holding all other control variables constant, would result in a $14.23 increase in mean after-tax family incomes (149.32 * loge(1.1) = $14.23). This increase would be spread over an estimated average of 169 families per

reserve (487.51, the average labour force population in 2006 [Appendix C] * 0.347 [Married Ratio ’06, Appendix C]).[19] The increase in family income per reserve would then be $2,404.87 (169 * $14.23). As in our first model, the federal spending required to achieve this increase would be $2,070.79. This would imply a rate of return of 16% ($2,404.87/$2,070.79 - 1 = 0.16). Since our treatment funding would have a wider effect on after-tax family income (Family Income Change) because of the higher number of people benefiting, one would expect a higher rate of return than our first model, which focused on forest workers and the resultant partial rate of return. Another difference is that Period 1 funding, whether in its linear or logarithmic form, had no discernable effect on reserve well-being in our second model: benefits in Period 2 were likely too muted across the wider reserve population.

However, the Weeks Worked ’06 variable may have induced a similar path dependency effect on Family Income Change as Period 1 funding did on Forest Income Change. The positive significance of the Weeks Worked ’06 suggests that more employment in one time frame engenders more employment in later time frames: the more weeks worked in 2005, the larger the outcome variable Family Income Change.

That said, the negative sign of the Family Income ’06 variable is puzzling. It may reflect worsening economic conditions across most sectors between the censuses, as evidenced by the 199 reserves that saw a decrease in mean family after tax income between the censuses (Appendix B). The negative sign for this control variable means that this decrease was relatively greater for those reserves with a higher Family Income ’06. For example, suppose that higher-income reserves are more sensitive to economic conditions because they have more enterprises dependent on external demands for products or services. In this case their decline might be relatively greater than lower income reserves with a greater reliance on internal sources of income. A significant control variable in explaining the effect of the FNFP on average reserve after-tax family income was the ratio of persons who were married, living common law, or separated to the total population in 2006 (Married Ratio ’06). This likely reflects the income-boosting effects of an increasing proportion of families with dual income earners, some of which may have been attributable to FNFP treatment funding.

This model also includes the Post Secondary Ratio ’06 variable. The negative sign on the rate of individuals possessing a certificate of education beyond high school in relation to the total population in 2006 may indicate the effect of income foregone while pursuing post-secondary education, whether in forestry or other fields.

Finally, six Provincial dummy variables proved to be significant in explaining variation in our outcome variable, Family Income Change (Table D2, Appendix D). These increases or decreases in after-tax family income between 2006 and 2011 are all relative to Family Income Change in Ontario.

Conclusion

This study affirmatively answered its research questions as to whether First Nations communities that received FNFP support experienced an increase in their well-being in terms of increased income. While the FNFP’s -54% rate of return when using

federal funding to increase after-tax incomes of forest workers is not a good return on investment from a profit-motivated business point of view, positive rates of return may not be the primary objective of government programs meant to improve the well-being of underprivileged and disadvantaged social groups. Projects in the Forest-Based Business Development business line would not have generated income or employment if the proposed business developments did not go ahead. The same could be said of projects in the Access to Forest Resources business line. After all, the FNFP was chiefly meant to help Indigenous Peoples to work in the forest sector, not to provide income and employment per se. But while a broader look at how well the FNFP's rates of return compare with similar programs across the national spectrum is an interesting area of future research, it is beyond this paper's scope.

On the other hand, the rate of return on increasing after-tax family incomes between the censuses was 16%, suggesting this was the FNFP's main benefit, as it is clear the program had spillover effects across the wider reserve population. The central importance of family and kinship for the well-being of Indigenous people cannot be overemphasized (Durie, 2006; Grieves, 2007; Greiner et al., 2005; Kral et al., 2011, as cited in Yap & Yu, 2016), and collective and relational sense of well-being is a recurring theme in the well-being literature (Yap & Yu, 2016).

That said, there are a few factors that may have affected our results. The recessionary effects of the 2008 financial crisis would have been acutely felt during our study period, especially since many First Nations businesses undertake contracts with larger companies (Hickey & Nelson, 2005) or are involved in joint ventures for the construction of a timber mill or forest management and planning (Wyatt, 2008). Indeed, the number of CSDs with forest workers decreased by 98 reserves from 2006 to 2010, probably reflecting the tough economic times. However, despite the gloomy economic conditions, our income models suggest that the FNFP had positive effects on reserve inhabitants' well-being in terms of the dependent income variables used in our models. Another concern is that the FNFP is only one of several federal programs meant to bolster the economic fortunes of Indigenous communities; parallel increases in other programs may have been an unaccounted-for factor potentially undermining our findings. However, a review of economics-related federal spending programs in reserve communities showed a net decrease of $296 million over our study period. This would support our overall evaluation of the FNFP.

However, the most prominent source of uncertainty arose from our efforts to tie FNFP funding to reserves when project proponents were First Nations businesses or organizations. The benefits gained through project funding may have been unequally distributed when project proponents were from bands that resided among two or more reserves, and the funding effects of projects involving a single band would be masked when aggregated with non-participating bands. In addition, our models do not account for income changes in the bands' off-reserve population because of the challenges posed by tying non-reserve CSD's Indigenous populations to particular reserves. This is a key concern as an increasing proportion of Canada's Indigenous population resides in urban centres. For example, the number of Indigenous people living in metropolitan areas increased by nearly 60% between 2006 and 2016 (Collier, 2020). Our effort to

apportion project funding among constituent reserves according to their forest worker population rather than on their total population was done out of the belief that this would reduce the uncertainty of the apportioning. The strong significance of the FNFP treatment and control spending variables, as well as the better goodness-of-fit statistics in our model based on the forest worker-apportioned dataset, seems to have borne out the validity of this approach.

One connection between the FNFP's after-tax income increments and their overall benefits to FN well-being may lie in improvements in overall community health. There is little doubt that the structural social and economic disadvantages affecting Indigenous people also adversely affect their health and wellbeing (Anderson et al., 2016). Capacity, specifically, is a frequently recurring structural disadvantage in wellness literature concerning Indigenous peoples. To this end, the FNFP was intended to augment First Nations participation in the forest sector by enhancing their capacity to engage in economic opportunities. Our finding that experience in forestry led to increased income suggests that projects were linked to increased capacity for participating in the forest industry generally.

Another consideration is that our finding linking projects to an increase in the after-tax income of forestry workers and reserve families may have a greater association with well-being than an indicator such as incremental revenue.[20] Our findings using the economic indicators directly suggest that profits and employment income from FNFP projects have reached the workers and families on the reserves, likely increasing their well-being.

Our findings also suggest several potential policy recommendations. The question of whether the FNFP laid the foundation for continued or improved well-being beyond this study's survey period could be answered by examining two similar programs that followed the FNFP.[21] Since our work demonstrates some FNFP success, a resultant policy recommendation is that these programs continue until they no longer fulfill their intended purpose at an acceptable cost. Another policy recommendation is to further address a key hindrance to greater Indigenous involvement in forestry: access to the forestland base. While many collaborative arrangements between Indigenous Peoples and the forest sector exist,[22] "despite apparent federal and provincial political support and successful examples of Indigenous forestry, greater Indigenous involvement remains a challenge under most current management systems" (Lawler & Bullock, 2017, p. 120). As noted by Calliou (2021), the erosion of First Nations' land base is a significant hurdle in their bid for self-government, a legacy of the long expansion and eventual dominance of settler society and the continuing effects of oppressive and paternalistic treatment by the Canadian state, particularly through the Indian Act. The emergence of the Land Back movement in the 2010s is symptomatic of Indigenous Peoples' efforts to reestablish political and economic control over their ancestral lands in tandem with meaningful involvement in decision-making and free, prior, and informed consent.

It is important to remember that our conventional measure of economic outcomes represents only one component of total well-being. Because well-being is multidimensional, encompassing objective and subjective notions, an important aspect of understanding well-being is recognizing that the interconnectedness of different

dimensions is as crucial as the individual parts (Smylie et al., 2014). Ever present in the lived experiences of Indigenous peoples is the balancing and negotiation of relationships and trade-offs among the different dimensions of well-being (Yap & Yu, 2016). The interconnectedness between the different dimensions is embodied in the concept of Mino Bimaadiziwin, a term used by Anishinaabeg and other Algonquian-speaking Indigenous Peoples that means the "good life" or "living the good life." It reflects a comprehensive Anishinabek worldview and ontology incorporating culture, spirituality, and health. Similarly, the philosophy of mabu liyan permeates all aspects of Yawuru well-being. It reflects their sense of belonging and being in connection with country, culture, others, and oneself. Indeed, the Yawuru believe that having the necessities—an education, both Western and cultural; secure and meaningful work; and a constant stream of income—not only ensures stability but is instrumental in achieving other valued functions such as autonomy (Yap & Yu, 2016). It is therefore necessary to pursue an integrated approach to well-being, wherein a system of indicators extends across every element of people's lives, combining social information with economic and environmental factors so that relationships between the different aspects can be considered (PUMC-UNAM, 2008 cited in Yap & Yu, 2016).[23]

Ultimately, the present study has gone a step beyond the usual practice of evaluative efforts that look at outputs rather than outcomes: we have shown that the FNFP had a significantly positive outcome on the well-being of Indigenous peoples in terms of a conventional measure of economic outcomes. An important caveat is that our measure represents only one component of overall well-being and further work is necessary to determine the role and extent of other components.

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Appendix A

Number of Projects, Total Project Funding, Funding Source Components, and Number of Proponents by Province or Territory in the First Nations Forestry Program, 2003 to 2010

Province or territory	Number of funded projects	Total project funding ($)	Total FN funding component ($)[a]	Total FNFP funding component[b] ($)	Total partner funding component ($)[a]	Number of proponents
NL	15	934,245.03	534,076.00	347,024.03	53,145.00	2
PE	9	217,050.00	83,124.00	100,038.00	33,888.00	3
NS	22	2,118,546.00	570,807.00	1,510,205.00	37,534.00	2
NB	47	2,541,358.30	967,481.10	1,068,412.20	505,465.00	14
QC	139	16,709,747.00	9,673,913.00	3,721,804.00	3,314,030.00	34
ON	201	21,118,684.76	6,473,829.52	4,289,275.55	10,355,580.69	93
MB	113	10,138,314.33	5,309,644.16	2,086,448.56	2,742,221.61	42
SK	138	11,245,776.36	4,814,557.75	2,865,848.00	3,565,370.61	42
AB	122	9,937,911.00	4,686,967.70	2,817,783.20	2,433,160.10	43
BC	230	10,111,376.02	2,616,228.90	5,602,922.31	1,892,224.81	122
NT	29	1,121,351.00	450,371.80	478,510.50	192,468.70	17
YT	13	1,370,696.00	291,969.00	972,104.00	106,623.00	2
Canada	1,078	87,565,055.80	36,472,969.93	25,860,375.35	25,231,711.52	416

[a] Includes cash and in-kind contributions.
[b] Total FNFP funding represents a cash-only federal source component within the larger FNFP that encompasses all three funding source components.
Note. NL=Newfoundland and Labrador, PE=Prince Edward Island, NS=Nova Scotia, NB=New Brunswick, QC=Quebec, ON=Ontario, MB=Manitoba, SK=Saskatchewan, AB=Alberta, BC=British Columbia, NT=Northwest Territories, YT=Yukon Territory

Note. FN = First Nations.

Appendix B

Outcome Variable Characteristics for the 555 Census Subdivisions in the Study Sample

Outcome variable description	Variable name	Number of associated CSDs	Mean of variable	Median of variable
Increase in mean after-tax incomes of forest workers between 2006 and 2011 in constant dollars[a]	Forest Income Change	200[b]	9,068.14 (13,148.81)	4,698.52 (9 379.84)
Decrease in mean after-tax incomes of forest workers between 2006 and 2011 in constant dollars	Forest Income Change	265	13,804.82	10,019.05
Increase in mean family after-tax incomes between 2006 and 2011 in constant dollars	Family Income Change	356	8,450.42	6,015.16
Decrease in mean family after-tax incomes between 2006 and 2011 in constant dollars	Family Income Change	199	6,884.04	3,697.00

Note. CSD = census subdivision.

[a] The reference year for constant dollar determinations was 2002.
[b] 90 additional reserves had no after-tax incomes of forest workers reported in either census.

Appendix C

Descriptions of the Treatment and Control Variables in the Study Datasets Used in Statistical Modelling

Variable description	Variable name	Mean of variable	Median of variable
Treatment variable			
Funding by all source components in period 2 in constant dollars	FNFP Period 2 Spending	70,196.32	15,859.02
Control variables			
Total FNFP spending by all source components in period 1 in constant dollars	FNFP Period 1 Spending	56,603.09	10,541.07
Labour force population in 2006	Labour Force ‘06	487.51	229.0
Ratio of number of persons in the forestry labour force in relation to the labour force in 2006	Forest Labour Ratio ‘06	0.035	0.0156
Ratio of number of persons employed in forestry in relation to the employed labour force in 2006	Forest Employment Ratio ‘06	0.0221	0.0119
Average after-tax income of forest workers in 2006 in constant dollars	Forest Worker Income ‘06	15,370	-[a]
Average after-tax family income in 2006 in constant dollars	Family Income ‘06	30,740	14,0120
The average number of weeks worked, regardless of sector, by reserve inhabitants in 2005	Weeks Worked ‘06	14.19	14.32
Ratio of persons with high school graduation and education beyond high school in relation to the total population in 2006	High School Ratio ‘06	0.616	0.619
Ratio of persons with certificate of education beyond high school in relation to the total population in 2006	Post Secondary Ratio ‘06	0.494	0.502

[a]

Variable description	Variable name	Mean of variable	Median of variable
Ratio of persons with trade certification or diploma in relation to the total population in 2006	Trade Ratio ‘06	0.079	0.066
Ratio of persons who were married, living common-law or separated in relation to the total population in 2006	Married Ratio ‘06	0.347	0.335
Average age of reserve labour force population in 2006	Mean Age ‘06	31.49	29.53
The square of average age of reserve labour force population in 2006	Mean Age ’06 Squared	1,060.76	872.23
The province or territory a reserve is located in coded among 12 dummy variables	Province	n/a	n/a
Dummy variable coded zero for zero values of the outcome variable and coded one for non-zero values of the outcome variable	Forest Employed	n/a	n/a

Note. n/a = not applicable.

Suppressed for confidentiality reasons. Fewer than 120 CSDs had zero values.

Appendix D

Because our initial sample of 768 reserves represents 80% of all reserves in Canada, a percentage similar to the almost 80% of First Nations that are located within Canada's vast forests (Gysbers & Lee, 2003), it is reasonable to conclude that most forested reserves participated in the FNFP during the program's operation. Most of the 193 reserves that did not take part in the FNFP were urban reserves or reserves not close to forest resources. Given the size of this group of reserves in relation to our working sample of 555 reserves, there would be limited utility in using binary matching approaches to determine the treatment effects of the FNFP on the well-being of reserve inhabitants. Furthermore, the dissimilar natures of reserves with or close to forest resources compared with those without forest resources would render binary matching procedures problematic.

An extension of the binary matching tradition is the study of varying levels of treatment on outcomes, commonly termed dose response modelling. Although multiple linear regression is probably the most common method for estimating treatment effects, the statistical literature suggests that propensity score analysis is becoming more prevalent in some areas of research, its chief advantage being that comparisons made between matched groups are not confounded by differences in covariate distributions (Zanutto, 2006) through avoidance of functional form restrictions (Lauringson et al., 2011). However, Zanutto (2006) also noted that an advantage of multiple linear regression is its ability to reveal treatment differences due to important interactions with other covariates such as regions of a country: this is an important consideration when evaluating studies that take place in real-life settings rather than in highly controlled clinical trials. For this reason, we opted to pursue a multiple regression approach to research the FNFP's effect on the well-being of reserve inhabitants.

Table D1.

Estimation Results of the MLR Model of Changes in the Mean After-tax Incomes of Forest Workers (Forest Income Change) Between 2006 and 2011, Based on Treatment Funding Apportioned by Forest Worker Population

Predictor variable	Estimated coefficient	*t*-ratio
Log of FNFP period 2 spending	583.54***	5.12
Log of FNFP period 1 spending	637.30***	5.66
Forest worker income ‘06	-0.926***	-30.49
Forest labour ratio ‘06	20,357.92*	1.94
Mean age ‘06	901.51**	2.35
Mean age squared ‘06	-10.14**	-2.15
Province (BC)	3,355.92**	2.13
Forest employed[a]	6,953.51***	4.52
Constant	-19,386.59***	-2.61
Number of observations = 555		
$\bar{R}^2 = 0.65$		
Mean VIF = 1.29[b]		

* Significant at 0.1.
** Significant at 0.05.
***Significant at 0.01.

Note. VIF = variance inflation factor. See the following paragraph for details on the VIF.

[a] The inclusion of the Forest Employed dummy variable proved superior to the use of robust standard errors without the inclusion of this variable.

[b] This figure does not include Mean Age Squared ’06 in its determination as the to-be-expected high correlation between Mean Age ‘06 and Mean Age Squared ’06 unrealistically biases the mean VIF.

A good regression model must possess a high degree of confidence in its estimated coefficients. An indicator of this confidence is that the model’s independent variables should not be strongly correlated, as the presence of multicollinearity can lead to large standard errors and wide confidence intervals of the model’s coefficients. A measure of the degree of multicollinearity is the variance inflation factors (VIF) of the model’s coefficients. A VIF indicates how much of the variance of an estimated coefficient is being inflated because of multicollinearity; research by Hair et al. (2010) and Kennedy (1992) suggest that VIF values under 10 are acceptable. None of the VIF values in our three models were greater than 1.37.

Table D2.
Estimation Results of the MLR Model of Changes in After-tax Family Income (Family Income Change) Between 2006 and 2011, Based on Treatment Funding Apportioned by Total Reserve Population

Variable name	Estimated coefficient	*t*-ratio
Log of FNFP period 2 spending	149.32*	1.71
Weeks worked ‘06	631.77***	4.20
Family income ‘06	-0.728***	-8.08
Married ratio ‘06	19,573.89***	3.00
Postsecondary ratio ‘06	-12,917.26**	-2.20
Province (NL)	8,193 .05***	3.23
Province (QC)	3,898.98**	2.32
Province (MB)	-6,726.78***	-4.48
Province (AB)	5,912.23***	2.74
Province (YT)	8,306.97***	2.68
Province (NT)	10,969.65***	7.46
Constant	15,239.39***	3.41
Number of observations = 555 R^2 = 0.39		
Mean VIF = 1.32		

*Significant at 0.1.
**Significant at 0.05.
***Significant at 0.01.

Note. VIF = variance inflation factor.

The use of robust standard errors was employed in this model to counter the effects of heteroscedasticity in the dataset.

END NOTES

[1] The term "Indigenous" refers to the Indigenous inhabitants of Canada, including First Nations, Inuit, and Métis peoples (as stated in section 35(2) of the Constitution Act, 1982), and will be used in place of the terms "Aboriginal" or "First Nations" unless directly quoted from or in reference to associated literature.

[2] The dissolution of INAC was announced in 2017 along with the creation of two new departments: Indigenous Services Canada and Crown-Indigenous Relations and Northern Affairs Canada.

[3] The seventh domain, land use, was added to the original six domains of well-being after being identified by the Indigenous participants.

[4] The other components are education level and housing quality.

[5] Wise practices is an approach that blends local traditional knowledge and experience with best-practices competencies that Indigenous leaders would need to achieve successful community economic development.

[6] Project description taken from FNFP database.

[7] Project description taken from FNFP database

[8] The database also included a host of other items including province, fiscal year, brief project description, project proponents, business line(s), project status, and ancillary information.

[9] "Distinct census subdivisions" is Statistics Canada's general term for municipalities or areas treated as municipal equivalents for statistical purposes, such as First Nations reserves.

[10] Data is sourced from Indigenous and Northern Affairs Canada: http://fnp-ppn.aandc-aadnc.gc.ca/fnp/Main/index.aspx?lang=eng.

[11] There are actually 3,100 reserves in Canada, 961 of which are classified as census subdivisions as they have resident populations. The remaining reserves are small, remote parcels of land used for seasonal purposes. For more information, see http://www.statcan.gc.ca/pub/92-195-x/2011001/geo/csd-sdr/def-eng.htm.

[12] The 2011 National Household Survey is referred to as the 2011 census throughout the remainder of this work for the sake of brevity.

[13] The labour force is defined as employed persons and persons seeking employment while the employed labour force is defined as those who are employed. Both categories apply to persons 15 years of age and older who are not institutionalized.

[14] Because this variable was meant to record employment over a whole year, 2005 was the latest year that could be used for the 2006 census.

[15] This calculation is based on roughly 10% of the average Period 2 per reserve FNFP spending of $70,196.32 (see Appendix C).

[16] The sector of employment is based on the 2002 North American Industry Classification System (NAICS).

[17] The census day was May 16th in 2006 and May 10th in 2011.

[18] This range in incomes depends on how long forestry workers were employed for and which aspects of forestry they were involved in.

[19] A degree of error is introduced in this estimation because Married Ratio '06 is in relation to the total population, while the 487.51 figure is the mean labour force population in 2006.

[20] As noted earlier, Vining and Richards (2016) use a CWB that includes per capita income and labour force activity. Consult their work for more information on incremental revenue as a well-being indication.

[21] The Aboriginal Forestry Initiative and the succeeding Indigenous Forestry Initiative that is currently in effect.

[22] For examples, see Wyatt et al.'s (2013) typology of the five main and 34 sub-types of collaborative arrangements.

[23] An example of an integrated approach and its challenges is featured in the 2020 work of Kohn et al. that developed a set of 41 indicators towards measuring Indigenous sustainability among the Bedouin tribes of Israel. These indicators were grouped into three areas: physical sustainable space such as access to drinkable water (11 indicators with a weighting of 30%), social and economic sustainable

space such as average wage (19 indicators also with a weighting of 30%) and mental sustainable space such as place and Indigenous tradition preservation (11 indicators with a weighting of 40%).

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