Master's Thesis of Graduate School of International Studies

Resource Dependence and Income Inequality

– Empirical Study on Canadian Local Economies –

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캐나다 지역 경제에 관한 실증적 연구

August 2019

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이 논문을 조하얀석사학위논문으로 제출함

2019 년 8 월

서울대학교 국제대학원

국제학과 국제통상전공

조하얀

조하얀의 석사학위논문을 인준함

2019 년 8 월

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The purpose of this quantitative study is to investigate the relationship between resource dependence and income inequality across ten Canadian provinces, and a potential role of fiscal transfer and income tax in weakening its relationship. While overall Canadian economy is described as relatively stable, regional economies have experienced significant hardships in maintaining its stability during commodity price bust – oil prices specifically. This led to the question of whether provinces that are more reliant on their natural resources have relatively less stable economy compared to their counterparts. There are many approaches to empirically assess the impact of resource dependence on economic growth and development – one of which is using income inequality as a development indicator. Previous literatures have shown evidence to support that resource dependent countries have shown higher income

inequality compared to others. Extending from this literature, this study uses provincial-level Gini coefficient to assess the impact of resource dependency in Canada. Moreover, this study uses three different types of Gini coefficient – based on market income, total income, and after-tax income – to see whether fiscal transfer and income tax plays a role in this relationship. The results show resource dependence leads to higher market income inequality, while mixed results are shown when fiscal transfer and income taxes are considered suggesting that fiscal transfer and income tax plays a role, albeit limited, in alleviating the effect of resource dependency on income inequality.

Keywords: Resource Dependence, Income Inequality, Canada, Regional-level Analysis

Student Number: 2017-25915

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I. Introduction

Some provinces in Canada are highly dependent on their natural resources. From 1997-2017, oil and gas extraction accounted for on average 34% of total GDP in Newfoundland and Labrador, 30% in Saskatchewan and 26% in Alberta. Comparatively, only one-digit percentage accounted for rest of the provinces, such as Ontario and Quebec. Alberta thoroughly enjoyed the blessing of their oil industry – so much so that Premier Ralph Klein announced and delivered $400 Prosperity Bonus to every individual who filed for taxes in Alberta[1] in 2005. This blessing, unfortunately, did not last. Alberta faced great economic shocks leading to massive lay-offs and worker-migration after the commodity price shock in late-2014. Canadian media outlets blamed the fall of oil prices as main reason for drastic economic downturn[2]. It put great stress on the labor force leading to a lingering question of whether Canadian government and its economy are readily prepared for the next fluctuation of commodity prices.

Several studies were conducted in response to this situation. One stream focused on analyzing the effect of resource dependence and its resource curse effect on the Canadian economy to understand the core reasoning of this fluctuation between resource blessing and resource curse. Empirical analyses showed mixed results in both cross-country and regional comparison (see Allcott and Keniston, 2018; Beine et al.,

[1] Harding, K. 2005. "Alberta to cut 'prosperity bonus' cheques." *The Globe and Mail,* September 13.
[2] Cattaneo, C. 2017. "100,000 jobless energy workers struggle for a place in the new economy." *Financial Times*, September 7.

2012; Debè and Polése, 2015). Another stream focused on other social queues – such as human development index, income inequality, and access to medical care – to find solutions that the government can action on to protect its people (see Carmignani, 2013; Easterly and Levine, 1997; Goderis and Malone, 2011; Gylfason and Zoega, 2003).

To expand on the first stream of studies, resource curse literature developed in diverse ways in dealing with heterogeneity, data availability, and endogeneity issues. First, heterogeneity issue arose in earlier studies where they conducted cross-country comparison between resource-rich versus resource-poor countries. These studies were conducted in response to lack of exponential economic growth in developing nations, such as Latin America and Africa, with abundance of natural-resources. The theoretical framework suggested that reliance on natural-resource production pulled assets away from manufacturing sector hindering the overall economic development (Torvik, 2002). However, it was criticized as it did not account for political and social differences between countries. With unique characteristics of each country, it was improbable to identify generalized framework. So to control for these issues, recent studies are conducted in a case-study format to find whether a particular country face natural resource curse.

Secondly, there is an issue of data availability. Parcero and Papyrakis (2016) indicated that resource-rich developing countries tend to report less of their economic changes leading to data availability issues. They argued that developing countries have tendency of higher corruption leading to false-reporting or leading elites to take advantage of public reporting (Ross, 2007). Meanwhile, more developed countries

collecting increasing amount of taxes are faced with higher accountability from its citizens for data collection and public reporting. This disruption to empirical analysis of resource curse literature led to narrowing down of geographical scope to local economies with similar data availability.

Lastly, there are endogeneity issues. For example, certain nations have more power over world oil prices compared to others. It is impossible to differentiate whether change in world commodity price is due to change in supply and demand or other factors, such as exchange rate appreciation from a price determinant country. Much of earlier studies uses change in exchange rate and change in GDP per capita as growth indicators based on the Dutch disease framework. However, natural resource price change does not account for hundred-percent of exchange rate volatility. Although Beine et al. (2012) was able to isolate the impact of commodity price on Canadian exchange rate – fully accounting for other influences – this is only possible because Canada has relatively small economy. The United States exchange rate volatility accounts for 76 percent of Canadian exchange rate volatility (Beine et al., 2012). This is not always true in every single country. It would be extremely difficult to isolate this complex calculation of exchange rate volatility making it less plausible to use exchange rate as an indicator for economic growth. In response to this issue, the recent literature uses other economic indicators such as income inequality, human development index, and political stability to account for economic development.

According to Bolton and Breau (2012), there is significant gap in income inequality differences between provinces in Canada. Provinces with relatively higher

income inequality are the ones that have relatively more natural resources. Following the paper by Carmignani (2012), this research looks at the relationship between resource dependency and income inequality. It considers the role of policies in easing the relationship by using three different types of Gini coefficient – based on market income, total income, and after-tax income, respectively – as an indicator for income inequality. In doing so, it hopes to lead better pathway for Canadian government to better prepare its natural-resource reliant provinces from world commodity price shocks.

The paper is organized as follows. Section II introduces existing literature on resource curse literature and its relations to income inequality. It also introduces characteristics of Canadian economy and regional resource dependency analysis within its border. Section III presents the data and the empirical approach for this study. Results are discussed in Section IV and Section V concludes.

II. Background

1. Development of the Resource Curse Framework

The resource curse framework was initially described through the term "Dutch Disease," first coined in *the Economist*[3] article in 1977. The article described how natural-resource discovery in Netherlands led to unforeseen negative side-effects. It illustrated that the export-reliant industries in Netherlands lost their price competitiveness in the international market due to exchange rate appreciation in response to exponential growth in the natural resource sector. Following this revelation, many scholars have been focused on establishing a framework in order to define Dutch disease as well as suggest appropriate steps to prevent the negative side-effects of Dutch disease (see Corden and Neary, 1982; Corden, 1984 ; Krugman, 1987).

Much of Dutch disease framework is highly based on Corden and Neary (1982). The framework divided an economy into three sectors: (1) a booming tradable sector, (2) a non-tradable sector, and (3) a lagging tradable sector. Subsequent to natural-resource discovery, an economy is exposed to Spending Effect and Resource Movement Effect (Corden & Neary, 1982). An economy is exposed to shocks from exogenous increase in the world price of the product of booming tradable sector as well as an exogenous positive productivity shocks affecting the sector as well (Corden & Neary, 1982). This would cause non-tradable sector to increase their price to match

[3] The Economist (1977). *The Dutch Disease*, pp. 82-83.

their newly increased domestic demand while the lagging tradable sector loses its price competitiveness in the international market and experience labor and capital movement to newly found booming tradable sector – crowding out the manufacturing sector.

In economic growth literature, it is a well-received fact that manufacturing sector allows for learning-by-doing and knowledge spill-over, which makes it an indicator for further economic development (Krugman, 1987). The crowding-out of manufacturing sector has been used as an indicator for deindustrialization of an economy. Krugman (1987) argued that the crowding-out effect must be permanent to cause deindustrialization of an economy. He argued that the Dutch disease only becomes a disease when the manufacturing sector does not rebound back after the resource boom (Krugman, 1987). Earlier studies uses this indicator to conduct cross-country analysis comparing oil-rich countries versus others. These initial studies are challenged with the following issues.

First, there is an issue of whether countries were comparable. Each country has different types of political regimes and unique economic development plans to meet their own needs. Moreover, some countries have more power over world commodity prices than others causing endogeneity issues. Due to this issue, the literature now either focuses on specific case or conducts within-country analysis (see Dubé and Polése 2015; Allcott and Keniston 2018; Fleming et al. 2015).

Second, there is an issue with the definition of what accounts for economic growth. The economic development literature itself is still underway in identifying its indicators (Harris, 2011). To deal with this issue, studies uses other economic

indicators, such as human development index, income inequality, political regimes, and others (see Carmignani 2013, for human development index; Parcero and Papyrakis 2016, for income inequality; Kim and Lee 2018, for regime types). Following section provides better picture of the relationship between income inequality and resource dependency.

2. Income Inequality and Economic Growth

According to Dahlby and Ferede (2013), there are two distinctive factors that influence income inequality in recent years. First, development of technology leads to boost in productivity. This means that the economy now needs more highly skilled workers. To meet the demand for highly skilled workers with limited pool, the income for highly skilled workers increased. Meanwhile, technology begins to replace the work of low skilled labor. There is larger pool of low skilled labor with decreasing demand leading to decrease in their income. This increases the wealth gap between highly skilled labor and low skilled labor. Second factor is globalization – "the increasing integration of economies through trade and finance has also raised demand for highly skilled workers in developed countries relative to lower skilled workers who perform routine tasks that can now be outsourced offshore" (Dahlby & Ferede, 2013).

The relationship between income inequality and economic growth is also complex. Theoretically, the relationship between income inequality and economic growth is indirect at best. Most framework assumes indirect impact of income inequality through its direct impact on human capital (Dahlby & Ferede, 2013). When

income inequality is great, low-income households tend to invest less on health and education, which increase their vulnerability to economic and political shocks (Ostry et al., 2014). Moreover, education has direct effect to the development of human capital. This pattern leads to unsustainable lagging economic growth.

There is also a question on whether income redistribution by government intervention helps economic growth. There are mixed opinions about this phenomenon. While redistribution would indeed help to reduce income inequality, others have argued that these measures may discourage high-income earning workers. In extreme cases, burden of income tax "can give rise to disincentives to work, save and invest"(Dahlby & Ferede, 2013). Hence, the government intervention can rather lead to slower economic growth. This emphasizes the importance of how a government should intervene to reduce income inequality. It will have to be able to reduce the income gap whilst not discouraging high-income population.

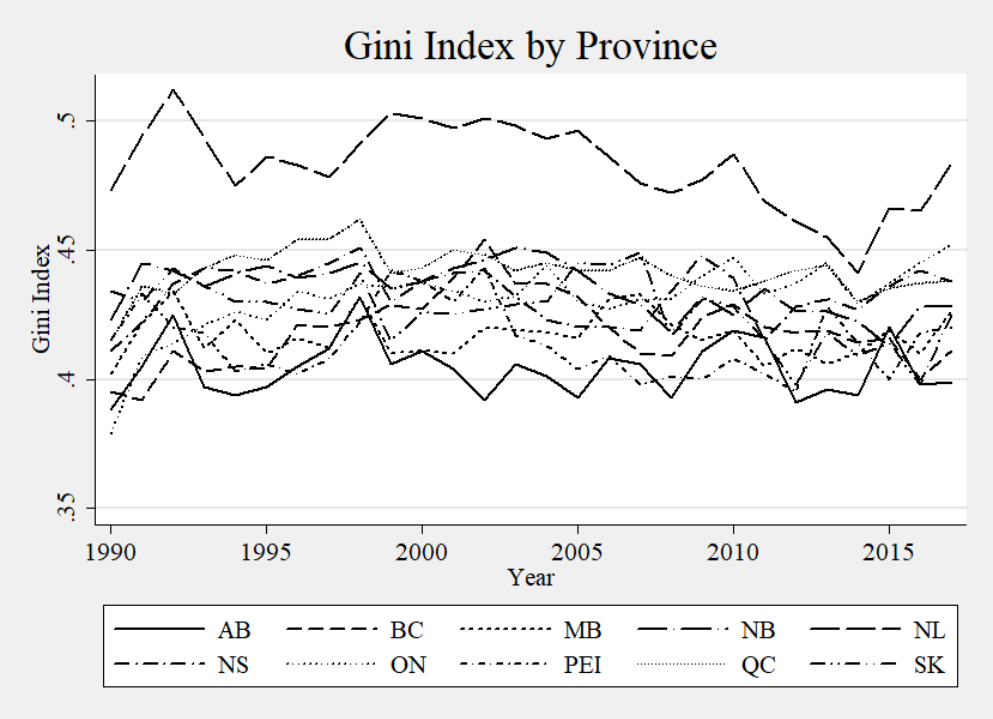
Ostry et al. (2014) conducted the first income inequality study using data set that distinguished market income inequality from net inequality, which considered both fiscal transfer and income tax. Their findings show that lower net inequality was related to more sustainable growth. However, they found that redistribution policies had insignificant impact on overall economic growth.

3. Resource Dependence and Income Inequality

Following the trend of using economic indicators in this literature, this paper has chosen income inequality as its economic growth indicator to assess Canadian provincial economies. Natural-resource curse literature has shown extremely mixed results as described above. Increasing literature suggest that resource dependence is neither good or bad; however, its impact on the economy depends highly on other factors, such as institutional quality, ethnic fractionalization, and labor quality (Carmignani, 2013). Income inequality can be used as transmission channel for resource dependence. Its role in health and education is already a documented fact under the health economics (Carmignani, 2013).

Much of studies on income inequality and natural-resource dependence are conducted under cross-country analysis. This is because Gini index created common ground for reporting countries allowing for cross-country analysis (see Gylfason and Zoega, 2003; Parcero and Papyrakis, 2016; Carmignani, 2013). However, this paper argues that this is also under the assumption that income inequality is similar within a country. It fails to acknowledge that there may be significant income inequality differences between regions which can be seen in Figure 1. Figure 1 shows trend of income inequality in each province.

<Figure 1> Market Income Gini Index by Province (1990-2017)



Source: Statistics Canada

Previous studies have shown mixed results under the cross-country analysis. Gylfason and Zoega (2003) and Leamer et al. (1999) suggested income inequality is much bigger in natural-resource-rich countries because labor force is less concentrated in manufacturing sector, which has higher potential for technological development. Schubert (2006) supported this relationship as well, arguing oil-dependence leads to underemployment of labor force causing long-term income inequality. Through 2SLS regression, Carmignani (2013) suggested that natural-resource dependence leads to higher income inequality; in turn, higher income inequality leads to reduction of

human development. Meanwhile, Parcero and Papyrakis (2016) revealed that there is lower income inequality in oil-rich countries up to certain threshold.

With these mixed cross-country results, Mallaye et al. (2015) proposed that the relationship between natural-resource curse and income inequality has different short-term and long-term outcomes. Goderis and Malone (2011) also supported this view. They argued that the short-term relationship is mainly due to labor movement effect between booming-tradable and lagging-tradable sector while the long-term relationship is driven by share of oil revenues in total income. Furthermore, Nademi (2018) conducted threshold regression for Iran and suggested an inversed U-shaped relationship between oil revenue and income inequality corresponding with Kuznets (1955) argument that there is larger income inequality beginning of development and it is reduced after certain threshold.

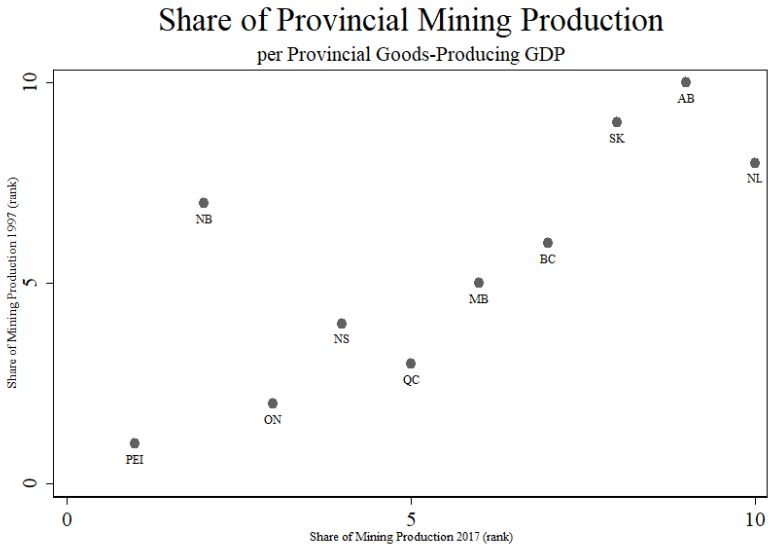
Henceforth, this paper makes its contribution to research on relationship between resource dependence and income inequality in local economies. Following section describes characteristics of Canadian economy that makes it ideal for this study.

4. Why Canadian Economy?

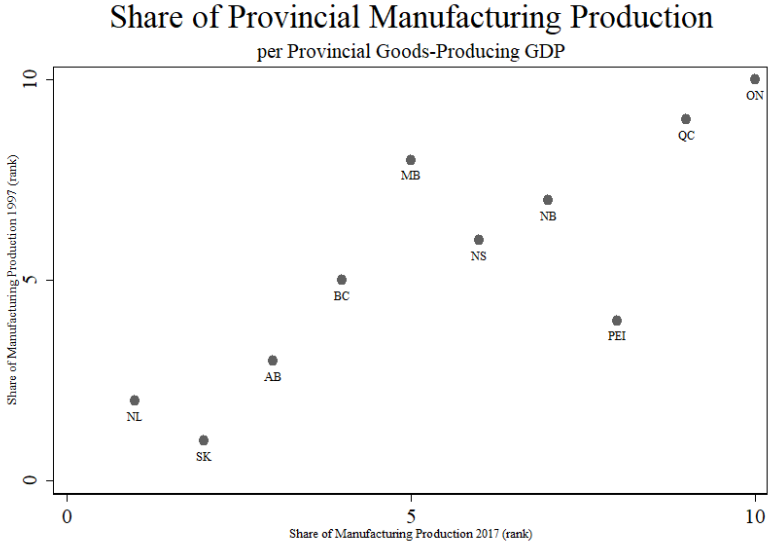
Despite its enormous land-size, Canadian economy is described as a small and highly dependent to American economy. Overall, it has shown relatively stable national economy throughout the Asian Financial Crisis of 1997 and the recent financial recession. However, like other economies, Canada does have its own problems. Organisation for Economic and Development (2008) reported that Canada showed the second-largest increase in income inequality from mid-1990s to mid-2000s. In response to increase in income inequality, many scholars have focused their research on identifying key factors contributing to unequal distribution of wealth (Bolton & Breau, 2012). These studies are mainly based national-level although there is significant difference in income inequality between Western Canadian cities compared to others (Bolton & Breau, 2012). One of the main reasons behind this disparities can be further explained by agglomeration of Canadian industries.

Canada's economic development relied heavily on its physical features in each region (Poleses, 2006). Naturally, Canadian economy follows Marshall's steps to agglomeration: (1) concentration of industries to achieve economies of scale, (2) pools of skilled labor meeting specific industry standards, and (3) knowledge spill-over effect (Baldwin et al., 2008). To make matters worse (or better), Canada is one of major producer of crude oil and other mineral goods exposing some provinces to world commodity price volatility. Figures 2-a and 2-b further corroborates this phenomenon in mining and manufacturing production, respectively. From 1997 to 2017, the mining production is concentrated in Western Canada. This makes provinces, such as Alberta

<Figure 2-a> Mining Production



<Figure 2-b> Manufacutring Production



Source: Statistics Canada

and Saskatchewan, to specialize in oil industries exploiting its natural-resource availability. As such, oil income is concentrated in these provinces making them the leading regional economies deriving overall Canadian economic growth (Cross, 2007). On the other hand, Ontario and Quebec were not bless with natural-resources but they had strategic geographical advantage. With close proximity to the American market and its technology, they have high concentration of manufacturing production (Poleses, 2006). In 2006, Alberta experienced investment growth of 21 per cent (Bolton & Breau, 2012). However, it also experienced 49 per cent greater income inequality compared to non-oil producing provinces (Cross, 2007). Naturally, one can question whether natural-resource income influence distribution income in these particular provinces.

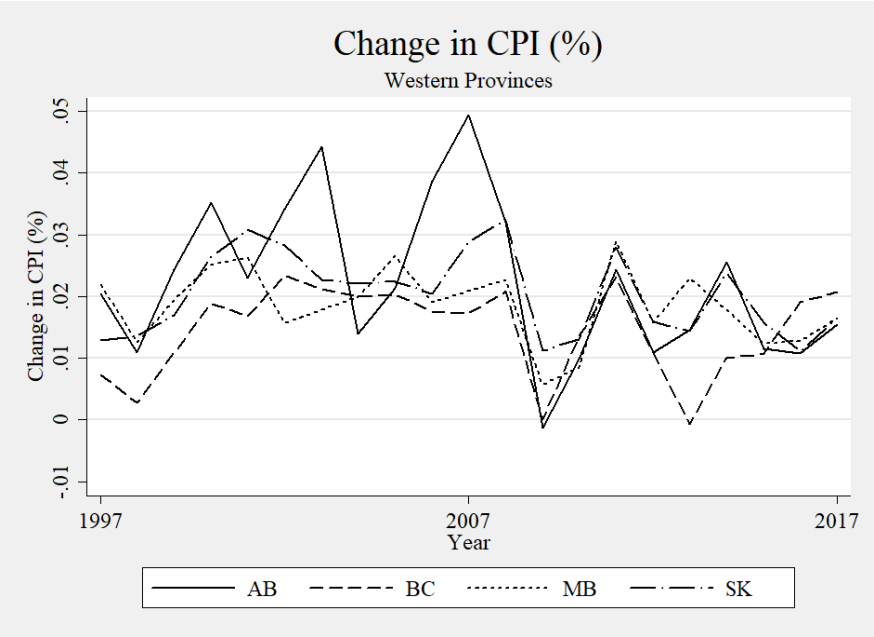
These unique regional characteristics make Canada suitable to conduct regional-comparison analysis. First, Canada has no price setting power, meaning world commodity price can be taken as exogenous. Second, there are potential bias explained in the introduction that can be avoided compared to cross-country analysis. Cross-country analysis carry possible endogeneity issues around the relationship between resource wealth and political regimes, economic policies, culture and other factors (Cust & Poelhekke, 2015). By focusing on regional studies, the endogeneity issue can be limited. Third, Canada's major source of labor is through foreign migration pool. While Canada proudly promotes its multiculturalism, some ethnic fractionalization is expected. The significance of this is explained in data section.

Signs of negative impact of resource dependence in Canada can be illustrated with simple descriptive statistics. In accordance with the resource curse Core Model's[4] Spending Effect, Figures 2 shows change in consumer price index from 1997-2017. They show relatively higher volatility in Western provinces compared to Ontario and Quebec. Alberta, the leading province for oil production, shows more volatility compared to other Western provinces. As Alberta received significant amount of investment to their oil sand, it boosted employment as well as billions of dollars in revenue to the provincial government (Poleses, 2006).

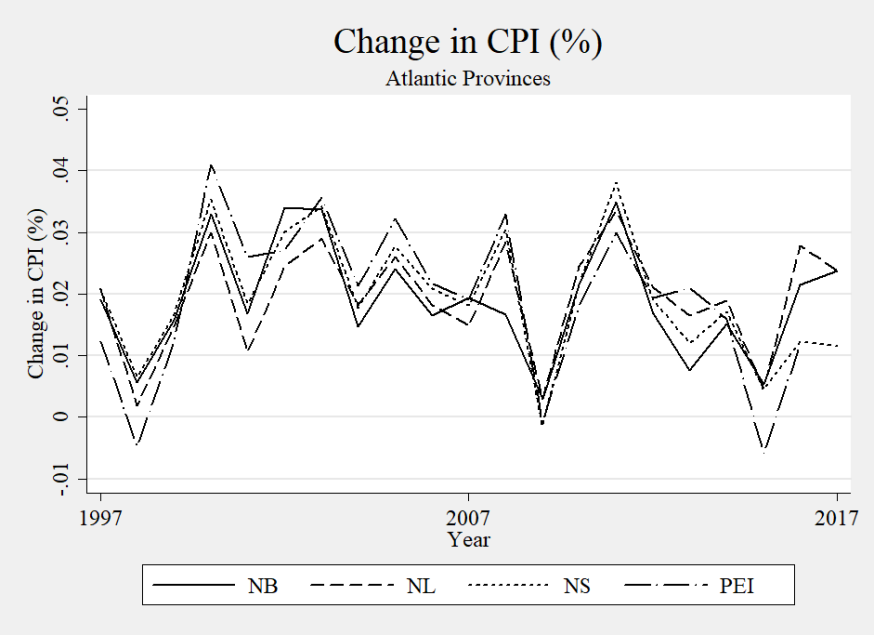
The Resource Movement Effect can be seen through inter-provincial migration patterns. Table 1 shows details of inter-provincial migration movements from the perspective of origin province in 1997-2017. Manufacturing-based provinces, Ontario and Quebec, have lost significant number of residents to the Western provinces. Atlantic Provinces have lost substantial portion of their residents to Alberta as well.

[4] Corden and Neary (1982)

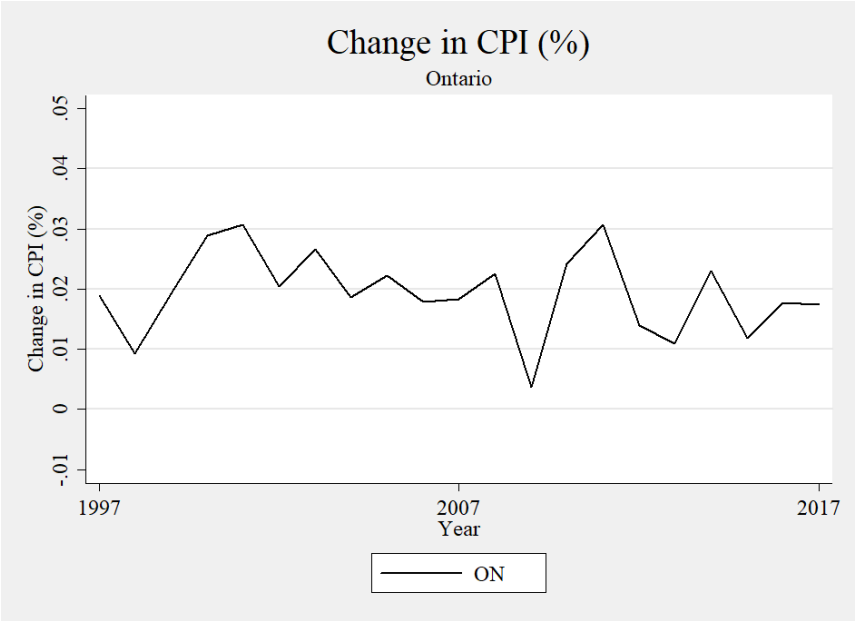
<Figure 3-a> Western Canada



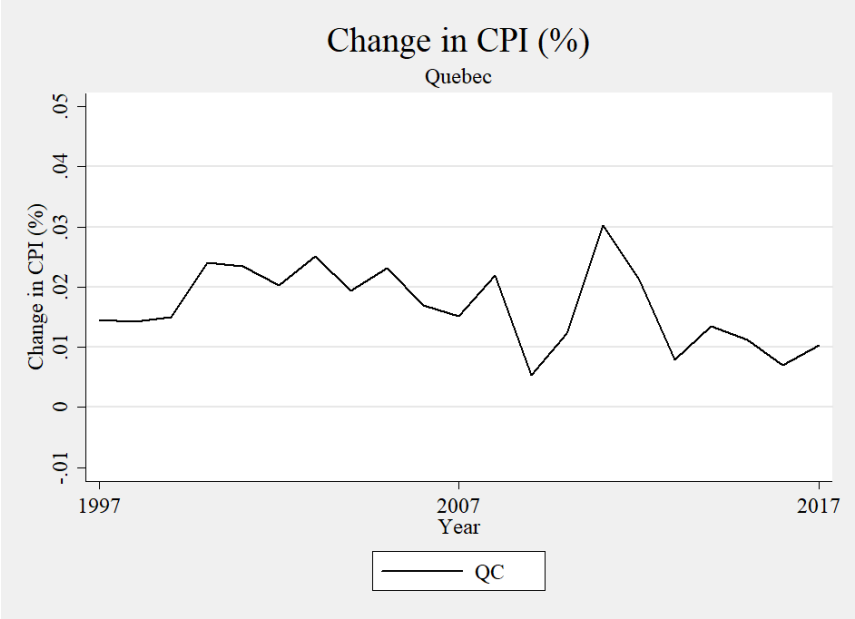
<Figure 3-b> Atlantic Canada



<Figure 3-c> Ontario



<Figure 3-d> Quebec



Source: Stiatistics Canada, Own Calculation

<Table 1> Interprovincial Migration, 1997-2007

Org	Dest	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
NF	**PE**	-133	-156	-87	-112	-52	-63	-74	-79	-24	-60	72
NF	**NS**	-836	-865	-756	-699	-745	-562	-382	-307	-139	-119	-78
NF	**NB**	-279	-333	-223	-306	-260	-70	-91	-15	-103	-81	-69
NF	**QC**	-12	42	47	-37	5	-19	11	-30	25	-44	-26
NF	**ON**	-2,696	-2,582	-2,150	-1,907	-318	-118	-24	43	575	797	1,034
NF	**MB**	-114	-86	-36	-52	-45	22	-87	-53	-37	-47	22
NF	**SK**	-200	-43	-2	-45	-67	-13	-58	-41	-87	-118	-7
NF	**AB**	-4,850	-1,718	-1,196	-1,243	-1,703	-697	-1,133	-2,966	-4,187	-4,139	-1,312
NF	**BC**	-281	108	226	22	-	-69	-48	-112	-247	-143	-129
PE	**NS**	-74	-27	31	3	52	-40	-24	112	-36	-61	14
PE	**NB**	-41	8	-2	54	23	-13	13	-38	-19	-110	-29
PE	**QC**	29	22	36	25	6	41	16	-7	21	27	11
PE	**ON**	-6	14	-74	-16	47	152	232	175	136	63	49
PE	**MB**	-12	12	18	-11	5	6	8	15	22	12	21
PE	**SK**	-18	-1	31	4	11	-8	-16	-16	-7	-11	-8
PE	**AB**	-414	-67	-70	-94	-138	-43	-150	-405	-653	-768	-337
PE	**BC**	-21	78	44	56	-4	29	-15	-56	-115	-39	42
NS	**NB**	313	195	111	-88	-208	83	-70	82	189	-109	-7
NS	**QC**	203	231	-72	-57	-36	-162	-134	27	24	7	25
NS	**ON**	-1,219	-931	-1,363	-1,852	-785	174	194	-146	530	247	-242

Org	Dest	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
NS	**MB**	-33	-38	40	23	-6	65	16	74	98	35	40
NS	**SK**	-123	89	130	-2	62	35	53	16	-45	-97	-65
NS	**AB**	-2,516	-598	-406	-892	-636	-366	-1,074	-2,724	-3,686	-4,101	-1,510
NS	**BC**	-72	378	553	150	104	170	-191	-504	-271	-157	-78
NB	**QC**	16	-209	-146	-372	-389	-517	-433	-227	-259	86	87
NB	**ON**	-1,096	-738	-1,069	-919	-472	-268	34	-25	-197	68	58
NB	**MB**	-30	-40	-17	-5	43	15	40	98	45	-26	68
NB	**SK**	-86	-35	-13	2	5	-5	-7	2	10	-35	29
NB	**AB**	-1975	-492	-269	-485	-903	-100	-403	-1,511	-2,813	-2,808	-1,153
NB	**BC**	-31	124	204	-61	79	69	-96	-324	-218	-203	-72
QC	**ON**	-12,136	-10,903	-10,949	-9,122	-4,093	-2,288	-412	-2,632	-4,255	-5,341	-4,982
QC	**MB**	-128	-130	16	47	41	167	18	85	104	-7	68
QC	**SK**	-76	22	-13	81	24	46	30	-5	-63	-215	-223
QC	**AB**	-2,694	-1,344	-1,060	-430	-691	-326	-566	-1,783	-3,967	-5,641	-5,343
QC	**BC**	-1,652	-618	-162	-437	-41	-84	-498	-833	-1,408	-1,496	-1,041
ON	**MB**	464	655	1,176	1,369	916	659	30	733	760	374	648
ON	**SK**	86	683	1,168	952	675	219	153	287	-98	-475	-953
ON	**AB**	-6,155	-1,356	925	644	-2,101	-1,494	-2,605	-9,026	-14,946	-17,968	-14,472
ON	**BC**	-2,456	1,499	3,274	1,783	288	-1,084	-4,442	-5,677	-6,434	-5,946	-3,893
MB	**SK**	1,988	2,115	2,313	2,202	2,293	2,324	2,118	2,005	1,792	1,554	1,737

Org	Dest	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
MB	**AB**	-3,808	-1,474	-2,162	-2,314	-2,777	-1,423	-1,553	-4,234	-4,551	-2,996	-1,333
MB	**BC**	-602	-242	-273	-917	-639	-650	-1,000	-1,943	-2,021	-1,771	-1,375
SK	**AB**	-3,851	-3,900	-6,110	-6,623	-7,122	-4,331	-3,465	-8,150	-6,752	437	2,727
SK	**BC**	500	206	-438	-515	-769	-339	-878	-1192	-1072	-305	67
AB	**BC**	15,126	13,162	11,337	8,431	9,558	2,780	-686	2,670	3,241	-4,712	-7,893

Source: Statistics Canada, Author's own calculation.

<Table 2> Interprovincial Migration, 2008-2017

Org.	Dest.	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
NF	**PE**	45	-	-	-	-7	4	31	-12	-32	-75
NF	**NS**	77	-1	13	180	88	-26	-48	-201	-484	-534
NF	**NB**	31	-83	-55	72	25	73	-58	-22	-113	-198
NF	**QC**	-10	19	-33	4	40	50	1	-10	-33	-134
NF	**ON**	1,566	1,016	740	850	755	589	400	47	-478	-930
NF	**MB**	58	66	47	24	62	10	61	31	27	-20
NF	**SK**	-7	-9	-32	-35	-36	-10	-3	21	-16	-26
NF	**AB**	-40	441	-790	-606	-384	-429	-115	478	-64	-1,536
NF	**BC**	153	54	98	8	-70	-86	-142	-104	-238	-244
PE	**NS**	-159	-101	-40	59	-58	-123	-89	-44	-55	-105
PE	**NB**	-106	62	-5	-15	-51	-38	21	51	49	112
PE	**QC**	4	54	28	18	-	12	29	30	24	39
PE	**ON**	-24	-43	-27	-151	-198	-127	-35	28	315	-408
PE	**MB**	20	22	5	-4	-2	6	16	8	-7	-4
PE	**SK**	-16	13	-3	-34	-8	-13	3	-9	9	52
PE	**AB**	-118	35	-94	-399	-545	-537	-441	112	86	1
PE	**BC**	-78	22	-70	-116	-28	-126	-149	-184	-7	-207
NS	**NB**	3	-52	-72	139	172	261	371	461	340	458
NS	**QC**	-25	-104	41	62	152	149	48	107	128	6
NS	**ON**	252	331	587	376	-174	363	-86	-269	661	713

Org.	Dest.	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
NS	**MB**	32	65	94	34	-7	139	64	-1	81	249
NS	**SK**	2	-41	16	-206	-171	-106	-96	82	110	195
NS	**AB**	-1,094	41	-838	-2,717	-3,253	-3,090	-2,407	591	663	-147
NS	**BC**	26	245	139	-246	-123	-373	-372	-433	251	455
NB	**QC**	-152	73	-84	76	68	116	33	89	163	-57
NB	**ON**	182	363	254	-54	-455	-320	-267	-667	48	-162
NB	**MB**	69	-55	76	-66	-22	-36	-22	24	34	64
NB	**SK**	33	-30	-14	-85	-151	-214	-43	-21	-57	-36
NB	**AB**	-522	166	-445	-1,343	-2,397	-2,407	-1,630	242	534	266
NB	**BC**	101	-35	-71	-129	-211	-322	-523	-270	3	182
QC	**ON**	-3,666	-2,415	-3,483	-4,332	-5,483	-7,228	-8,919	-8,123	-7,200	-7,085
QC	**MB**	24	22	50	94	-29	-4	-53	-58	69	301
QC	**SK**	-161	-181	-101	-116	-236	-256	-195	33	71	35
QC	**AB**	-2,916	-283	-1,049	-1,998	-3,642	-4,985	-4,778	-920	251	320
QC	**BC**	-805	-283	-144	-365	-707	-1,470	-2,012	-1,781	-934	-439
ON	**MB**	578	574	704	458	330	948	981	1,090	1,863	3,620
ON	**SK**	-1,893	-1,454	-1,287	-2,448	-1,779	-1,029	-172	1,172	1,760	2,530
ON	**AB**	-11,722	-2,425	-3,801	-10,798	-16,157	-16,789	-11,628	3,258	5,849	2,801
ON	**BC**	-4,121	-1,922	-1,383	-952	-1,599	-4,030	-6,556	-5,276	-2,567	941
MB	**SK**	1,539	1,630	1,535	1,580	1,327	1,454	1,564	1,486	1,491	1,459

Org.	Dest.	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MB	**AB**	-1,000	-483	-1,218	-2,129	-2,827	-3,221	-2,880	-1,024	-8,42	-2,280
MB	**BC**	-1,141	-1,161	-1,086	-1,135	-1,177	-1,994	-2,477	-2,480	-2,286	-2,438
SK	**AB**	828	946	-934	-1,762	-2,367	-2,729	-3,023	-815	-1,636	-4,041
SK	**BC**	-138	-621	-165	167	-355	-1,415	-2,222	-2,483	-2,208	-2,479
AB	**BC**	-3,894	-5,092	-889	5,361	6,359	569	-5,705	-13,371	-10,774	-3,549

Source: Statistics Canada, Author's own calculation.

III. Empirical Approach

1. Model Specification

The model for this study explores the association between income inequality and resource dependency controlling for other explanatory variables that have been found to be important in income inequality literature. It relies on cross-provincial panel data to draw empirical estimations for these underlying relationships. Table 3 lists variable descriptions, data source, and corresponding descriptive statistics. The empirical specification is of the following form:

$$Gini_{it} = \beta_1 Oil_{it} + \beta_2 Z_{it} + \varepsilon_{it}, \quad (1)$$

where $Gini_{it}$ is the Gini coefficient for province *i* at time *t*, Oil_{it} refers to the measure of oil dependence, Z_{it} is a vector of control variables associated with income inequality literature, , ε_{it} corresponds to the error term. The following section provides detailed data description.

2. Data Description

a. Dependent Variable: Gini Coefficient

Gini coefficient provided by Statistics Canada is used as the dependent variable in this study. Due to data availability, only the ten provinces are considered in the data set. Three different types of Gini coefficient are used: 1) Market Income, which is income before taxes and transfers, 2) Total income including government

<Table 3> Descriptive Statistics

Variables	Description and Data Source	Mean	St. Dev.	Min	Max
Gini Coefficient (Market Income)	Index calculated with income before taxes and transfers. Source: Statistics Canada (CANSIM 206-0033)	.4311	.0228	.3910	.5030
Gini Coefficient (Total Income)	Index calculated with income including government transfers. Source: Statistics Canada (CANSIM 206-0033)	.3391	.0179	.2800	.3780
Gini Coefficient (After-tax Income)	Index calculated with total income after taxes Source: Statistics Canada (CANSIM 206-0033)	.2985	.0168	.2500	.3410
Log Income	Log of GDP Source: Statistics Canada (CANSIM 379-0030)	10.7085	0.2677	10.2256	11.3239
Resource Dependence	Share of mineral output (NAICS: 21) to GDP Source: Statistics Canada (CANSIM 379-0030)	.1069	.1332	.0002	.4978
Log Resource Abundance	Share of resource output (NAICS: 21) per capita Source: Statistics Canada (CANSMI 379-0030)	7.4203	1.9418	1.9828	10.3672
Government Spending	General government expenditure including provincial and federal Source: Statistics Canada (CANSIM 384-0038)	.2600	.0716	.1407	.3990
Agriculture	Share of agricultural output to total GDP Source: Statistics Canada (CANSIM 379-0030)	.0329	.0237	.0080	.1134
Ethnic Fractionalization	Share of aboriginals and immigrants to total population (5-year term) Source: Statistics Canada (Census of Population)	.1479	.0932	.0183	.3399

transfers and before deduction of federal and provincial income taxes, and 3) After-tax income[5]. With stable institution, the study should see decreasing influence of natural-resource dependence on income inequality as government transfers and income tax are introduced in the equation. While this study does not attempt to assess the magnitude of this influence, it tries empirically to show that the government intervention do, in fact, help with income inequality issues. This also allows to see the quality of institutions in Canadian provinces.

b. Oil

Oil variable will represent resource dependence as a share of total mineral output per goods-producing GDP in each province *i* in time *t*. There is a debate on whether resource dependence is a good indicator to empirically calculate an economy's reliance to natural resources. According to Brunnschweiler and Bulte (2008), effect of resource dependence to economic growth is eliminated when dealt with endogeneity issues. They argued that "resource dependence appears as a symptom, rather than a cause of underdevelopment" (Brunnschweiler & Bulte, 2008). They further argued that resource dependence show indirect relationship to income growth rather resource abundance, share of mineral output per capita, shows direct effect on economic growth. In response to this argument, resource abundance is also be used to evaluate impact of natural resource industry on income inequality.

Previous studies have shown mixed results with this variable as discussed in

[5] Definition provided by: Statistics Canada, Table 11-10-0175-01 Gini coefficient of market, total and after-tax income.

the previous section. The influence of resource dependence may show negative relationship with income inequality, meaning resource dependence helps to reduce income inequality, if the country distributes its income equally (Parcero & Papyrakis, 2016). This may not be the case in Canada due to agglomeration of industries and privatization of oil industry. With oil income concentrated in specific provinces, the model is expected to show positive relationship between resource dependence and income inequality.

b. Control Variables

Several control variables are used to avoid omitted-variable bias. First, GDP per capita is used to control for development stages of each region. As mentioned in the literature review, there is potential inverse U-shaped relationship when dealing with income and income inequality. To control for each province's development, GDP per capita (in logs) is included as well as quadratic form of GDP per capita (in logs) to capture weight of Kuznets Curve. Parcero and Papyrakis (2016) found weak statistical support for quadratic form of GDP per capita – in lined with previous cross-country comparison studies. Nademi (2018) found stronger statistical support for this relationship within Iran. As Canada is fully developed country, it is expected to show strong positive coefficient for GDP per capita and strong negative coefficient for the quadratic form of GDP per capita supporting Kuznets Curve.

Amount of government spending to GDP is considered to control for the different sizes of each provincial government. According to Lee (2005), countries with

better institution showed lower income inequality as governments are more successful in redistribution of income. He argued that better institutional quality creates an environment where governments are more responsive to the lower class. Meanwhile, Nademi (2018) found opposite effect arguing that "an increase of government expenditure has a damaging impact on resource allocation and market efficiency, and so, it may decrease economic growth and employment, and therefore, inequality may increase". As Canada has shown some unconventional ways in dealing with extra oil income and redistribution, it is expected to see a negative coefficient for this variable.

The model uses share of agriculture in GDP because income from agricultural sector tends to be more equally distributed. Parcero and Papyrakis (2016) empirically showed negative relationship between the share of agriculture in GDP and income inequality supporting the argument that agricultural income is relatively equally distributed compared to other sectors. This study also expects this variable to show negative relationship to income inequality.

Finally, number of immigrants to total population by province is used to reflect ethnic fractionalization. Easterly and Levine (1997) argued there is greater income inequality in ethnically heterogeneous country as certain ethnic groups have relatively more political power. This could mean that the powerful group had more control over redistribution policies compared to others. As Canada is well-known for its multiculturalism and its economic dependence in immigration pool for labor source, this variable is expected to show negative coefficient reducing income inequality.

IV. Results

Table 4 shows the summary of regression results with market-income based Gini coefficient as its dependent variable. *Log Income* shows positive coefficient while the quadratic form shows negative coefficient supporting Kuznets Curve. The initial increase in income will increase income inequality up to a certain threshold, at which point income inequality will start to decline. The results show negative coefficient for *government spending, agriculture,* and *ethnic fractionalization* – indicating that these variables will reduce market-income inequality, which is as expected. Resource dependence shows statistically significant positive coefficient ranging from 0.16 to 0.19.

This is not the case for total income Gini coefficient shown in Table 4. After considering for fiscal transfer, resource dependency shows mixed results ranging coefficient from -0.01 to 0.02 and losing statistical significance. While fully assessing the relationship between fiscal transfer and resource dependency is difficult in this study, careful suggestion can be made on that fiscal transfer indeed affects how resource dependency influences income distribution.

Table 5 compares the regression results between market income, total income, and after-tax income Gini coefficient as its dependent variable, respectively. Although total income results show statistically insignificant results, it shows relatively smaller coefficient for resource dependence compared to results from market income based Gini coefficient. After-tax income shows even smaller coefficient for resource

<Table 4> Resource Dependence on Market Income Gini Coefficient

	(1)	(2)	(3)	(4)	(5)
Log Income	-0.0734***	2.405***	2.182***	1.779***	2.823***
	(0.00744)	(0.347)	(0.359)	(0.315)	(0.477)
Log Income (quad)		-0.115***	-0.106***	-0.0867***	-0.134***
		(0.0161)	(0.0166)	(0.0145)	(0.0217)
Resource Dependence	0.161***	0.172***	0.177***	0.190***	0.155***
	(0.0150)	(0.0135)	(0.0136)	(0.0119)	(0.0170)
Government Spending			-0.0681*	-0.0314	-0.0874*
			(0.0316)	(0.0277)	(0.0351)
Agriculture				-0.357***	-0.277***
				(0.0429)	(0.0474)
Ethnic Fractionalization					-0.0555**
					(0.0196)
Constant	1.200***	-12.14***	-10.83***	-8.669***	-14.37***
	(0.0785)	(1.871)	(1.951)	(1.710)	(2.615)
N	210	210	210	210	170
R^2	0.369	0.494	0.505	0.631	0.703

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

dependence compared to both market income and total income. Interestingly, when using total-income based income inequality, which accounts for both fiscal transfer and income tax, the resource dependence coefficient loses its significance. Concretely assessing the impact of fiscal transfer is difficult in this study – however, it will be interesting to see if lost in significance is due to fiscal transfer achieving its goal in redistributing oil income evenly across all provinces. Another explanation, in line with Brunnschweiler and Bulte (2008), may be that resource dependence data is not reliable to truly assess the impact of resource reliance on economic development. In response to this criticism, a result of the same regression using resource abundance is available in the Appendix. Resource abundance show consistency in reflecting worsening of income inequality regardless of how the Gini coefficient is calculated. This shows income redistribution may not be enough to overcome the influence of natural resources. Further evaluation will be required to assess the impact of fiscal transfer and income tax in redistributing income in Canada.

<Table 5> Comparison of Gini Coefficient Types

	(1) Market Income	(2) Total Income	(3) After-tax Income
Log Income	2.823***	0.424	-0.230
	(0.477)	(0.435)	(0.400)
Log Income (quad)	-0.134***	-0.0206	0.00964
	(0.0217)	(0.0198)	(0.0182)
Resource Dependence	0.155***	0.0255	0.0328*
	(0.0170)	(0.0155)	(0.0143)
Government Spending	-0.0874*	-0.146***	-0.119***
	(0.0351)	(0.0320)	(0.0295)
Agriculture	-0.277***	-0.221***	-0.191***
	(0.0474)	(0.0432)	(0.0397)
Ethnic Fractionalization	-0.0555**	0.0576**	0.0854***
	(0.0196)	(0.0179)	(0.0164)
Constant	-14.37***	-1.812	1.679
	(2.615)	(2.385)	(2.192)
N	170	170	170
R^2	0.703	0.611	0.632

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

V. Conclusion

Studies on negative impact of resource dependence on overall economic growth expanded in recent years as a reaction to bring sustainable economy to developing countries. Much of these studies are based on the Dutch disease framework (Corden & Neary, 1982), which had its difficulties in providing concrete empirical evidence to support these claims. As one of the ways to deal with this issue, recent studies have narrowed down its research to pin-point to exactly which economic growth factor is influenced by resource dependency.

This study follows one of those approaches by limiting its empirical analysis to resource dependence effect on income inequality in Canada. While income inequality does not directly impact economic growth, it definitely has direct impact on health and education quality of individual households – which, in turn, is known to have direct impact on economic growth. As local economies suffer extensively during commodity price bust, this study evaluates whether resource dependence has significant effect on income inequality indirectly leading to unsustainable economy. It also evaluates whether current fiscal transfer and income tax system is efficient enough to overcome the negative side effects of resource dependency. Overall, the results show resource dependence increase market income inequality while it shows mixed results when fiscal transfer and income tax are considered. It does, although limited, show that these government interventions do decrease the negative impact of resource dependency on income inequality.

While this study found limited evidence to assess the impact of government intervention in reducing income inequality, further studies are suggested to analyze the magnitude of these variables on alleviating the effect of resource dependency on income inequality. By doing so, it will be possible to empirically evaluate a country's fiscal transfer and income tax programs. In turn, this will provide stepping stone to deliver empirically supported framework to bring sustainable economy in resource dependent countries.

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Appendix

1. Market Income Inequality and Resource Dependence

	(1)	(2)	(3)	(4)	(5)
Log Income	-0.0734***	2.405***	2.182***	1.779***	2.823***
	(0.00744)	(0.347)	(0.359)	(0.315)	(0.477)
Log Income (quad)		-0.115***	-0.106***	-0.0867***	-0.134***
		(0.0161)	(0.0166)	(0.0145)	(0.0217)
Resource Dependence	0.161***	0.172***	0.177***	0.190***	0.155***
	(0.0150)	(0.0135)	(0.0136)	(0.0119)	(0.0170)
Institution			-0.0681*	-0.0314	-0.0874*
			(0.0316)	(0.0277)	(0.0351)
Agriculture				-0.357***	-0.277***
				(0.0429)	(0.0474)
Ethnic Fractionalization					-0.0555**
					(0.0196)
Constant	1.200***	-12.14***	-10.83***	-8.669***	-14.37***
	(0.0785)	(1.871)	(1.951)	(1.710)	(2.615)
N	210	210	210	210	170
R^2	0.369	0.494	0.505	0.631	0.703

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

2. Total Income Inequality and Resource Dependence

	(1)	(2)	(3)	(4)	(5)
Log Income	0.0476***	1.724***	1.098***	0.835**	0.424
	(0.00630)	(0.307)	(0.283)	(0.261)	(0.435)
Log Income (quad)		-0.0779***	-0.0511***	-0.0388**	-0.0206
		(0.0143)	(0.0130)	(0.0120)	(0.0198)
Resource Dependence	-0.0397**	-0.0318**	-0.0167	-0.00867	0.0255
	(0.0127)	(0.0120)	(0.0107)	(0.00985)	(0.0155)
Government Spending			-0.192***	-0.168***	-0.146***
			(0.0249)	(0.0230)	(0.0320)
Agriculture				-0.233***	-0.221***
				(0.0355)	(0.0432)
Ethnic Fractionalization					0.0576**
					(0.0179)
Constant	-0.167*	-9.191***	-5.501***	-4.095**	-1.812
	(0.0665)	(1.654)	(1.535)	(1.415)	(2.385)
N	210	210	210	210	170
R^2	0.268	0.361	0.505	0.591	0.611

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3. After-tax Income Inequality and Resource Dependence

	(1)	(2)	(3)	(4)	(5)
Log Income	0.0515***	1.347***	0.835**	0.623*	-0.230
	(0.00564)	(0.280)	(0.265)	(0.251)	(0.400)
Log Income (quad)		-0.0602***	-0.0383**	-0.0284*	0.00964
		(0.0130)	(0.0122)	(0.0116)	(0.0182)
Resource Dependence	-0.0480***	-0.0419***	-0.0296**	-0.0231*	0.0328*
	(0.0113)	(0.0109)	(0.0100)	(0.00947)	(0.0143)
Institution			-0.157***	-0.138***	-0.119***
			(0.0233)	(0.0221)	(0.0295)
Agriculture				-0.187***	-0.191***
				(0.0342)	(0.0397)
Ethnic Fractionalization					0.0854***
					(0.0164)
Constant	-0.248***	-7.222***	-4.202**	-3.070*	1.679
	(0.0595)	(1.507)	(1.437)	(1.361)	(2.192)
N	210	210	210	210	170
R^2	0.334	0.397	0.507	0.570	0.632

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4. Market Income Inequality and Resource Abundance

	(1)	(2)	(3)	(4)	(5)
Log Income	-0.0614***	1.888***	2.071***	1.827***	4.265***
	(0.00801)	(0.397)	(0.415)	(0.409)	(0.482)
Log Income (quad)		-0.0903***	-0.0983***	-0.0866***	-0.199***
		(0.0184)	(0.0191)	(0.0189)	(0.0221)
Resource Abundance	0.00893***	0.00893***	0.00916***	0.00860***	0.00547***
	(0.00110)	(0.00105)	(0.00106)	(0.00104)	(0.000968)
Institution			0.0533	0.0742*	-0.0816*
			(0.0363)	(0.0358)	(0.0395)
Agriculture				-0.203***	-0.131*
				(0.0559)	(0.0528)
Ethnic Fractionalization					-0.162***
					(0.0164)
Constant	1.022***	-9.484***	-10.55***	-9.267***	-22.44***
	(0.0796)	(2.141)	(2.255)	(2.219)	(2.632)
N	210	210	210	210	170
R^2	0.254	0.332	0.339	0.379	0.625

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5. Total Income Inequality and Resource Abundance

	(1)	(2)	(3)	(4)	(5)
Log Income	0.0131*	1.791***	1.150***	0.885***	0.354
	(0.00614)	(0.297)	(0.275)	(0.256)	(0.373)
Log Income (quad)		-0.0824***	-0.0545***	-0.0417***	-0.0177
		(0.0138)	(0.0127)	(0.0118)	(0.0171)
Resource Abundance	0.00345***	0.00344***	0.00265***	0.00203**	0.00331***
	(0.000847)	(0.000784)	(0.000699)	(0.000648)	(0.000748)
Government Spending			-0.186***	-0.163***	-0.145***
			(0.0240)	(0.0223)	(0.0305)
Agriculture				-0.220***	-0.173***
				(0.0349)	(0.0408)
Ethnic Fractionalization					0.0467***
					(0.0127)
Constant	0.174**	-9.410***	-5.701***	-4.308**	-1.404
	(0.0611)	(1.602)	(1.493)	(1.386)	(2.035)
N	210	210	210	210	170
R^2	0.290	0.396	0.532	0.608	0.647

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6. After-tax Income Inequality and Resource Abundance

	(1)	(2)	(3)	(4)	(5)
Log Income	0.0191***	1.446***	0.893***	0.667**	-0.163
	(0.00568)	(0.281)	(0.266)	(0.252)	(0.346)
Log Income (quad)		-0.0661***	-0.0420***	-0.0312**	0.00643
		(0.0130)	(0.0122)	(0.0116)	(0.0158)
Resource Abundance	0.00249**	0.00249***	0.00180**	0.00128*	0.00302***
	(0.000783)	(0.000740)	(0.000676)	(0.000640)	(0.000695)
Institution			-0.161***	-0.141***	-0.118***
			(0.0232)	(0.0221)	(0.0283)
Agriculture				-0.188***	-0.142***
				(0.0345)	(0.0379)
Ethnic Fractionalization					0.0680***
					(0.0118)
Constant	0.0755	-7.619***	-4.413**	-3.227*	1.315
	(0.0565)	(1.513)	(1.443)	(1.369)	(1.889)
N	210	210	210	210	170
R^2	0.310	0.387	0.503	0.566	0.660

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

<국문초록>

자원 의존과 소득 불평등:

캐나다 지역 경제에 관한 실증적 연구

조하얀

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본 연구는 캐나다 10개 주의 자원의존도와 소득불평등의 관계성 그리고 그 관계를 약화시키는데 있어 재정이전(fiscal transfer)의 잠재적인 역할에 대해 조사하였다. 비교적 캐나다 경제는 안정적이라고 알려져 있지만 지역경제는 물가폭락(commodity price bust)에 민감하게 반응하며 안정성을 유지하는데 상당한 어려움을 겪어왔다. 문헌검토를 통해 이미 자원의존도가 높은 지역이 보다 높은 소득 불평등을 보인다는 사실을 알 수 있었다. 본 연구는 재정이전(fiscal transfer)과 소득세의 역할을 평가하기 위해 시장소득(market income), 총소득(total income), 세후소득(after-tax income)에 근거한 세가지 유형의 지니계수(Gini Coefficient)를 불평등의 지표로 사용하였다. 결과적으로 자원의존성이 시장의 소득불평등을 증가시킨다

는 것을 보여준다. 하지만 재정이전(fiscal transfer)과 소득세를 고려하였을 때 소득불평등을 야기하는 자원의전도의 성질을 약화시키는데 제한적으로나마 영향을 미치고 있음을 알 수 있다.

주요어: 자원의존, 소득불평등, 캐나다, 지역연구

학　번: 2017-25915