NATURAL RESOURCES AND EDUCATION:

EVIDENCE FROM CHILE*

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Abstract

This paper empirically addresses how natural resource abundance affects educational attainment. Using within-country information for Chilean municipalities between 2000 and 2013, we exploit aggregate changes in natural resource exports and differences in local markets exposure to these changes to assess the question whether local specialization patterns may be related with educational outcomes. Our findings indicate that higher natural resource exports reduce educational attainment, in particular by discouraging young people to engage in tertiary education. The effect is robust and quantitatively important. Our findings are consistent with the idea that natural resource abundance may be detrimental for human capital accumulation.

* We thank seminar participants at University of Chile and Alberto Hurtado University for valuable comments and suggestions.

1. Introduction

Development strategies based on natural resources specialization have been historically controversial. Several decades ago, the ideas of Singer (1950) and Prebisch (1950) on secular deterioration of international prices of raw materials and commodities had a great impact on strategies followed by many countries in the developing world. A large number of less developed countries implemented an industrialization strategy based on import substitution that had profound effects on their economic performance (Edwards, 1993; Taylor, 1998).

More recently, the so-called *natural resources curse* has revived the old debate concerning the growth consequences of natural resource abundance. This debate was greatly influenced by the empirical evidence provided by Sachs and Warner (1995), showing that countries rich in natural resources experienced lower economic growth rates than poorly endowed ones. Later evidence provided by Sachs and Warner (2001), Gylfason (2001) and Kroneberg (2004) has confirmed the existence of a negative relationship between natural resource abundance and economic growth. The issue, however, remains in dispute. Some authors have analyzed the robustness of these results to alternative econometric techniques, while others have focused on explaining what are the factors underlying this negative relationship (Rodriguez and Sachs, 1999; Leite and Weidman, 2002; Lederman and Maloney, 2007; Hausmann and Rigobon 2003, Mehlmun, et. al. 2006; Hodler, 2006). Even, some recent evidence challenges the idea that natural resources are bad for economic growth (James, 2015; Smith, 2015).

A country's specialization in natural resources has been indicated not only as harmful for economic growth, but also as detrimental for human capital accumulation and income distribution. For example, Leamer et al. (1999) show that resource rich countries may exhibit a specialization pattern that increases income inequality. They argue that specialization patterns based on natural resources would explain why Latin America, a region highly abundant in natural resources, has one of the largest inequality around the world. The idea is that natural-resource-intensive sectors absorb the scarce capital in these economies, delaying industrialization. The absence of incentives to accumulate human capital increases inequality and hinders the surge of manufacturing industries that require skilled labor[1].

Based on this model, we analyze the relationship between natural resource abundance and educational attainment using municipality's information in Chile for the period 2000-2013. This setting is particularly interesting because Chile is an economy strongly dependent on natural resources and during this period – particularly for mining products – the country experienced a strong rise in exports. Given that these increases in commodity prices may be argued as mostly exogenous, we exploit ex-ante local differences in exposure to natural resource export growth to look at how educational attainment responded to changes in economic conditions. To be sure that

[1] Other important research is on the impact of factor endowments on institutions and growth. Engerman and Sokoloff (1997, 2000) have argued and presented evidence suggesting that differences in factor endowments were responsible for differences in development paths among new world economies. Acemoglu and Robinson (2001) also present evidence on this regard, but exploiting differences in settler mortality as source of variation in institutions quality.

we are capturing a true causal effect, we use an instrumental variables approach for the local relative demand associated with natural resource (NR) exports growth.

Several papers have explored the relationship between country specialization and factor endowments.[2] Few papers, however, have looked at the relationship between NR and education. Gyalfason (2001) presents cross-country evidence supporting a negative correlation between the importance of natural capital and several measures of education, such as secondary enrollment and public expenditure in education. Nevertheless, Stijns (2006) concludes that Gyalfason (2001) results are not robust. In fact, he finds a positive correlation between minerals abundance and human capital.

More recently, research has improved the assessment of endogeneity issues and has shown causal evidence about the relationship between export composition and skill acquisition. Blanchard and Olney (2015) estimate cross-country regressions and show how export composition affects educational attainment. Using an IV strategy based on gravity equations, they find that higher shares of the agricultural sector and unskilled-intensive manufactures regarding export composition reduce human capital accumulation. More related with our approach, Atkin (2015) analyzes within-country effects of exports growth in Mexico and finds that increases in manufacturing exports reduced skill acquisition. The evidence is consistent with the idea that manufacturing plants opening increased school dropout because manufacturing in Mexico is an unskilled-intensive activity. There are also other papers looking at similar issues. For example, Kruger (2007) looks at how variations at county-level value of coffee

[2] For a survey, see Harrigan (2003).

production in Brazil affects schooling decisions. She finds that poorer children were withdrawn from school, while richer children were not affected.

We contribute to this literature in three main dimensions. First, we focus on the recent commodity prices boom affecting a variety of primary exports in Chile. Second, we provide novel evidence on how educational attainment may be affected by transitory positive shocks – mostly – for a population of young people facing the decision of whether to continue studying or to enter into the labor force. Third, our paper relates the literature of within-country specialization patterns with the recent studies on local market effects of trade shocks (for example, Costa et al., 2014; Edmonds et al., 2010).

This paper is structured as follows. In section 2, we discuss the conceptual framework for studying specialization patterns and human capital accumulation. In section 3, we describe the data used and display descriptive statistics that motivate our research question In section 4, we present the methodology and identification strategy used. In section 5 we present our main results regarding the impact of NR on educational attainment and labor force participation, as well as robustness checks for our main results. Finally, section 6 concludes.

2. Factor-Endowment-Driven Specialization

In this section, we discuss the main implications of specialization patterns on human capital accumulation in an economy rich in NR. The theoretical framework is based on the Heckscher-Ohlin model, which argues that production and trade patterns are explained by differences in countries' factor endowments. This model predicts that a country has comparative advantages in those goods that use more intensively its more abundant productive factor. The basic model with two goods and two factors (capital and labor) is, however, too simple for discussing differences in development paths. In the simple version of the model, according to the Rybczynski theorem, capital accumulation increases output in the more capital-intensive good and it reduces output in the labor-intensive good. NR abundance plays no role in this model: all countries should follow the same development path, as capital accumulation changes the output mix from labor-intensive goods to more capital-intensive goods.

Leamer (1987) extends the traditional model to a case with three factors and *n* goods. In this context, it is possible to analyze in a richer way how countries with different factor endowments experience dissimilar development paths. One interesting feature of this model is that economies are located in different diversification cones, which are defined by the mix of products in which the economy specializes, which in turn are determined by the relative abundance of the three productive factors. Contrary to the previous model, Leamer's extension predicts different development paths depending on NR abundance.

In Figure 1, we illustrate the case of 2 factors and 3 goods. In panel A, using a Lerner-Pearce diagram, we show a "poor" capital economy specialized in apparel and textiles, and a "rich" capital economy producing textiles and machinery. The Rybczynski theorem predicts that capital accumulation in the poor economy increases output in textiles and reduces output in apparel. Further increases in capital will make the production of machinery profitable. At that point, this economy will stop producing apparel and will shift its specialization to more capital-intensive goods. Panel *b* illustrates changes in output of each good as long as the economy increases its capital per worker.

By introducing a third factor, Leamer (1987) shows that development paths will be different depending on the relative abundance of NR. The output mix of resource-rich economies will be different from that in resource-poor economies. Consequently, capital accumulation will generate transitions to different diversification cones across countries depending on NR relative abundance.

Figure 2 displays one specialization triangle suggested by Leamer (1987).[3] The corners of this triangle represent three factors of production: labor, NR and capital. Points inside this triangle represent both factor endowments of countries and factor requirements of productive sectors. Every endowment point and factor requirements located on a straight line emanating from one corner have the same ratio of the other two factors.[4] Movements in the direction of the corresponding vertex depicts an increase in the respective factor endowment. For instance, if a country originally located in cone A increases its capital endowment, it moves to cone B.

A resource-abundant country like Chile, for example, could be illustrated by an endowment point located in cone F, producing three goods (i) mining an agricultural products, (ii) wood, and (iii) food. In contrast, a labor-abundant country (for example,

[3] A more detailed discussion is presented by Leamer et al. (1999).

[4] For example, capital per worker used for producing one machinery unity value is higher than capital per worker used for producing one apparel output unit value.

China) would be located in cone A. Clearly, the output mix in both economies is very different.

The arrows in Figure 2 represent three different development paths. The bottom arrow illustrates the development path experienced by economies relatively scarce in NR. As long as they accumulate capital, they move from cone A toward cones B, C and D, reducing output in labor-intensive goods and increasing output in capital-intensive goods. An economy rich in NR follows a different development path, changing its specialization from cone E to F, G and D. Initially, these economies are specialized in primary agricultural and forestry products, and extractive mining. Capital accumulation is accompanied by changes in the specialization pattern to elaborated goods based on those NR that are more physical- and human-capital intensive (cone F). Only if these countries are able to make large increases in their capital endowments, they will produce machinery (cone D), a predominant sector in more developed countries.

There are two main messages from this model that we emphasize in this paper when looking at different regions (or municipalities in the Chilean context) within a country. First, different regions may be producing different products mix, with natural-resource-abundant regions more specialized in natural-resource-intensive products. Second, a higher specialization in NR reduces incentives to human capital accumulation because unskilled workers are relatively well-paid in resources intensive industries. Also, the no emergence of manufacturing industries in resource abundant regions – which are relatively more intensive in human capital – reduces the incentives to accumulate this factor.

These ideas have been contextualized in a microeconomic setting by Findlay and Kierzkowski (1983) and Blanchard and Olney (2015), where individuals must decide between studying and entering the labor force in a context of a two-sector economy with skilled and unskilled labor. When facing an exogenous increase in unskilled wages, more individuals decide to enter the market today instead of acquiring education and gaining a higher skilled wage in the future. In our context, we expect that regions experiencing a positive shock in NR industries will increase unskilled wages, encouraging the entry of young people to the labor market and, therefore, reducing average schooling of the relevant population. In aggregate terms, the suggested interpretation is that regions more exposed to NR shocks, possibly due to higher relative NR local abundance, will show slower patterns of human capital accumulation.

3. Data Description and Stylized Facts

In this section we describe the data used to analyze the relation between human capital accumulation and NR abundance. Then, we display some stylized facts that motivate the research question and the empirical strategy used in Section 4.

3.1. Data Description

Our main data source is the Chilean National Socioeconomic Characterization (CASEN) Survey. CASEN is a household survey applied since 1985 by the Chilean Social Development Ministry (MIDEPLAN) every two or three years. The survey has been used for computing Chile's socioeconomic statistics, in addition to assess the impact of different social policies and programs. CASEN's information is complemented with UN COMTRADE data regarding Chilean (NR and total) exports. NR industries considered are essentially agriculture, forestry, fishing and mining.[5]

We use six CASEN waves: 2000, 2003, 2006, 2009, 2011 and 2013. We focus in these waves for two reasons. First, municipalities' coverage in previous CASEN waves is significantly lower than more recent ones. This is important given that our empirical analysis is done at the municipality level. Second, we use the Chilean NR exports growth induced by the commodity prices boom as an exogenous shock for local labor markets. Since the boom began in 2003, the waves chosen comprise the relevant period.

We aggregate CASEN's household data at the municipal level using municipal expansion factors. A municipality (or commune) is similar to the concept of county: it may contain several cities and towns and is governed by a directly elected mayor (*alcalde*) and a group of councilors (*concejales*), for a period of four years. As municipalities are the smallest administrative units in Chile, their use constitutes the best way for approximating the concept of "local labor markets".

Data could have been alternatively aggregated at a higher level (provinces or regions). Nevertheless, working with municipalities not only increases the number of observations, but also constitutes a conservative strategy for assessing the research question: if larger administrative units are better to approximate local labor markets,

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[5] There were considered categories 01, 02, 05, 10, 11, 12, 13 and 14 of classification ISIC Rev. 3 as NR industries.

then it is less likely to find significant effects at the municipality level (for example, if people work and live in different municipalities within the same province or region). Thus, if existing, bias caused by the administrative unit used works against our results.

Table 1 gives an overview of CASEN's waves used. It also contains information about 1996's and 1998's waves to illustrate the municipality coverage issue. It can be seen that the dataset is an unbalanced panel, as municipal coverage varies along the years. Moreover, many communes surveyed in early waves were not valid for doing analysis at the municipality level, further reducing the available information. In concrete, a notorious difference regarding coverage exists between 1996's and 1998's waves and post-2000's waves. As it is explained deeply in the section 4, our empirical strategy needs some variables to be fixed in a base year, with the condition of being a pre-boom year. Due to the issues already mentioned, 2000's wave appears as the natural candidate for delimiting the period analyzed.

3.2. Stylized Facts

In order to motivate the research question and the subsequent empirical strategy, some empirical stylized facts are shown below. First, it is important to state that the commodity boom affected Chilean exports dynamics. Figure 3 shows NR exports' trend for the period analyzed. It can be seen that they grew considerably, not only in absolute terms, but also as a share of total exports. Between 2000 and 2013 the NR share increased from 25.6% to 34.2%.

Second, regarding local labor markets, we show evidence that municipalities differ in their exposure to NR external dynamics. Figure 4 shows the distribution of the share of labor force that is related with NR industries, for 2000 and 2013. It can be seen that, both in the beginning and in the end of the relevant period, there exists a considerable dispersion in the labor market exposure to NR dynamics. In 2013, the median labor share of NR industries was 26.1% and the first and third quartile were 11.8% and 42.0%, respectively. Therefore, it is reasonable to expect a differential impact, if any, of the commodity boom among the different municipalities.

Third, in average, municipalities with the higher labor market NR exposure appear to have less skilled labor force. Figure 5 shows that there exists a negative correlation between the share of total labor force employed in NR industries and the average years of schooling of the local total labor force. It is particularly interesting that almost all municipalities with labor forces showing average years of schooling above 12 (years of schooling corresponding to secondary education) are municipalities in which labor force related with NR industries is practically inexistent.

Finally, for our mechanism explored to be true, NR industries have to be more unskilled intensive than the rest of industries and, in addition, wages for unskilled workers must have grown faster in NR industries in the period analyzed. Figures 6 and 7 support the first issue: NR industries show lower shares of labor force with tertiary education and higher shares of labor force with only primary education. On the other hand, Figure 8 shows that average wages for unskilled workers in NR industries, as a proportion of average wages of the same population in other industries, have shown a positive trend in the period considered, especially for workers with secondary education.

4. Methodology and Identification Strategy

In this section, we describe the methodology and the identification strategy used to analyze the relationship between NR abundance and human capital accumulation. To illustrate the mechanism explored, consider the population between 17 and 20 years old, who faces the decision whether to continue studying or to enter the labor force. Many issues influence the decision, as for example demographic characteristics or local labor market conditions. Suppose that at the time of the decision, the relevant population is exposed to an exogenous increase in local demand for unskilled workers. This shock may encourage marginal agents to enter the labor force, thus affecting negatively their probability of continue studying. In aggregate terms, this should have impact on human capital accumulation.

Under the assumption that NR industries are particularly unskilled intensive, we want to test whether local NR relative abundance may be related with slower patterns of human capital accumulation by exploring the mechanism previously described. We use the commodity price boom as quasi-experimental variation which, through the exports channel, is expected to work as a local labor demand shock for exposed municipalities.

For doing that, we take advantage of the temporal distance between CASEN waves. As they are spaced by two or three years, we can see how the local NR labor market exposure affected human capital accumulation of the relevant population two or three years later. If local labor markets more exposed to NR dynamics made more young people enter the labor force instead of continue studying, then we should see lower average years of schooling due to an increase in labor force participation in populations between 20 and 23 years old in municipalities that were more exposed to the shock.[6] Then, the equation to estimate is

$$Y_{ct} = \alpha_c + \alpha_{rc} + \delta NR_{ct-k} + \beta X_{ct} + \varepsilon_{ct}$$

where Y_{ct} is the (log of) years of schooling of the relevant population (or, alternatively, the proportion of the relevant population participating in the labor force) of municipality c in year t, NR_{ct} is the employment share of NR industries of municipality c in year t (used as a measure of local labor market NR exposure), k is the temporal distance between CASEN waves, X_{ct} is a vector of control variables of municipality c in year t and α_c and α_{rt} are municipality fixed effects and region-year fixed effects, respectively. In vector X we include average demographic characteristics of the relevant population that may be affecting labor force participation decision (age, sex and household size), as well as other local labor market variables that were probably relevant at the time of the decision (local labor market size in other industries, measured by the (log of the) workforce related with other economic sectors; and the local returns for tertiary education, measured as the (log of the) average wage earned by local labor force with tertiary education).[7] The key parameter, δ, is expected to be negative (positive) when Y represents years of schooling (labor force participation) under the hypothesis tested.

[6] Between 2009's, 2011's and 2013's waves, temporal distance is of 2 years. Then, for that wave the relevant population are the people between 19 and 22 years.

[7] As local labor market variables follow the same logic regarding NR exposure, they are included lagged in regressions.

OLS estimation of equation (1) may be inconsistent due to NR potential endogeneity. Endogeneity concerns may be explained by two reasons. First, there are unobservable local conditions which may be simultaneously affecting NR labor demand and schooling/labor force participation decisions (for example, decisions made by the elected mayor, that may vary along the period and, therefore, are not captured by municipality fixed effects). Second, Rybczynski theorem raises reverse causality concerns, as human capital accumulation may reduce NR production and, therefore, induce a reduction in local labor demand.

To tackle this issue, we estimate equation (1) using two-stage least squares. Following similar previous literature (Bartik, 1991; Autor and Duggan, 2003, and Aizer, 2010), we compute a predicted local NR employment share using predicted local exports based on aggregate NR growth. The instrumental variable is calculated as follows,

$$IVNR_{ct} = \frac{\lambda_{c,2000}^{NR} \cdot X_t^{NR}}{\lambda_{c,2000} \cdot X_t},$$

where $\lambda_{c,2000}^{NR}$ is NR employment in municipality c over total national NR employment, $\lambda_{c,2000}$ is total employment in municipality c over total national employment, X_t^{NR} are NR exports in period t and X_t are total exports in period t, both measured in nominal dollars. The basic idea of our instrument is that an increase in NR exports (relative to total exports) will lead to an increase in the demand for unskilled labor, being this effect larger in more exposed municipalities. In that sense, our instrument seeks to approximate the concept of "local exports", that are supposed to be related with local demand for workers in NR industries. As we are working with Chilean total exports attributed to municipalities using initial relative importance of NR employment at the national level, it is plausible to assume that the instrument is exogenous to municipalities. On the other hand, Figure 9 shows that the instrument and our endogenous variable are highly correlated. This suggests that our instrument should comply the relevance condition.

All variables used in the estimations are shown in Table 2. In terms of our dependent variables, the average schooling years and participation rates are 11.8 and 0.59, respectively. The average NR exployment is 0.31, with a minimum of 0 and a maximum of 0.82.

5. Results

5.1 Basic Results

The results for the baseline OLS and IV regressions are shown in Tables 3 and 4 for schooling and labor participation, respectively. Standard errors are clustered at the municipality level in all specifications. For both variables, the OLS regressions show no significant relationship between NR exposure and the interest variables. However, the IV regressions show evidence consistent with the idea that a positive shock to NR exports incentives schooling dropout of young people. As it can be appreciated in Table 3, we find a negative and significant impact of NR labor demand on average schooling years of the relevant population. The effect is robust to the inclusion of several control variables. The quantitative impact is relevant considering that an increase in one standard deviation of NR labor share reduce schooling years by 22.9%.

In Table 4, we show the results for the impact of NR labor share on labor participation for people between 20 and 23 year-old. As we expect, the impact is positive and significant. This implies that larger labor demand in NR industries increases the participation rate of young people. According to the parameter, an increase in one standard deviation in NR labor share increase the participation rate by 8.6 percentage points.

We undertake several robustness checks by varying our sample. We exclude the metropolitan region, we use a balanced sample of municipalities, and we exclude municipalities with extreme NR labor shares. The results presented in Table 5 for schooling years and Table 6 for labor participation confirms our previous results. For all of these estimations, increases in NR labor share reduced schooling years and increased labor participation for young people.[8]

5.2 The Role of Migration

Given that people may migrate to municipalities with increasing labor demand associated with NR industries, and migration is expected to be mostly associated with unskilled workers, part of the reduction in schooling years and the increases in labor participation for people between 20 and 23 years-old could be explained by immigration issues instead of our mechanism proposed. This is important, as both mechanisms have differential impacts on human capital accumulation patterns.

[8] Statistical significance is slightly loss in some labor participation specifications. Nevertheless, point estimates are highly consistent with previous results.

To deal with this issue, we use information from CASEN survey. Since 2006, people is asked where were they living 4-5 years ago. Then, we define as immigrants those people who were not living in the same municipality before, and estimate our regressions excluding them for the same available survey years (2006-2013).

In Table 7, we present the results with migrants and without migrants for the available period. Baseline regressions considering the shorter period are consistent with previous findings, showing that increasing NR labor share reduced schooling and increased labor participation. Albeit being slightly lower in absolute terms, our findings holds when excluding immigrants: higher NR demand growth reduced schooling at young people and increased their labor force participation. These results suggest that the impact of employment opportunities on education does not seem to be only associated with unskilled immigrants towards local markets. Excluding migrants, our main results hold.

5.3 Impact of NR by Gender

We hypothesize that the impact of NR employment growth should be different by gender, considering that NR industries are relatively more intensive in men workers In fact, the ratio of women employed to total employment in NR industries is 0.14, while in the rest of industries is 0.40. Then, we test whether increasing NR labor demand has lower effects in women.

Our results, presented in Table 8, are consistent with this idea. We find that the parameter for NR labor share is lower – in absolute value – for women. An increase in one standard deviation in this variable reduce schooling by 19.8% in women and by in

25.9% in men. Estimations for labor participation indicate that the impact of NR is only positive and significant for men. An increase in one standard deviation in NR labor share increases men labor participation in 13 percentage points (average is 59%).

6. Conclusions

There is long debate on the impact of natural resources abundance on economic performance. One of the mechanisms suggested by the literature for the negative effects of natural resources is that reduce human capital accumulation and then economic growth. Nevertheless, yet there is a documented negative correlation between natural resources and education, the literature is not very abundant in showing evidence of a causal relationship.

In this paper, we have studied the relationship between NR exports and human capital accumulation using information of local communities in Chile during a period of strong growth of commodities exports and an IV strategy that exploits differences in local markets to changes in aggregate NR exports. In particular we look at the population between 20 and 23 year old that has previously faced a positive labor demand shock and must decide between studying or entering the labor force. For this young people, we find evidence than positive labor demand growth attributable to NR exports reduce their schooling year and increases labor participation. Our results are robust to several changes in the sample and to migration considerations. In addition, our findings are stronger for men, which it can be explained because this sector – compared to other industries – is less intensive in women.

Our evidence is consistent with implications of 3-factors and n-goods where different regions may be producing different products mix, with natural-resource-abundant regions more specialized in resource-intensive products. In this context, a higher specialization in natural resources reduces incentives to human capital accumulation because unskilled workers are relatively well-paid in resources intensive industries and resource abundant regions do not produce manufacturing good that are more human-capital intensive factors (Leamer, 1987). Then, our findings are useful to understand why there are large differences in education across locations in a country and how human capital decisions are affected by positive shocks in labor demand for unskilled workers.

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Table 1

Overview of CASEN Data

Wave	Number of Observations	Number of Households	Municipalities Covered	Valid Municipalities Covered
1996	134,262	33,636	204	124
1998	188,360	48,107	243	196
2000	252,748	65,036	304	285
2003	257,077	68,153	313	302
2006	268,873	73,720	335	335
2009	246,925	71,460	334	334
2011	294,741	86,397	324	324
2013	218,491	66,825	324	324

Source: CASEN Survey (MIDEPLAN).

Table 2

Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Av. Years of Schooling	1,400	11.80	0.93	7.90	14.88
Share of Labor Force	1,400	0.59	0.12	0	1
NR Exposure	1,400	0.31	0.20	0	0.82
Age	1,400	21.07	0.51	19.70	22.08
Sex	1,400	0.50	0.09	0	1
Household Size	1,400	4.74	0.50	2.96	6.88
LF (Other Sectors)	1,400	18,295.03	34,106.86	89	362,783
Average Wage (Tertiary)	1,389	3,916.04	3899.86	785.39	82,196.59

Source: CASEN Survey (MIDEPLAN).

Table 3

Main Results: Schooling

	Log(esc)-OLS	Log(esc)-OLS	Log(esc)-OLS	Log(esc)-IV	Log(esc)-IV	Log(esc)-IV
NR LF Share	-0.0578*	-0.0507	0.0128	-0.784***	-0.745***	-1.146***
	(0.0332)	(0.0322)	(0.0433)	(0.153)	(0.150)	(0.271)
Age		0.00342	0.00357		0.00534	0.00557
		(0.00959)	(0.00958)		(0.0101)	(0.0124)
Sex		0.0734***	0.0633***		0.0505**	0.0448
		(0.0211)	(0.0209)		(0.0237)	(0.0283)
Household Size		-0.0129**	-0.0152***		-0.0116**	-0.0139**
		(0.00552)	(0.00543)		(0.00545)	(0.00600)
LF (Other Sectors)			0.0235			-0.273***
			(0.0173)			(0.0743)
Log(W_Terc)			0.00704			0.00434
			(0.00465)			(0.00591)
Constant	2.516***	2.467***	2.179***	2.558***	2.475***	5.516***
	(0.0312)	(0.205)	(0.277)	(0.0358)	(0.209)	(0.891)
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F Test (CD)				56,477	55,881	39,389
F Test (KP)				46,364	44,447	23,135
Observations	1,400	1,400	1,389	1,400	1,400	1,389

Clustered standard errors at municipality level in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 4

Main Results: Labor Force Participation

	Share of Labor Force-OLS	Share of Labor Force-OLS	Share of Labor Force-OLS	Share of Labor Force-IV	Share of Labor Force-IV	Share of Labor Force-IV
NR LF Share	-0.00156	-0.0235	-0.139	0.453**	0.384*	0.432
	(0.0731)	(0.0706)	(0.0885)	(0.208)	(0.200)	(0.312)
Age		0.0661***	0.0577***		0.0650***	0.0568***
		(0.0202)	(0.0193)		(0.0186)	(0.0180)
Sex		-0.221***	-0.223***		-0.207***	-0.214***
		(0.0520)	(0.0503)		(0.0473)	(0.0467)
Household Size		0.0204**	0.0237**		0.0197**	0.0231***
		(0.00952)	(0.00936)		(0.00840)	(0.00828)
LF (Other Sectors)			-0.0540*			0.0922
			(0.0327)			(0.0851)
Log(W_Terc)			-0.00671			-0.00538
			(0.0100)			(0.00895)
Constant	0.445***	-0.886**	-0.0314	0.418***	-0.891**	-1.677
	(0.0566)	(0.413)	(0.536)	(0.0596)	(0.384)	(1.046)
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F Test (CD)				56,477	55,881	39,389
F Test (KP)				46,364	44,447	23,135
Observations	1,400	1,400	1,389	1,400	1,400	1,389

Clustered standard errors at municipality level in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 5

Schooling Years, Robustness Checks

	Exc. MR	Balanced Panel	Exc. Outliers
NR LF Share	-0.914***	-1.133***	-1.205***
	(0.212)	(0.275)	(0.286)
Age	-0.00739	0.00886	0.00673
	(0.0120)	(0.0128)	(0.0128)
Sex	0.0630**	0.0301	0.0468
	(0.0275)	(0.0282)	(0.0295)
Household Size	-0.0129**	-0.0156***	-0.0146**
	(0.00592)	(0.00602)	(0.00606)
LF (Other Sectors)	-0.246***	-0.271***	-0.288***
	(0.0655)	(0.0746)	(0.0776)
Log(W_Terc)	0.00568	0.00401	0.00354
	(0.00588)	(0.00602)	(0.00608)
Constant	5.443***	5.442***	5.674***
	(0.827)	(0.886)	(0.925)
County FE	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes
F Test (CD)	45,997	38,298	37,313
F Test (KP)	31,074	22,449	21,829
Observations	1,144	1,354	1,376

Clustered standard errors at municipality level in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 6:

Labor Force Participation, Robustness Checks

	Exc. MR	Balanced Panel	Exc. Outliers
NR LF Share	0.585**	0.388	0.487
	(0.297)	(0.312)	(0.332)
Age	0.0600***	0.0489***	0.0559***
	(0.0192)	(0.0178)	(0.0183)
Sex	-0.238***	-0.190***	-0.223***
	(0.0517)	(0.0449)	(0.0475)
Household Size	0.0160*	0.0237***	0.0234***
	(0.00943)	(0.00793)	(0.00829)
LF (Other Sectors)	0.148*	0.0774	0.106
	(0.0867)	(0.0849)	(0.0891)
Log(W_Terc)	-0.00573	-0.00473	-0.00372
	(0.00984)	(0.00889)	(0.00897)
Constant	-2.321**	-1.371	-1.823*
	(1.107)	(1.035)	(1.085)
County FE	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes
F Test (CD)	45,997	38,298	37,313
F Test (KP)	31,074	22,449	21,829
Observations	1,144	1,354	1,376

Clustered standard errors at municipality level in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 7

Schooling and Labor Force Participation, Excluding Migrants

	Log(esc)-IV	Share of Labor Force-IV	Log(esc)-IV	Share of Labor Force-IV
	Sample 2006-2013		Sample 2006-2013, exc. migrants	
NR LF Share	-0.836**	0.893	-0.693*	0.674
	(0.382)	(0.610)	(0.376)	(0.616)
Age	0.00790	0.0582***	0.0174	0.0531***
	(0.0116)	(0.0211)	(0.0111)	(0.0201)
Sex	0.0539**	-0.189***	0.0670***	-0.208***
	(0.0262)	(0.0567)	(0.0244)	(0.0546)
Household Size	-0.0123**	0.0223**	-0.0103**	0.0235**
	(0.00576)	(0.0106)	(0.00506)	(0.0103)
LF (Other Sectors)	-0.218**	0.249	-0.181*	0.171
	(0.108)	(0.169)	(0.105)	(0.172)
Log(W_Terc)	0.00170	-0.00406	0.00218	-0.00576
	(0.00675)	(0.0121)	(0.00641)	(0.0121)
Constant	4.843***	-3.497*	4.199***	-2.499
	(1.297)	(2.006)	(1.270)	(2.021)
County FE	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes
F Test (CD)	11,304	11,304	11,238	11,238
F Test (KP)	13,944	13,944	13,933	13,933
Observations	1,113	1,113	1,113	1,113

Clustered standard errors at municipality level in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 8

Schooling and Labor Force Participation by Gender

	Log(esc)-IV	Share of Labor Force-IV	Log(esc)-IV	Share of Labor Force-IV
	Women		Men	
NR LF Share	-0.992***	0.141	-1.297***	0.650*
	(0.287)	(0.464)	(0.324)	(0.366)
Age	0.00448	0.0594***	0.0206*	0.0404**
	(0.00949)	(0.0202)	(0.0107)	(0.0167)
Household Size	-0.0121***	0.00822	-0.0129**	0.0205**
	(0.00469)	(0.00999)	(0.00647)	(0.00984)
LF (Other Sectors)	-0.238***	0.0516	-0.314***	0.106
	(0.0769)	(0.125)	(0.0898)	(0.101)
Log(W_Terc)	0.00380	-0.00278	0.00431	-0.00556
	(0.00596)	(0.0134)	(0.00747)	(0.0115)
Constant	5.177***	-1.366	5.672***	-1.551
	(0.910)	(1.509)	(1.042)	(1.185)
County FE	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes
F Test (CD)	39,08	39,08	40,803	40,803
F Test (KP)	23,136	23,136	24,273	24,273
Observations	1,388	1,388	1,388	1,388

Clustered standard errors at municipality level in parentheses*** p<0.01, ** p<0.05, * p<0.1

Figure 1

Path of Development in a Two-Factors and Three-Goods Model

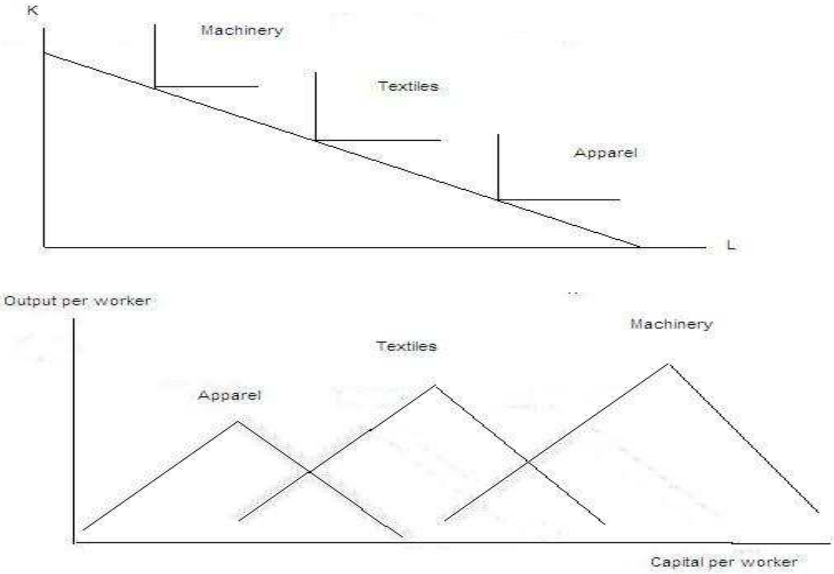


Figure 2

Path of Developments in Leamer's Triangle

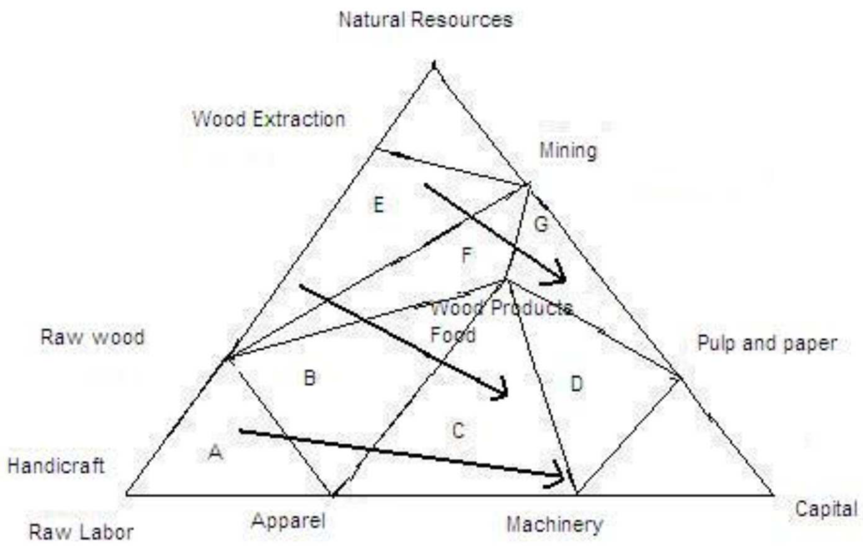
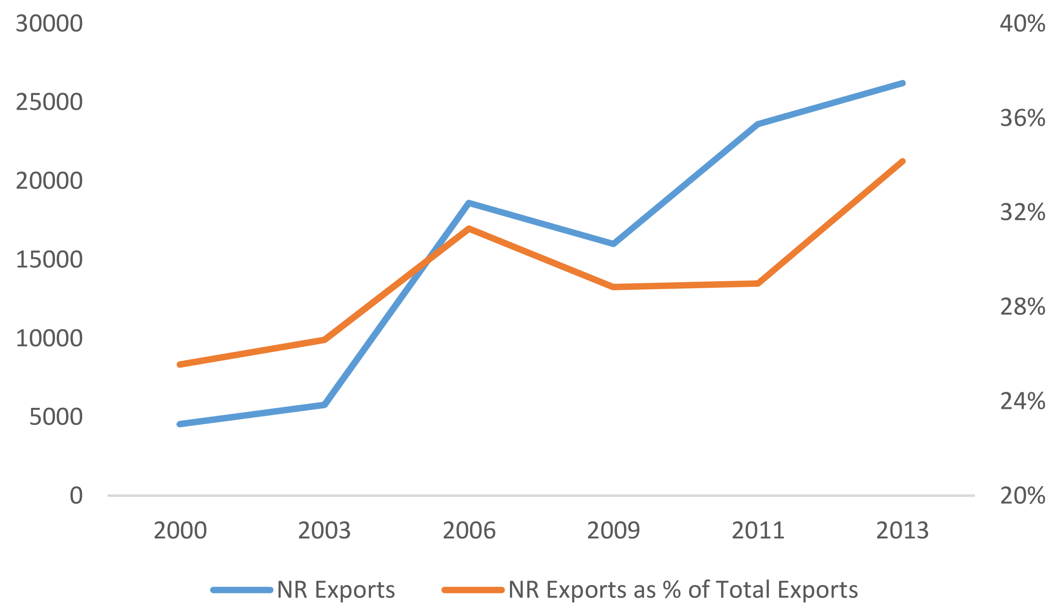


Figure 3

Evolution of NR Exports

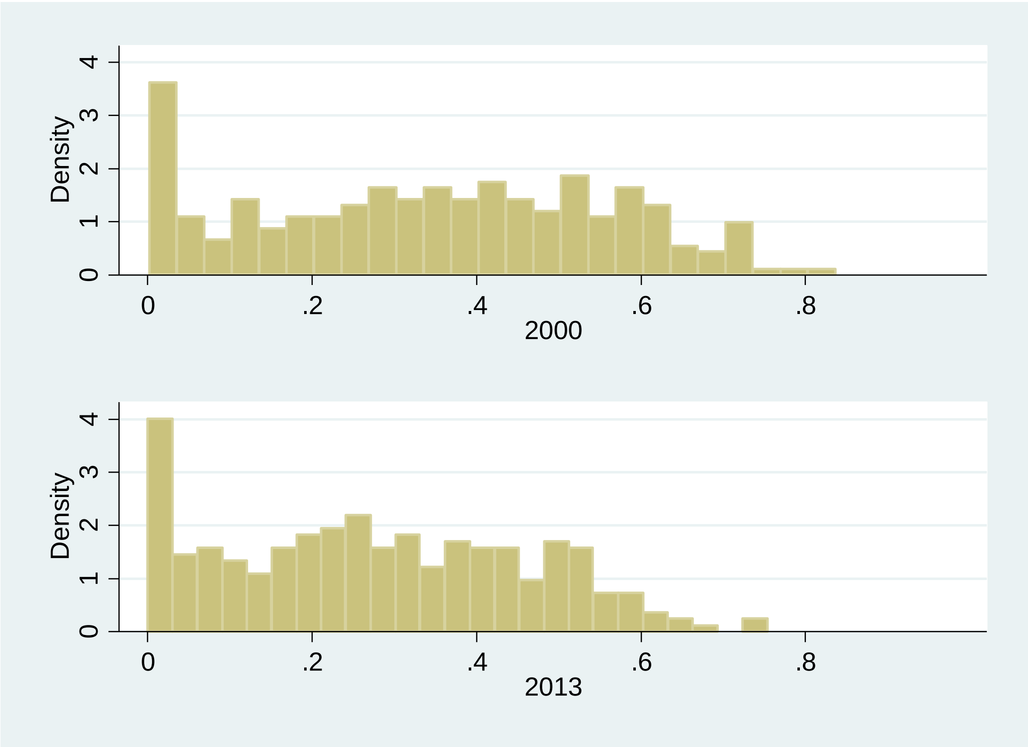


Source: UN COMTRADE Data. NR industries considered are agriculture, forestry, fishing and mining.

Left-y axis, associated with NR exports, is scaled in nominal millions of dollars.

Figure 4

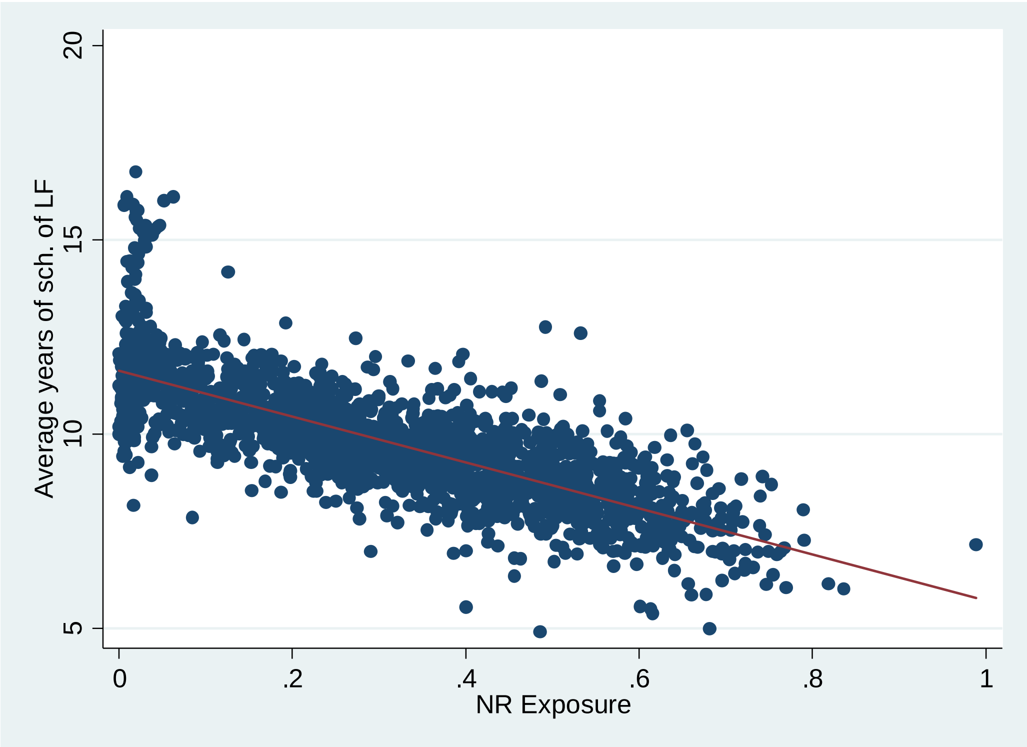
NR Labor Market across Municipalities



Source: CASEN Survey (MIDEPLAN). NR Exposure is measured as the share of local labor force working on NR industries (agriculture, forestry, fishing and mining).

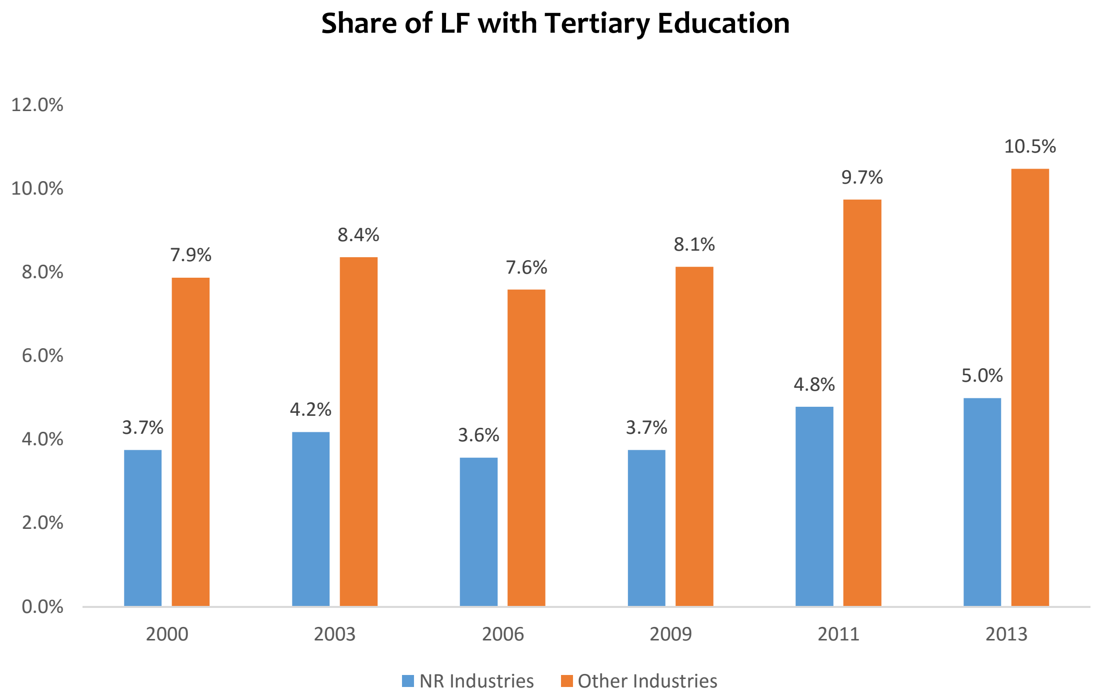
Figure 5

NR Exposure and Average Years of Schooling of Local Labor Force



Source: CASEN Survey (MIDEPLAN). NR Exposure is measured as the share of local labor force working on NR industries (agriculture, forestry, fishing and mining).

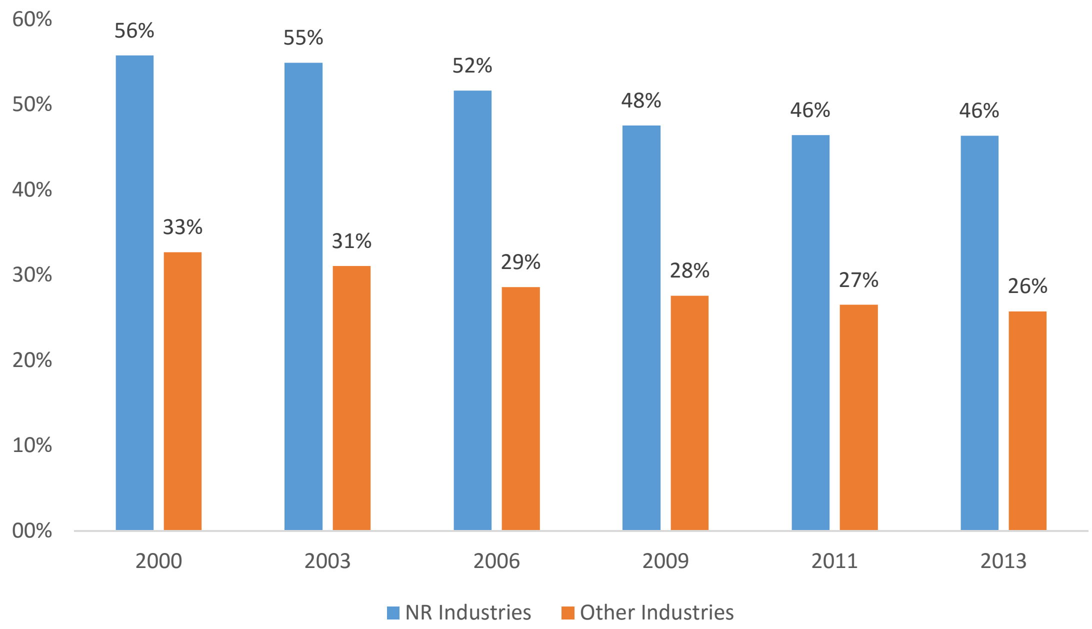
Figure 6



Source: CASEN Survey (MIDEPLAN). NR Exposure is measured as the share of local labor force working on NR industries (agriculture, forestry, fishing and mining).

Figure 7

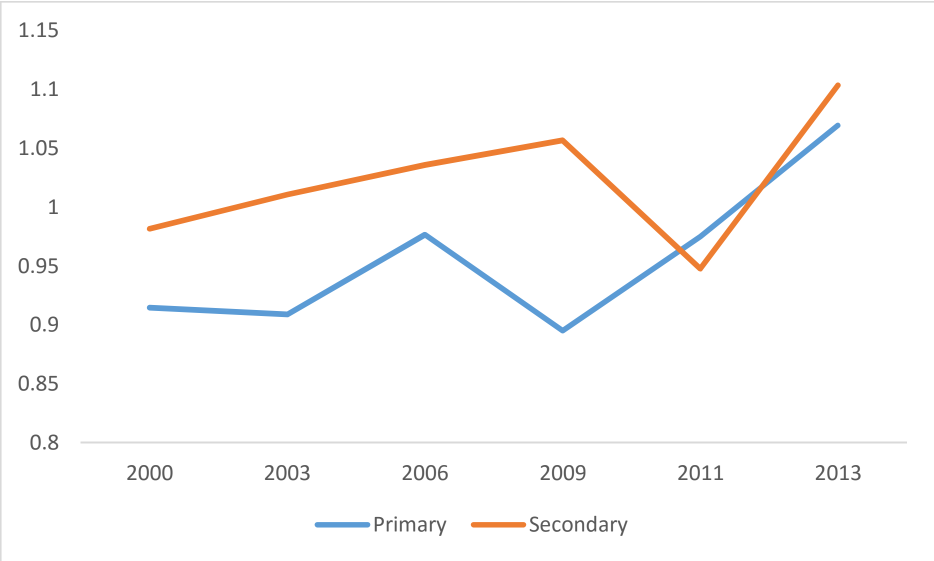
Share of LF with Primary Education



Source: CASEN Survey (MIDEPLAN). NR Exposure is measured as the share of local labor force working on NR industries (agriculture, forestry, fishing and mining).

Figure 8

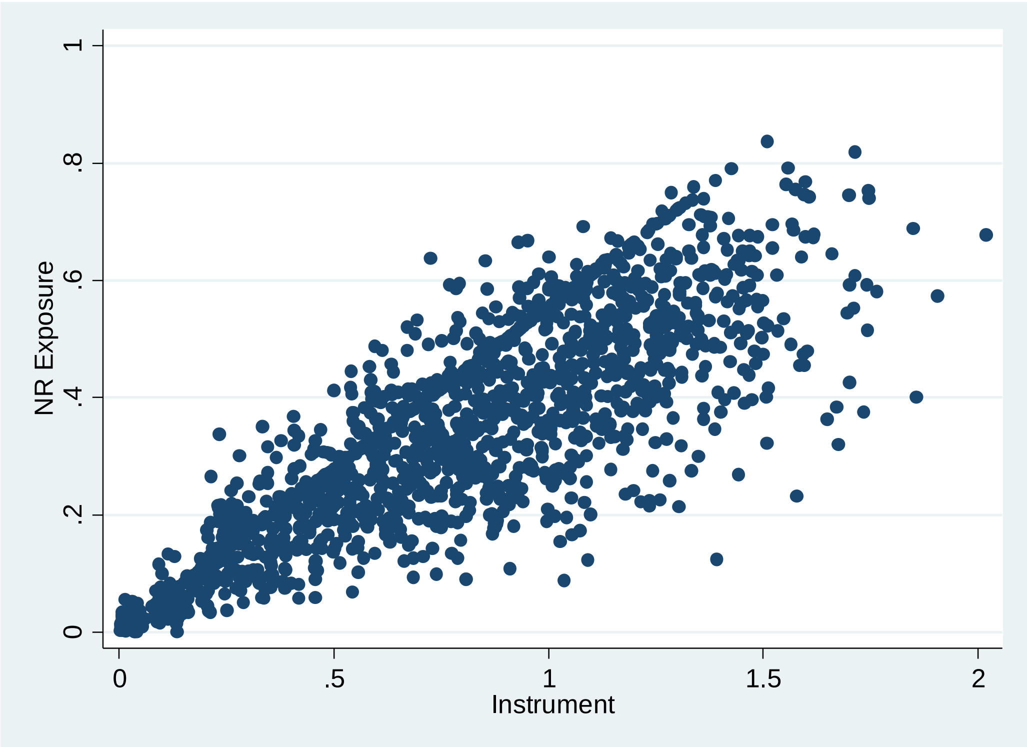
Relative Wages between NR Industries and Other Industries



Source: CASEN Survey (MIDEPLAN). NR Exposure is measured as the share of local labor force working on NR industries (agriculture, forestry, fishing and mining).

Figure 9

Instrument Relevance



Source: CASEN Survey (MIDEPLAN) and UN COMTRADE Data. NR Exposure is measured as the share of local labor force working on NR industries (agriculture, forestry, fishing and mining).