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Natural Resources and Education: Evidence from Chile

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NATURAL RESOURCES AND EDUCATION: EVIDENCE FROM CHILE*

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Abstract

This paper empirically addresses the relationship between natural resource abundance and educational attainment. Using 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 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 from tertiary education. The effect is robust and quantitatively important. Our findings are consistent with the idea that natural resource abundance may have positive effects in the short-run, but may be detrimental for human capital accumulation.

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1. Introduction

The development strategies based on natural resources specialization have been historically controversial. Several decades ago, the ideas of Prebisch (1950) and Singer (1950) on secular deterioration of international prices of raw materials and commodities determined the development strategy 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 resource curse* has revived the old debate concerning the consequences of natural resource abundance on economic growth and inequality. This debate was greatly influenced by Sachs and Warner (1995), who showed 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 Kronenberg (2004) has confirmed the existence of a negative relationship between natural resource abundance and economic growth. The issue, however, is far from being solved. Some authors have analyzed the robustness of these results to alternative econometric techniques, while others have focused on explaining the factors underlying this negative relationship (Rodriguez and Sachs, 1999; Leite and Weidman, 2002; Lederman and Maloney, 2007; Hausmann and Rigobon, 2003; Mehlun, et. al., 2006; Hodler, 2006).

Regarding the potential mechanisms behind this negative relationship, a country's specialization in natural resources has been indicated as also being detrimental for human capital accumulation and income distribution. For example, Leamer et al. (1999) find a cross-country negative correlation between net exports of natural resource-intensive goods and secondary enrollment, and a positive correlation with the Gini index. 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 indexes around the world. The idea is that natural-resource-intensive sectors absorb the scarce capital in these economies, delaying industrialization. The absence of incentives for accumulating human capital increases inequality and hinders the creation 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 level 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 the country experienced a strong rise in exports, particularly mining related ones. 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 ensure that we are capturing a true causal effect, we use an instrumental variables approach for the local relative demand associated with natural resource (NR) export growth.

Results suggest that NR abundance is detrimental for human capital accumulation: young people are more likely to choose against tertiary education and enter the labor market when they live in municipalities with labor markets highly exposed to NR dynamics. This negative relationship between NR exposure and educational attainment is found to be highly robust. As discussed later, the effect is heterogeneous across gender and family income.

[1] Other relevant research focuses on the impact of factor endowments on institutions and growth (Engerman and Sokoloff: 1997, 2000; Acemoglu, et al., 2001).

Several papers have explored the relationship between countries specialization and factor endowments.[2] Few papers, however, have looked at the causal 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 educational expenditures. Nevertheless, Stijns (2006) concludes that Gyalfason's (2001) results are not robust. In fact, he finds a positive correlation between mineral abundance and human capital.

More recently, research has improved the assessment of endogeneity issues and has shown causal evidence of 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 greater agricultural labor and unskilled-intensive export manufacturing reduce human capital accumulation. More closely related to our approach, Atkin (2016) analyzes within-country effects of export growth in Mexico and finds that increases in manufacturing exports reduced skill acquisition. The evidence is consistent with the idea that manufacturing plants increased school dropout rates because manufacturing in Mexico is an unskilled-intensive activity. There are other papers looking at similar issues. For example, Kruger (2007) looks at how variations at the county-level value of coffee 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 price boom affecting a variety of primary exports in Chile. Not much empirical

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

evidence exists of the consequences of this boom on human capital decisions in developing countries. Second, we provide novel evidence on how educational attainment may be affected by transitory positive shocks mainly for a population of young people facing the decision of whether to continue studying or to enter into the labor force. Third, our paper contributes to the literature of within-country specialization patterns looking at the local market effects of trade shocks (for example, Costa et al., 2016; 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 and extensions of our main results. Finally, Section 6 concludes.

2. Factor-Endowment-and Specialization

Based on Leamer (1987) and Leamer et al. (1999), we present the theoretical framework used to analyze the relationship between specialization patterns and human capital accumulation. The framework proposed is an extension of the Heckscher-Ohlin (H-O) model.

The H-O model argues that a country has comparative advantages in those goods that use its more abundant productive factors more intensively, thus predicting production and trade patterns based on countries' relative factor endowments. In the basic model — two goods and two factors (capital and labor) — the development paths are relatively simple and common across countries. According to the Rybczynski theorem, capital accumulation increases output in the more capital-intensive good and reduces output in the labor-intensive good. In this world, even in the n-goods model, NR abundance does not play a role in shaping comparative advantages. Every country should follow the same development path as capital accumulation increases, changing their output mix from labor-intensive to more capital-intensive goods.

In Figure 1, we illustrate the case of 2 factors and 3 goods. In panel A, using a Lerner-Pearce diagram, we show that an economy with lower capital to labor endowment is specialized in the production of the most labor-intensive goods: apparel and textiles. In contrast, a capital abundant economy produces textiles and machinery. In this model, the Rybczynski theorem predicts that capital accumulation in the poor economy increases textile output and reduces apparel output. Further increases in capital will make the production of machinery profitable. At some point, this economy will stop producing apparel and will shift its specialization to more capital-intensive goods. Panel B show the expected changes in output for each good as long as the country increases its relative capital abundance.

Leamer (1987) extends the H-O model to a more general case, where the economies are endowed with three factors (capital, labor and land) and produce n goods. In this context, it is possible to conclude that countries with different natural resource endowments, experience dissimilar development paths. Given these differences in endowments, the output mix of resource-rich economies will not be the same that the output mix in resource-poor economies. Consequently, capital accumulation will generate transitions to different diversification cones across countries depending on NR relative abundance.

In Figure 2, we show an example of the specialization triangles suggested by Leamer (1987).[3] The corners of this triangle correspond to the three factors of production: labor, NR and capital.

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

Points inside this triangle represent both countries' factor endowments and goods' factor requirements. Every endowment point and factor requirement 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 depict an increase in the respective factor endowment. For example, if a country originally located in cone A increases its capital endowment, it will move to cone B.

Consider a resource-abundant country like Chile. It may be illustrated by an endowment point located in cone F, producing three goods: (i) mining and agricultural products, (ii) wood, and (iii) food. In contrast, a labor-abundant country (China for example) would be located in cone A. Clearly the output mix in both economies is very different. Chile produces resource-intensive goods and China specializes in labor-intensive goods.

The arrows shown in Figure 2 represent three development paths. The bottom arrow illustrates the development path experienced by economies with relatively scarce 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 specialize 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

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

F). Only if these countries are able to greatly increase their capital endowments, will they produce machinery (cone D), a predominant sector in more developed countries.

There are two main takeaways from this model that we emphasize in this paper when looking at different regions within a country. First, different regions may have a different product mix, with NR abundant regions more specialized in NR intensive products. Second, a higher specialization in NR reduces incentives for human capital accumulation because unskilled workers are relatively well-paid in resource intensive industries. Also, that manufacturing industries — which require more skills — are less likely to emerge in resource abundant regions, reduces the incentives for increasing human capital

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 into the labor force in a context of a two-sector economy with skilled and unskilled labor. In this setting, 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 exposed population. In aggregate terms, the suggested interpretation is that regions more exposed to NR shocks, due to higher relative NR abundance, will have lower patterns of human capital accumulation.

3. Data Description and Stylized Facts

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

3.1. Data Description

Our main data source is the Chilean National Socioeconomic Characterization (CASEN) Survey. CASEN is a household survey given 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 assessing 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 agriculture, forestry, fishing, and mining.[5]

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

We aggregate CASEN's household data at the municipality level. 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*), who are up for election every four years. As municipalities are the smallest administrative units in Chile, we think that their

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

use constitutes the best way for approximating to the concept of “local labor markets” commonly used in this literature

We could have used information aggregated at a higher level (provinces or regions). However 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 for approximating local labor markets, then it is less likely we will 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, the bias caused by using this administrative unit works against our results. In any case, we also show estimations using province-level data.

Table 1 gives an overview of CASEN waves used. It also contains information about surveys carried out in 1996 and 1998 to illustrate how municipality coverage changed over time. It can be seen that the dataset is an unbalanced panel, as municipal coverage varies across years. It is clear that coverage is lower for the first surveys (1996 and 1998) in comparison with those starting at 2000. As explained in depth in Section 4, our empirical strategy needs some variables to be fixed in a base year, specifically a pre-boom year. Due to a higher coverage of municipalities, CASEN 2000 is an appropriate beginning year 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, the data shows that, on average, municipalities with the higher labor market exposure to NR industries appear to have a less skilled labor force. Figure 3 shows that there exists a negative correlation between the share of total labor force employed in NR industries and average years of schooling of the local total labor force. It is particularly interesting that almost all municipalities with average schooling above 12 years (i.e. having finished secondary school) are municipalities in which there is almost no NR industry labor force.

Second, it is important to note that the worldwide commodity boom affected Chilean export dynamics. Figure 4 shows NR exports' trends 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 export share increased from 25.6% to 34.2%.

Third, regarding local labor markets, we show evidence supporting the idea that municipalities differ in their exposure to NR exports boom. Figure 5 shows the distribution of the share of the labor force working in NR industries for 2000 and 2013. In the beginning and in the end of the relevant period, there exists a considerable dispersion in this variable. 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 of the commodity boom among the different municipalities.

Finally, for our mechanism explored to be true, NR industries have to be more unskilled labor intensive than other industries and, in addition, wages for unskilled workers must have grown faster in NR industries than others. Figures 6 and 7 support the first issue: NR industries have fewer workers with tertiary education and more with only a primary education. Additionally, Figure 8 shows that average wages for unskilled workers in NR industries, compared to other industries, have shown a positive trend in the period considered especially for workers with secondary education.

4. Methodology

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 a segment of the population who faces the decision whether to continue studying or to enter the labor force. In particular, we focus on those finishing the secondary education, which in the case of Chile is people mainly 17 and 18 years old.[6] Many factors may influence this decision such as 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 continuing their education. In aggregate terms, this should have an impact on human capital accumulation. Then fewer people will be enrolled in tertiary education, so average schooling years will be lower compared to the situation without positive shocks to unskilled employment.

Under the assumption that NR industries are particularly unskilled labor 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 boom as a quasi-experimental variation that, through the export channel, is expected to be a positive local labor demand shock for exposed municipalities.

We link local NR abundance, proxied by the share of the local labor force working in NR industries, with schooling and labor participation of the exposed population. In this particular case,

[6] Given that some people may delay this decision we consider the population between 17 and 20 years old. We check the robustness of our results to changes in the age groups considered.

given that CASEN survey is not yearly, we look at the impact of positive shocks in $t-s$ on schooling and labor participation in t where s is the number of years between surveys.[7]

We estimate the following equation:

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

where Y_{ct} is either the years of schooling (in logs) or the participation rate of the exposed population in municipality c in year t. NR_{ct-s} is a measure of local labor market exposure to NR dynamics in $t-s$. Given that we do not have information of local NR abundance, we use the employment share of NR industries for municipality c in year $t-s$. 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 affect labor force participation decisions (age, gender, 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).[8]

Given that exposed population is 17 to 20 years old when face the shock in $t-s$, and schooling and labor participation are measured in t, the age range for exposed population is (17+s, 20+s). The key parameter, δ, is expected to be negative (positive) when Y represents years of schooling (labor force participation) under the hypothesis tested.

[7] s is equal to 3 in the first CASEN surveys (2000, 2003, 2006, 2009) and equal to 2 in the two following surveys (2011, 2013).

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

The OLS estimation of equation (1) may be inconsistent due to NR potential endogeneity. Endogeneity concerns may be explained by two main reasons. First, there are unobservable local conditions which may be simultaneously affecting NR labor demand and schooling/labor force participation decisions. Second, Rybczynski theorem raises concerns regarding reverse causality in the sense that 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 previous literature (Bartik, 1991; Autor and Duggan, 2003, and Aizer, 2010), we compute a predicted local NR employment share based on information about aggregate NR exports and initial NR employment shares.

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 the NR employment share of municipality c over total national NR employment in $t = 2000$, $\lambda_{c,2000}$ is employment share of municipality c over total national employment in $t = 2000$, X_t^{NR} are NR exports in period t and X_t are total exports in period t, both measured in nominal dollars. As was previously argued, the commodity price boom may be considered an exogenous shock, which is translated to local labor dynamics through an exogenous increase in exports demand.

The basic idea of our instrument is that an increase in NR exports relative to total exports $\left(\frac{X_t^{NR}}{X_t}\right)$ will lead to an increase in the demand for unskilled labor, and that this effect will be larger in more exposed municipalities, i.e., those ones with initial higher relative employment share in NR industries ($\lambda_{c,2000}^{NR}/\lambda_{c,2000}$).

The instrument seeks to approximate the concept of "local NR exports," that are positively related with local demand for workers in NR industries. Thus, for example, if copper exports are growing in respect to total exports, there will be higher demand (and wages) for unskilled labor in the copper industry. This demand will be disproportionally larger for municipalities where relative demand for copper workers is higher.

There are two issues with our instrumental variables approach. First, the exogeneity assumption requires that our predicted demand for unskilled workers is not correlated with the error term, i.e. it is uncorrelated with other shocks affecting local labor demand. In our case, this is a reasonable assumption because aggregate NR exports and initial labor shares are likely to be uncorrelated with local specific shocks. It can be argued that it is very unlikely that local shocks affect aggregate NR exports. Moreover, in contrast to Bartik (1991), we use a different and plausibly exogenous variable (NR export growth) — not national employment growth — for predicting local employment share. Moreover, employment shares are pre-determined and plausibly not affected by future expected changes in NR exports. The implicit and reasonable assumption is that employment decisions were not taken in anticipation to changes in exports.

The second issue is about the correlation between the instrument and the endogenous variable. Figure 9 shows that the instrument and our endogenous variable are highly correlated. This suggests that our instrument satisfy the relevance condition. First-stage tests are reported in the following section and suggest that, in general, we do not have a problem of weak instrument

All variables used in the estimations are shown in Table 2. In terms of our dependent variables, average schooling years and participation rates for the exposed population are 11.8 and 0.59 respectively. The average age of the population is between 19.7 and 22.08 years. In terms of gender, the distribution between men and women is nearly equal. The average household size is almost 5 members. Regarding our main explanatory variable, the average NR employment share 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.[9] For both variables, the OLS regressions show no significant relationship between NR exposure and the variables of interest. However, the IV regressions show evidence consistent with the idea that a positive shock to NR industries labor demand incentives leaving school for the young. As it can be seen in Table 3, we find a negative and significant impact of NR labor demand on average schooling years of the exposed 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 (0.2) reduces schooling years by 22.9%.

Regarding the control variables, IV regressions show that the proportion of women in the segment of young population increases the schooling years and the average household size has

[9] Results are robust to clustering the standard errors at a higher level of aggregation (provinces).

the contrary effect. In the case of general employment conditions, we find that they tend to be correlated with lower schooling. In contrast, tertiary average wages do not affect schooling[10].

In Table 4, we show the results for the impact of NR labor share on labor participation for the exposed population. As we expect, the impact is positive and significant. This implies that a larger labor demand in NR industries increases the participation rate of young people, consistent with the dropout hypothesis. In the last column, the parameter of IV regression is not significant, but this happens when we introduce control variables that are not significant. Therefore, the loss of significance may be attributed to the higher variance induced by the inclusion of irrelevant variables. According to the parameter of this last specification, an increase in one standard deviation in NR labor share increase the participation rate by 5.2 percentage points.

The IV parameter is larger – in absolute value in the case of schooling – than the OLS estimation, suggesting that endogeneity generates an attenuation bias. Yet this bias may be originated by measurement error, which is plausible given that we do not measure labor demand from exports directly, we believe that the explanation comes from the fact that our data corresponds to the market equilibrium. When we use an instrument for changes in demand, the impact in labor supply is better identified. The effect along the supply curve should be larger than the change in employment equilibrium.

The rest of the variables generally show the expected results. The average age and household size are positively correlated with labor force participation. In contrast, a higher presence of

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[10] This result needs to be interpreted cautiously because, theoretically, the relevant variable is expected and not current tertiary wages.

women reduces entry into labor markets. This may reflect a lower sensitivity of female workers to temporary changes in unskilled labor demand.

We also present the first-stage estimation to check whether our instrument is weak or not. In general, the F-test is above 10, which generally (Staiger and Stock, 1997) would indicate that we do not have problem of instrument weakness. This finding is supported also by the Kleibergen-Paap test that usually rejects the null hypothesis of weak instrument.

5.2 Robustness Checks

We undertake several robustness checks by varying our sample in four main dimensions: (i) excluding the metropolitan region, because the concept of local labor markets may be less meaningful in a major urban area;[11] (ii) using a balanced sample of municipalities given that some of them are included only in the recent waves; (iii) excluding municipalities with extreme NR labor shares; and (iv) varying the exposed population considering segments of (16+s, 20+s) and (17+s, 18+s). We include students of 16 years old because they may be potentially thinking about their futures and, therefore, are susceptible to be affected by this shock. In the second, we reduce the exposed population to those who are supposed to be finishing the secondary education. This can be considered as the core group of the affected population.

The results presented in Table 5 for years of schooling, and Table 6 for labor force participation confirm our previous results. For all of these estimations, increased NR labor share reduces schooling years and increased labor participation for young people. Our main results are not sensitive to changes in the sample of municipalities neither to the definition of the affected young population.

[11] The capital city, Santiago, is located in the metropolitan region. In 2016, around the 40% of the population lived in this region.

We explore three additional robustness checks to ruling out the potential impact of migration, varying our definition of local labor markets, and considering the impact of unskilled demand growth from other industries.

5.1 The Role of Migration

Given that people may migrate to municipalities with increasing labor demand that can be associated with NR industries, and migration is mainly associated with unskilled workers, part of the reduction in schooling years and the increases in labor participation could be explained by immigration from regions with less job growth to those with more instead of the mechanism proposed. Therefore, it is important to isolate the potential impact of migration.

To deal with this issue, we use information about migration patterns included in CASEN survey. Since 2006, people is asked where were they living 4-5 years ago. Then, we define as immigrants in year t those people who were not living in the same municipality in year $t-4$ or $t-5$, for then estimating our regressions excluding them from the sample for the respective survey years (2006-2013).

In Table 7, we present the results with and without migrants for the available period. Baseline regressions — considering the shorter period — are consistent with previous findings, showing that increasing NR labor share reduces schooling and increases labor force participation. Although they are slightly lower in absolute terms, our findings hold when excluding immigrants. These results suggest that the impact of employment opportunities on education does not seem to be only associated with unskilled migration.

5.2 Provinces as Local Labor Markets

A higher level of aggregation in the survey is provided by the provinces, which are composed by several municipalities. A wider definition of local labor market allows us to remove potential concerns associated with the fact that people may live in one municipality, but may work in another. Thus we also estimate the model at this level of higher aggregation.

The results are shown in Table 8 for schooling and labor participation. For both variables the impact of increasing NR exports are as expected. The NR export boom is associated with lower schooling and higher labor participation. Our results show that the effect of NR exports is stronger than before as this specification captures the effect of people who live and may work (or study) in a different municipality. Then, our results are robust to define our variables at a higher level of aggregation.

5.3 Demand from Other Unskilled-Intensive Industries

It can be argued that the increasing demand for unskilled workers could be driven by higher demand from other unskilled-labor-intensive industries, which in turn may also be positively correlated with NR exports. For example, some industries could be selling inputs or services to NR industries and would expand jointly with the NR boom. In such a case, we would be overestimating the incidence of labor demand from NR exports. To address this issue, we include a variable capturing this additional demand driver for unskilled workers.

We calculate the average years of schooling for all industries in our sample and identify unskilled-intensive sectors as those with years of schooling lower than the 10th and 25th percentile of the distribution. Similar to the IV strategy, due to the potential endogeneity of this variable, we calculate the predicted increases in unskilled labor demand using aggregate employment and initial unskilled shares.

The results presented in Table 8 indicate that our results are robust to the inclusion of the demand for unskilled labor originating in other industries (low skilled demand). In general, the parameter for this variable is negative for schooling, but it does not change the result of the significant impact of NR labor share on schooling. We find something similar for labor participation. Thus we are confident that schooling and labor participation are affected by NR exports boom even after controlling for the demand originated by expansion of other unskilled-intensive industries.

5.4 Extensions

We analyze three extensions to the principal hypothesis in order to better illustrate the mechanisms underlying the relationship between schooling/labor market participation and NR industries labor demand. Concretely, we look at expected heterogeneous effects by gender, family income, and local supply considerations.

5.4.1 Differential Impact by Gender

We hypothesize that the impact of NR employment growth should differ by gender, considering that men are more likely to work in NR industries. In fact, the ratio of women employed to total employment in NR industries is 0.14 while for the rest of industries it is 0.40. If the schooling/participation decisions of young people were affected by increasing NR employment demand, we should find that the NR expansion had less effects on women.

Our results, presented in Table 9, are consistent with this idea. We find that the parameter for NR labor share regarding years of schooling is lower — in absolute value — for women. An increase in one standard deviation in this variable reduces schooling years by 19.8% for women labor force and by 25.9% in the case of men labor force. Our 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 male labor participation by 7.8 percentage points (the average is 59%).

5.4.2 Differential Impact by Family Income

It can be argued that the impact of NR expansion may differ by family income due to two complimentary reasons. First, poorer families may require the young members of the household to work to support the family, thus their schooling and labor force participation decisions may be independent of local labor demand shocks.[12] Second, given Chile's inequality, younger members of the richer families may not be sensitive to local demand shocks as their participation in tertiary education is almost taken for granted.

Our hypothesis is that a rise in unskilled worker demand would not affect young people in either poorer or richer families, but it can have a significant impact on the rest of the distribution. To test this hypothesis, we estimate the model by family income percentiles. We present the results in Table 10 for a panel of municipalities: family income in the first quintile (under the 20^{th} percentile), for those in intermediate percentiles (between 20^{th} and 90^{th}), and for families at the top of the income distribution (above the 90^{th} percentile). The coefficient for years of schooling is always negative, but is only significant for the young people with families in the middle of the

[12] For these families it may be more difficult to cover the costs associated with tertiary education. Although in Chile there are scholarships and credits for studying at universities and technical formation centers, additional expenses and the opportunity cost of studying can be very relevant for low-income families.

income distribution. In the same line, results show that the increase in labor participation is concentrated in the intermediate deciles, with the parameter now significant at 10%.[13]

5.4.3 Local Higher Education Supply

The impact of NR industries expansion may be different across municipalities depending on the educational supply conditions, i.e. depending on the availability of higher education institutions. For example, the exposed population may be more sensitive to labor demand shocks if there are not universities in its municipality, as engaging in tertiary education implies additional costs. Then, out hypothesis is that the increasing demand for unskilled workers will have a higher impact on municipalities without universities.

To test this hypothesis we include an interaction between the NR employment share and the number of tertiary education institutions in 2000 (before the export boom), measuring the number of institutions at both the municipality and province levels. The estimation results are presented in Table 11. Consistent with our hypothesis, the availability of higher education institutions attenuates the effect, but it remains statistically and economically significant.

6. Conclusions

There is a long debate on the impact of NR abundance on economic performance. One of the mechanisms suggested by the literature for explaining the natural resources' negative effects on economic growth is that they reduce human capital accumulation. Nevertheless, although there is a documented negative correlation between NR and education, there is little literature that has given evidence of a causal relationship.

[13] Given this result, an alternative explanation of the non-significant labor force participation estimates previously discussed is the existence of income heterogeneities of the dropout mechanism.

In this paper, we study the relationship between NR local labor markets and human capital accumulation on the municipality level in Chile during a period of strong growth in commodities exports using an IV strategy that exploits differences in local markets to changes in aggregate NR exports. In particular we look at the young population segment who faced a positive labor demand shock when they had to decide between continuing their education and entering the labor force. For this exposed population, we find evidence supporting the idea that positive labor demand growth attributable to NR exports reduces years of school and increases labor force participation rates.

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 NR sectors — compared to other industries — have fewer female workers. We also find expected heterogeneous effects depending on family income and tertiary institution availability.

Our evidence is consistent with the implications of the 3-factors and n-goods model where different regions may be producing different products mixes, with NR abundant regions being more specialized in resource-intensive products. In this context, a higher NR specialization reduces incentives for human capital accumulation because unskilled workers are relatively well-paid in resource intensive industries and resource abundant regions do not produce manufacturing goods that are more human capital intensive (Leamer, 1987). Thus our findings are useful in understanding why there are large differences in education levels 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

CASEN Data

Wave	Number of Observations	Number of Households	Valid Municipalities Covered
1996	134,262	33,636	124
1998	188,360	48,107	196
2000	252,748	65,036	285
2003	257,077	68,153	302
2006	268,873	73,720	335
2009	246,925	71,460	334
2011	294,741	86,397	324
2013	218,491	66,825	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
Participation	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
Male	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	34,106	89	362,783
Average Wage (Tertiary)	1,389	3,916	3,899	785	82,196

Source: CASEN Survey (MIDEPLAN).

Table 3

Main Results: Schooling

	OLS	OLS	OLS	IV	IV	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)
Male		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)
Log(LF Other Sectors)			0.0235			-0.273***
			(0.0173)			(0.0743)
Log(W_Tertiary)			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)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
First Stage (Instrument)				-0.473***	-0.472***	-0.300***
				(0.0694)	(0.0708)	(0.0624)
F Test (CD)				56.48	55.88	39.39
F Test (KP)				46.36	44.45	23.14
Observations	1,400	1,400	1,400	1,400	1,389	1,389

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

Table 4

Main Results: Labor Force Participation

	OLS	OLS	OLS	IV	IV	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)
Male		-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)
Log(LF Other Sectors)			-0.0540*			0.0922
			(0.0327)			(0.0851)
Log(W_Tertiary)			-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)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
First Stage (Instrument)				-0.473***	-0.472***	-0.300***
				(0.0694)	(0.0708)	(0.0624)
F Test (CD)				56.48	55.88	39.39
F Test (KP)				46.36	44.45	23.14
Observations	1,400	1,400	1,400	1,400	1,389	1,389

Clustered standard errors at the 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	16-20 yrs.	17-18 yrs.
NR LF Share	-0.914***	-1.133***	-1.205***	-1.142***	-0.808***
	(0.212)	(0.275)	(0.286)	(0.254)	(0.287)
Age	-0.00739	0.00886	0.00673	0.00827	0.0470**
	(0.0120)	(0.0128)	(0.0128)	(0.0101)	(0.0214)
Male	0.0630**	0.0301	0.0468	0.0396	0.0353*
	(0.0275)	(0.0282)	(0.0295)	(0.0312)	(0.0208)
Household Size	-0.0129**	-0.0156***	-0.0146**	-0.0127**	-0.0169***
	(0.00592)	(0.00602)	(0.00606)	(0.00576)	(0.00556)
Log(LF Other Sectors)	-0.246***	-0.271***	-0.288***	-0.270***	-0.208***
	(0.0655)	(0.0746)	(0.0776)	(0.0692)	(0.0757)
Log(W_Tertiary)	0.00568	0.00401	0.00354	0.00347	0.00844
	(0.00588)	(0.00602)	(0.00608)	(0.00547)	(0.00581)
Constant	5.443***	5.442***	5.674***	5.427***	3.970***
	(0.827)	(0.886)	(0.925)	(0.802)	(0.881)
Municipality FE	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes
First Stage (Instrument)	-0.370***	-0.297***	-0.298***	-0.300***	-0.303***
	(0.0664)	(0.0627)	(0.0637)	(0.0626)	(0.0613)
F Test (CD)	46.00	38.30	37.31	39.42	40.30
F Test (KP)	31.07	22.45	21.83	23.02	24.41
Observations	1,144	1,354	1,376	1,389	1,389

Clustered standard errors at the 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	16-20 yrs.	17-18 yrs.
NR LF Share	0.585**	0.388	0.487	0.387	0.547
	(0.297)	(0.312)	(0.332)	(0.282)	(0.437)
Age	0.0600***	0.0489***	0.0559***	0.0663***	0.0353
	(0.0192)	(0.0178)	(0.0183)	(0.0158)	(0.0451)
Male	-0.238***	-0.190***	-0.223***	-0.230***	-0.237***
	(0.0517)	(0.0449)	(0.0475)	(0.0527)	(0.0406)
Household Size	0.0160*	0.0237***	0.0234***	0.0290***	0.0248***
	(0.00943)	(0.00793)	(0.00829)	(0.00873)	(0.00932)
Log(LF Other Sectors)	0.148*	0.0774	0.106	0.0748	0.130
	(0.0867)	(0.0849)	(0.0891)	(0.0782)	(0.120)
Log(W_Tertiary)	-0.00573	-0.00473	-0.00372	-0.00716	-0.00806
	(0.00984)	(0.00889)	(0.00897)	(0.00869)	(0.0119)
Constant	-2.321**	-1.371	-1.823*	-1.729*	-1.709
	(1.107)	(1.035)	(1.085)	(0.956)	(1.585)
Municipality FE	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes
First Stage (Instrument)	-0.370***	-0.297***	-0.298***	-0.300***	-0.303***
	(0.0664)	(0.0627)	(0.0637)	(0.0626)	(0.0613)
F Test (CD)	46.00	38.30	37.31	39.42	40.30
F Test (KP)	31.07	22.45	21.83	23.02	24.41
Observations	1,144	1,354	1,376	1,389	1,389

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

Table 7

Schooling and Labor Force Participation, Excluding Migrants

	2006-2013, Full Sample		2006-2013, Exc. Migrants	
	Log (Esc)	LF Part.	Log (Esc)	LF Part.
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)
Male	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)
Log(LF Other Sectors)	-0.218**	0.249	-0.181*	0.171
	(0.108)	(0.169)	(0.105)	(0.172)
Log(W_Tertiary)	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)
Municipality FE	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes
First Stage (Instrument)	-0.214***	-0.214***	-0.214***	-0.214***
	(0.0574)	(0.0574)	(0.0572)	(0.0572)
F Test (CD)	11.30	11.30	11.24	11.24
F Test (KP)	13.94	13.94	13.93	13.93
Observations	1,113	1,113	1,113	1,113

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

Table 8

Additional Robustness Checks: Provinces as Administrative Unit and Low Skilled Sectors Labor Demand

	Province Level		Low Skilled Sectors (10%)		Low Skilled Sectors (25%)	
	Log (Esc)	LF Part.	Log (Esc)	LF Part.	Log (Esc)	LF Part.
NR LF Share	-1.049***	1.305***	-1.124***	0.458	-1.142***	0.431
	(0.269)	(0.411)	(0.269)	(0.315)	(0.269)	(0.311)
Age	-0.0194	0.122	0.00289	0.0579***	0.00544	0.0568***
	(0.0324)	(0.101)	(0.0126)	(0.0184)	(0.0124)	(0.0179)
Male	0.0118	-0.158	0.0435	-0.208***	0.0457	-0.215***
	(0.105)	(0.293)	(0.0282)	(0.0476)	(0.0282)	(0.0467)
Household Size	-0.0225*	0.0308	-0.0140**	0.0226***	-0.0137**	0.0230***
	(0.0129)	(0.0377)	(0.00596)	(0.00845)	(0.00599)	(0.00828)
Log(LF Other Sectors)	-0.0929	0.105	-0.271***	0.0984	-0.276***	0.0934
	(0.0570)	(0.0833)	(0.0748)	(0.0874)	(0.0748)	(0.0859)
Log(W_Tertiary)	-0.0164	0.0110	0.00381	-0.00440	0.00407	-0.00526
	(0.0177)	(0.0342)	(0.00591)	(0.00905)	(0.00590)	(0.00896)
Constant	4.307***	-3.416	32.24**	-26.36	43.25**	-17.78
	(0.982)	(2.399)	(13.83)	(18.98)	(18.59)	(24.68)
Low Skilled Demand			-2.666**	2.455	-3.709**	1.583
			(1.325)	(1.836)	(1.778)	(2.377)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
First Stage (Instrument)	-0.479***	- 0.479***	-0.299***	-0.299***	-0.301***	-0.301***
	(0.157)	(0.157)	(0.0623)	(0.0623)	(0.0617)	(0.0617)
F Test (CD)	12.12	12.12	39	39	40.08	40.08
F Test (KP)	9.29	9.29	23.09	23.09	23.88	23.88
Observations	248	248	1,367	1,367	1,389	1,389

Clustered standard errors at the municipality level in parentheses except columns 1 and 2 where standard errors are clustered at the province level. *** p<0.01, ** p<0.05, * p<0.1

Table 9

Schooling and Labor Force Participation by Gender

	Women		Men	
	Log (Esc)	LF Part.	Log (Esc)	LF Part.
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)
Log(LF Other Sectors)	-0.238***	0.0516	-0.314***	0.106
	(0.0769)	(0.125)	(0.0898)	(0.101)
Log(W_Tertiary)	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)
Municipality FE	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes
First Stage (Instrument)	-0.299***	-0.299***	-0.306***	-0.306***
	(0.621)	(0.621)	(0.0620)	(0.0620)
F Test (CD)	39.08	39.08	40.80	40.80
F Test (KP)	23.14	23.14	24.27	24.27
Observations	1,388	1,388	1,388	1,388

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

Table 10

Schooling and Labor Force Participation by Family Income

	Bottom 20%		20% - 90%		Richer 10%	
	Log (Esc)	LF Part.	Log (Esc)	LF Part.	Log (Esc)	LF Part.
NR LF Share	-0.0818	-0.500	-1.305***	0.621*	-0.640	-0.137
	(0.799)	(0.724)	(0.304)	(0.342)	(0.524)	(1.312)
Age	-0.0148	0.0168	8.08e-05	0.0377*	0.0220***	0.0621***
	(0.0150)	(0.0193)	(0.0126)	(0.0203)	(0.00762)	(0.0171)
Male	0.0572**	-0.285***	0.0556*	-0.163***	0.0247	-0.0462
	(0.0267)	(0.0396)	(0.0290)	(0.0533)	(0.0179)	(0.0394)
Household Size	-0.00395	0.0164**	-0.0128**	0.0272***	0.0262***	-0.0664***
	(0.00668)	(0.00811)	(0.00572)	(0.00841)	(0.00691)	(0.0128)
Log(LF Other Sectors)	-0.00370	-0.0375	-0.317***	0.117	-0.176	-0.0204
	(0.209)	(0.193)	(0.0843)	(0.0925)	(0.144)	(0.356)
Log(W_Tertiary)	-0.00258	-0.00177	0.00285	-0.00633	0.00961	0.00486
	(0.0107)	(0.0189)	(0.00701)	(0.0104)	(0.0118)	(0.0250)
Constant	2.824	0.645	6.139***	-1.550	4.011**	-0.683
	(2.162)	(2.240)	(0.995)	(1.140)	(1.688)	(4.174)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
First Stage (Instrument)	-0.290***	-0.290***	-0.302***	-0.302***	-0.248***	-0.248***
	(0.0605)	(0.0605)	(0.0622)	(0.0622)	(0.0584)	(0.0584)
F Test (CD)	38.51	38.51	39.72	39.72	29.86	29.86
F Test (KP)	22.94	22.94	23.51	23.51	18.01	18.01
Observations	1,372	1,372	1,389	1,389	1,274	1,274

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

Table 11

Schooling and Labor Force Participation, with Tertiary Educational Institutions Interaction

	Institutions in Municipality		Institutions in Province	
	Log (Esc)	LF Part.	Log (Esc)	LF Part.
NR LF Share	-1.087***	0.388	-1.261***	0.393
	(0.269)	(0.324)	(0.290)	(0.322)
NR LF Share*Institutions	0.422*	-0.319	0.0519*	0.0174
	(0.238)	(0.302)	(0.0291)	(0.0348)
Age	0.00656	0.0560***	0.00359	0.0561***
	(0.0122)	(0.0180)	(0.0126)	(0.0182)
Male	0.0418	-0.212***	0.0389	-0.216***
	(0.0277)	(0.0466)	(0.0291)	(0.0470)
Household Size	-0.0150**	0.0239***	-0.0124**	0.0236***
	(0.00593)	(0.00829)	(0.00612)	(0.00832)
Log(LF Other Sectors)	-0.250***	0.0747	-0.263***	0.0956
	(0.0743)	(0.0892)	(0.0750)	(0.0855)
Log(W_Tertiary)	0.00461	-0.00558	0.00477	-0.00523
	(0.00574)	(0.00893)	(0.00601)	(0.00899)
Constant	5.162***	-1.409	5.431***	-1.705
	(0.901)	(1.112)	(0.898)	(1.047)
Municipality FE	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes
First Stage (Instrument)	-0.299***	-0.299***	-0.299***	-0.299***
	(0.0681)	(0.0681)	(0.0644)	(0.0644)
	0.00632	0.00632	-0.000754	-0.000754
	(0.0820)	(0.0820)	(0.00828)	(0.00828)
First Stage (Instrument Interacted)	-0.0769*	-0.0769*	0.0958	0.0958
	(0.449)	(0.449)	(0.251)	(0.251)
	-0.487*	-0.487*	-0.458***	-0.458***
	(0.268)	(0.268)	(0.0682)	(0.0682)
F Test (CD)	18.16	18.16	19.64	19.64
F Test (KP)	10.52	10.52	11.52	11.52
Observations	1,389	1,389	1,389	1,389

Clustered standard errors at the 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

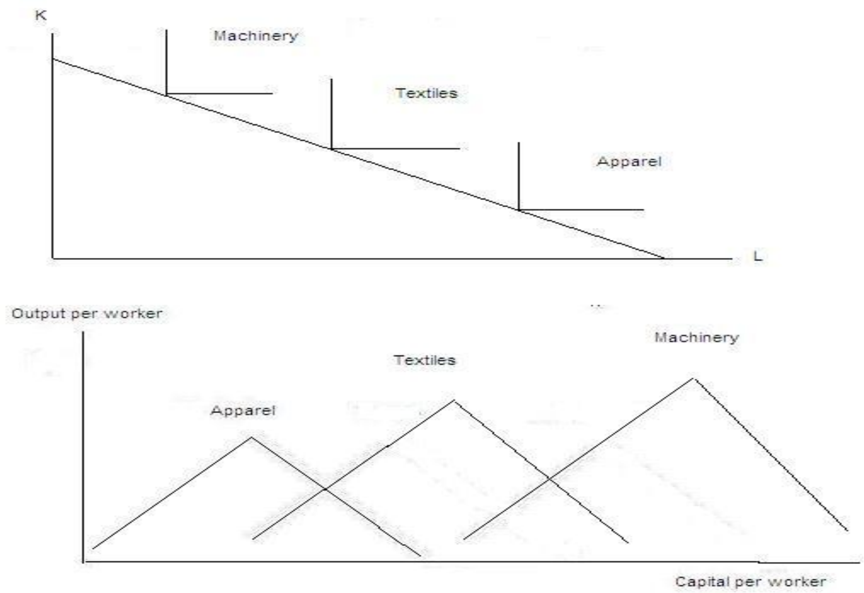


Figure 2

Path of Developments in Leamer's Triangle

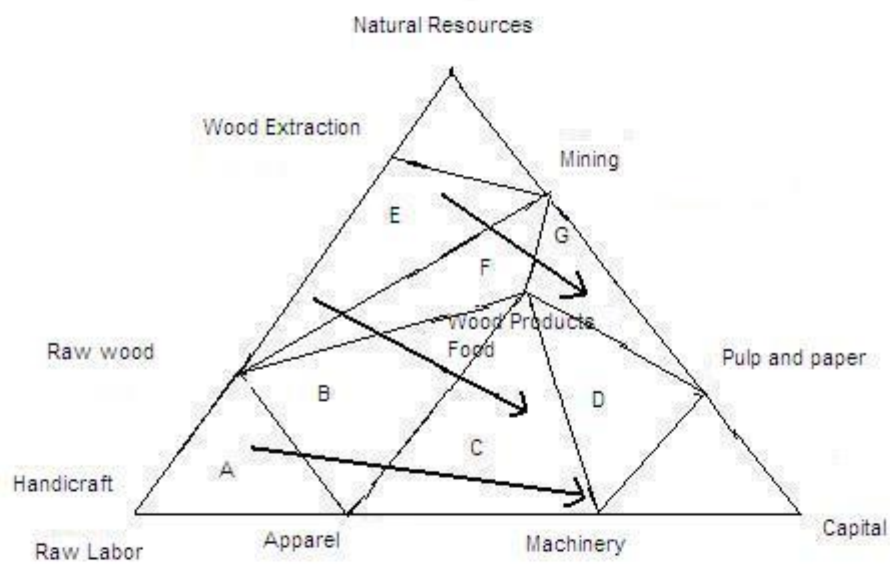
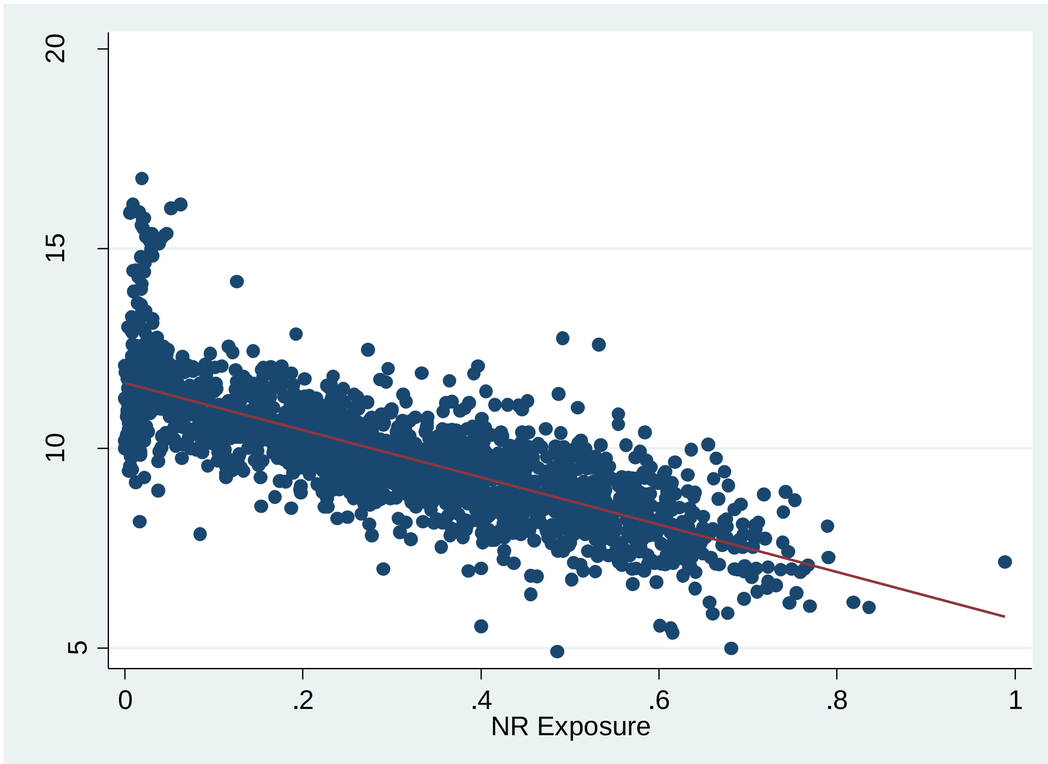


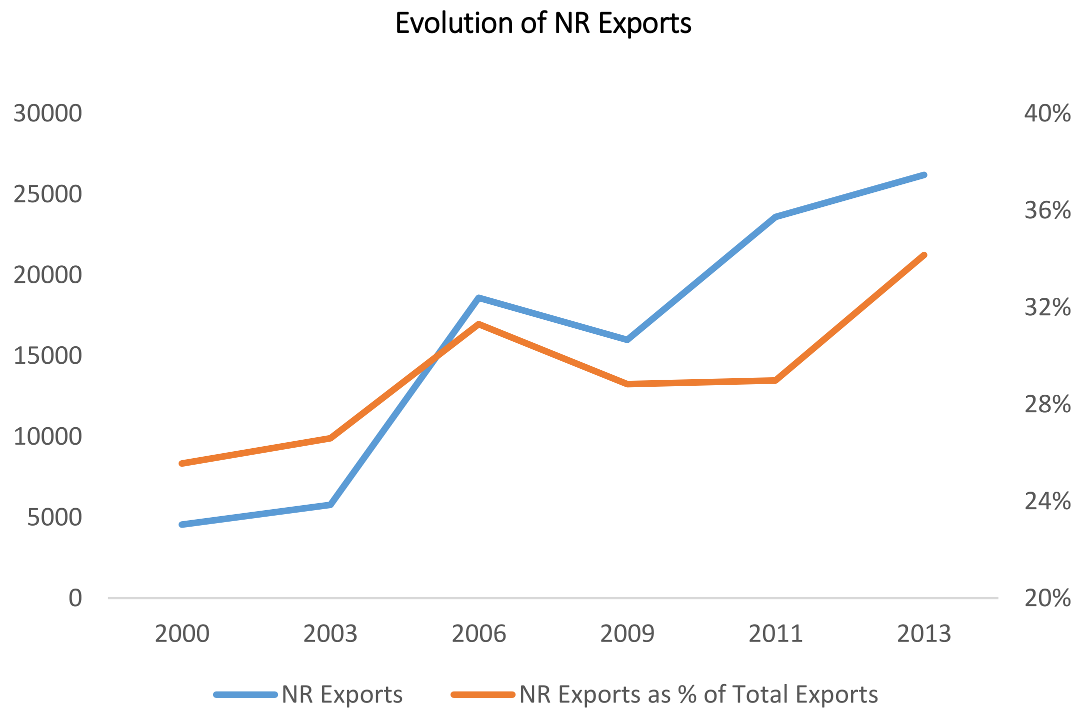
Figure 3

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 in NR industries (agriculture, forestry, fishing, and mining).

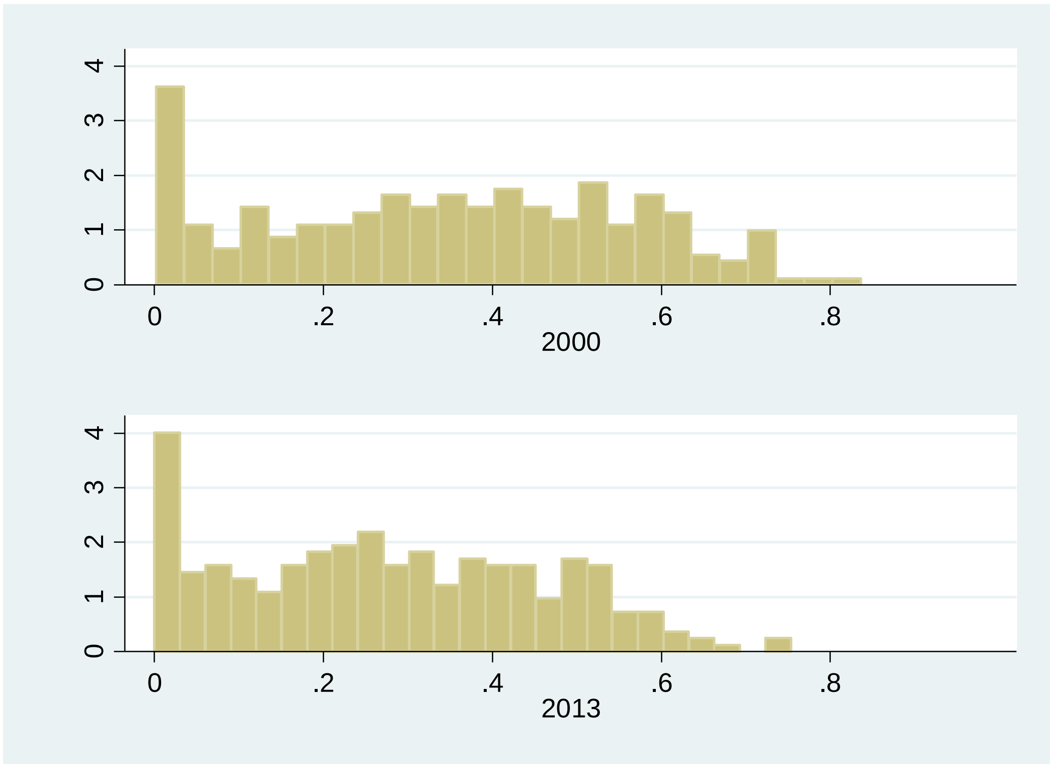
Figure 4



Source: UN COMTRADE Data. NR industries considered are agriculture, forestry, fishing, and mining. The left-y axis, associated with NR exports, is scaled in nominal millions of dollars.

Figure 5

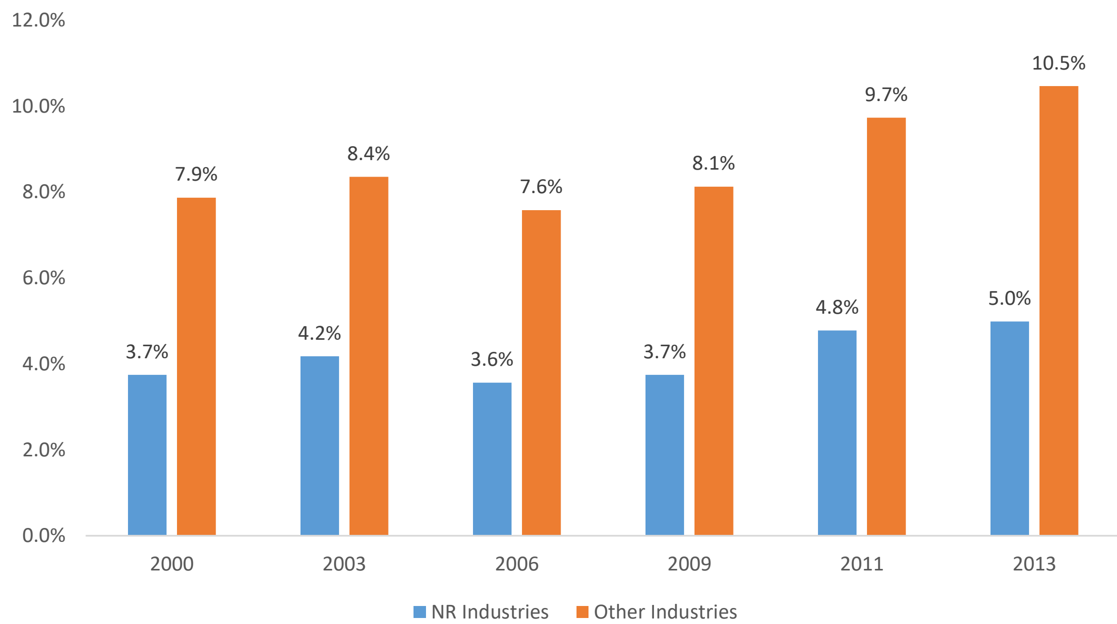
NR Employment Share across Municipalities



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

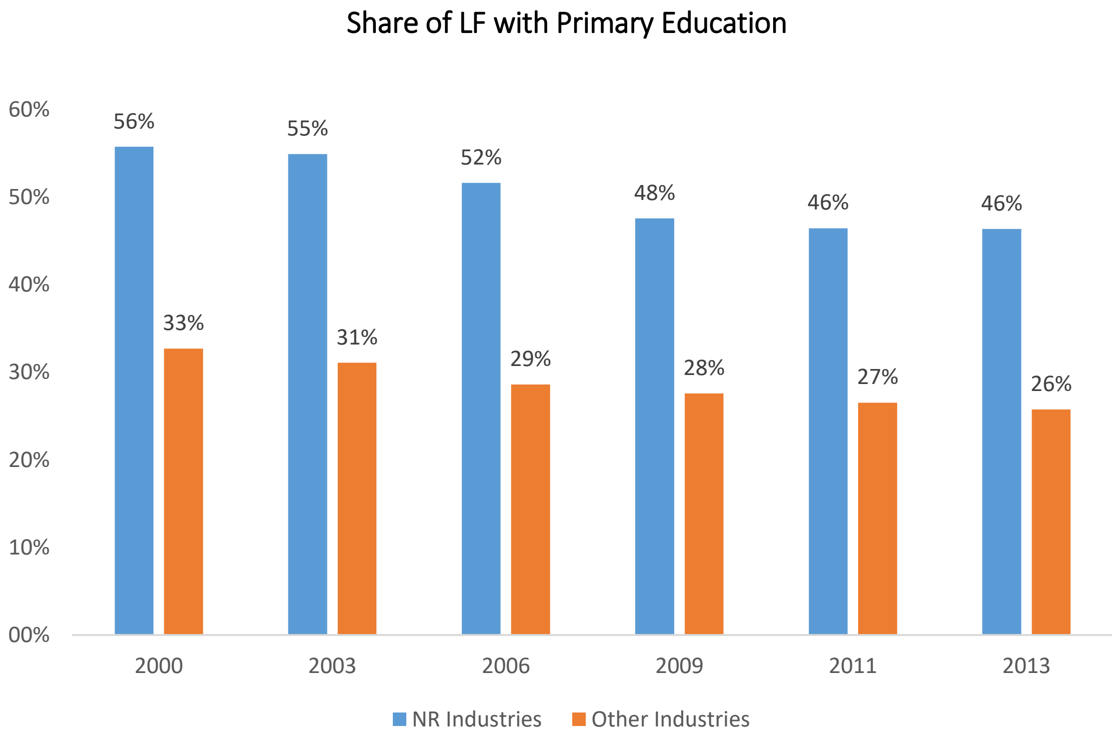
Figure 6

Share of LF with Tertiary Education



Source: CASEN Survey (MIDEPLAN). NR industries are agriculture, forestry, fishing, and mining.

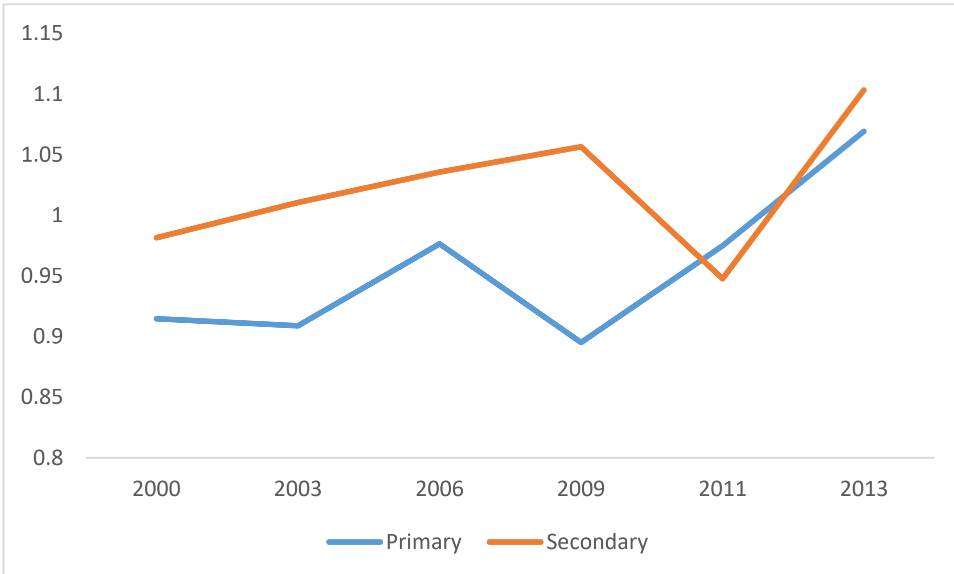
Figure 7



Source: CASEN Survey (MIDEPLAN). NR industries are agriculture, forestry, fishing, and mining.

Figure 8

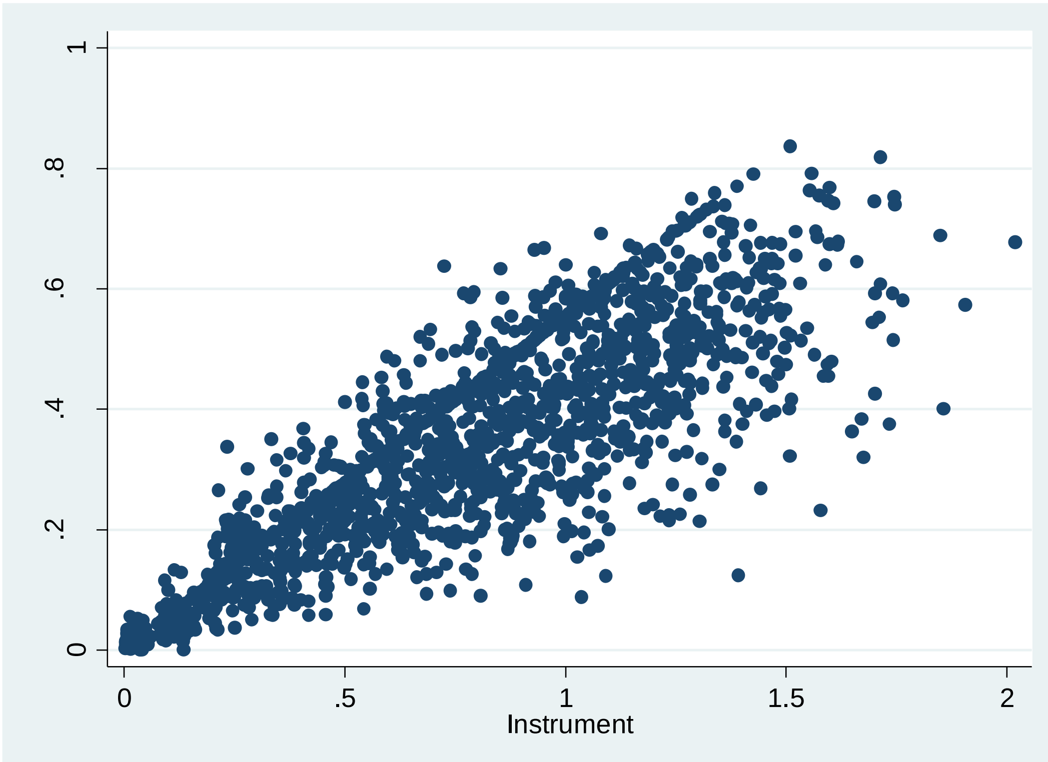
Relative Wages between NR Industries and Other Industries



Source: CASEN Survey (MIDEPLAN). NR industries are 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 in NR industries (agriculture, forestry, fishing, and mining).