

Are Returns to Education on the Decline in Venezuela and Does Mission Sucre Have a Role to Play?*

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Abstract

There is anecdotal evidence that the standard of living for the educated has fallen in Venezuela over the last few years. This evidence comes as a surprise because after experiencing an economic downturn in 2002 and 2003, Venezuelas economy has boomed (gross domestic product growth has hovered between 8 and 18%) in large part due to the increase in the price of petroleum. In this paper, we provide evidence that returns to education have decreased significantly in Venezuela from 2002 to 2008. More importantly, we focus on what has led to the decrease in returns. We explore a fall in quality and a supply-demand argument for this decline. Mission Sucre was enacted in September 2003 by President Hugo Chavez to provide free mass tertiary education, in particular targeting the poor and marginalized. The implementation of this program created a sudden increase in the supply of skilled labor and had a direct impact on quality of education. Although we do not claim that 100% of the decline between 2002-2008 can be linked to this program, we provide ample evidence that a good part of the falling returns can be linked to Mission Sucre. Specifically, we show that for a 1% increase in the share of Mission Sucre students in the state, returns to university level of education declined by about 5.6 percentage points between 2007 and 2008.

(JEL classification: J2, J24, J38, I21, O12, O15. **Keywords:** Human capital, Venezuela, Policy Reform, Returns to Education, Schooling)

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1 Introduction

After experiencing an economic downturn in 2002 and 2003, Venezuela's economy has boomed in large part due to the increase in the price of petroleum, which increased four-fold between 2002 and 2007 to just under \$100 a barrel. In Venezuela, the oil sector accounts for about 90% of export earnings. Since 2004, the annual growth rate of Venezuela's gross domestic product has hovered between 8 and 18%. However, contrary to what one might expect given an economic boom, anecdotal evidence suggests a trend in the opposite direction. "Things are worse than ever. You can't afford to live like you used to," said a middle-class resident of Caracas. Statements like this have become commonplace in Venezuela, especially among the more educated. Based on these contradictory observations, we attempt to answer whether the returns to education in Venezuela have decreased during this time of high economic growth, and if so, why?

There are several possible reasons that could lead to a decline in returns to education, but we focus on the potential reasons for this decline in the Venezuelan context given the changes that occurred in the country over the last decade.

One possible reason for a decline in the returns to education could be linked with the oil boom. Uwaifo (2006) shows that in Nigeria, another country heavily dependent on oil, returns to education have consistently declined during periods of booms. A possible explanation for this decline is the high returns to rent-seeking activities during resource booms and the ability of those with lower levels of education to move to rent-seeking jobs relative to those with higher levels of education in some developing countries. What this means is that the difference in income between these two groups will be attenuated over the period of a boom, and hence the average returns to education (the slope of the relationship between income and years of schooling) will decline. Another reason that can lead to a decline in returns to education is policy reforms and changes in institutional structures that could affect the supply and quality of labor. In Uwaifo (2008), the author highlights how democratic reforms and institutional change in Nigeria led to an increase in returns to education. Venezuela has undergone significant policy reforms over the last decade. It is the link between these policies and returns to education that we provide evidence for in this paper.

First, we try to answer the simple question: Have returns to education decreased in Venezuela post 2002? This is useful given that Patrinos and Sakellariou (2006) documented increases in overall

returns from 2000 to 2002. Related to this question is whether the change in returns is consistent across gender and states. Using data from Venezuela's household survey for 2002, 2003, 2007 and 2008, we estimate simple Mincer (1974) wage equations. Though we do not control for ability, we do not worry about the potential endogeneity of the schooling variable in the wage equation estimation. This is because our focus is not on obtaining a consistent estimate for schooling, but rather on the difference or change in returns to education over time. This difference we know will be consistent as long as the effect of ability on the returns to education estimate does not vary over time. Prior to 2004, we expect the effect of ability in Venezuela to be constant. However, the implementation of an education policy in late 2003 has the potential of varying the impact of ability post 2004. We test for this possible change in the impact of ability, noting no such change between 2004 and 2008.

We find that the average returns to education declined by 3.1 percentage points over 2002-2008. This decline occurred for both men and women, though the decline for women was about one percentage point higher. Similarly, we note a decline in returns across states in Venezuela. However, the decline across states varies significantly, between 1.2 and 5.6 percentage points. This variation across states is interesting and we explore it further in later parts of the study.

The confirmed decline in returns to education prompts our main question: What is the primary reason behind the decline? First we explain why an oil boom explanation, though possible, is an unlikely reason for the decline, especially between 2007 and 2008. Next, we provide detail on President Hugo Chavez's implementation of education reforms. We argue that these reforms can have labor market impacts. Specifically, we focus on the implementation of university education reform as a reason for the decline in returns to education. Mission Sucre was enacted in September 2003 by President Hugo Chavez to provide free mass tertiary education. Given the way it was implemented, which we discuss in detail, there are two potential economic based channels for why returns to education may decline in response to this program. The first is a simple demand-supply argument. The program dramatically increased the supply of skilled labor. It is easy to show, all other things equal, that returns to education will decline if the supply of labor increases and demand does not. Even if demand for skilled labor increases, as long as the increase in demand is less than the increase in supply, there is potential for a fall in returns to education. The second possible channel is quality. Quality of education is one of the standard explanations provided for declining

returns to education. There is evidence that education in the Mission Sucre universities is of low quality. Assuming this is true, it follows that returns to education will decline when graduates from this program join the work force. A related issue is the decline in the quality of students receiving tertiary education. The Sucre Mission universities eliminated screening/entrance exams, which applicants to public or private universities typically had to pass before entry into tertiary education. The removal of this quality screening mechanism for the Mission Sucre universities implies that the quality of students in Mission Sucre universities would be lower than elsewhere. In addition, the average quality of students who graduate from universities in Venezuela in general will decline over time, resulting in a fall in average returns to education. We focus the rest of the paper on providing evidence for these two explanations (excess supply and quality decline).

Specifically, we estimate the average returns to an extra year of tertiary education, returns to university education and returns to technical education for 2002, 2003, 2007 and 2008. We also exploit some of the unique features of the program and estimate the average returns to education and returns to levels of education across occupation categories we believe should be affected differently by the program. We carry out similar returns to education analysis across sectors of employment and age cohorts. The results from these analyses provide suggestive evidence for the impact of Mission Sucre. However, for our main analysis of the effect of the program, we focus more on the comparison between the returns to university education and technical education. The rationale for focusing more on these levels of education is that both are tertiary levels of education and hence might have similar general trends in returns. More importantly, Mission Sucre originally focused on only expanding university education. This allows us to classify those with university education as the treated group and those with technical education as a potential control group. Identification is based on the premise that if Mission Sucre is responsible for the fall in returns to education, we should only find significant changes in the returns to university education between 2007 and 2008. In contrast, we should find no change or insignificant changes in returns for those with technical education.

Using a difference in difference strategy, we estimate the impact of Mission Sucre between 2007 and 2008 on returns to university education. We focus on these two years because the first graduates from Mission Sucre entered the work force in 2008 and there was no other policy change between

2007 and 2008 that could affect returns to education differently across levels. If Mission Sucre had no impact, then any changes between 2007 and 2008 should be similar across university and technical education. If the program had an impact, then the difference in difference estimate should be significant. We focus on the youngest cohort in the work force (ages 23-28), where the impact is more likely. We also conduct a pseudo diff-in-diff analysis using the years 2002 and 2003 to show that our difference in difference results are not driven by a trend effect. We find that Mission Sucre led to a 2.7 percentage point decrease in returns to university education among the 23-28 age cohort between 2007 and 2008. We do not find a significant impact between 2002 and 2003.

In our final analysis, we exploit the differences in states' shares of Mission Sucre students. Our hypothesis is that the larger the share of Sucre students, the larger the decline of returns to university education in the state. We estimate the returns to university and technical education in each state for 2007 and 2008. We then find the difference in returns in each state over these two years. Subsequently, we run a regression of the share of Mission Sucre students in university enrollment on this difference. We also run a similar regression for our control group, technical education. As in our difference in difference strategy, if Mission Sucre explains the decline, and not a general trend or the oil boom, we expect a significant coefficient for university education and a insignificant coefficient for technical education. Our results are consistent with these expectations. We find that the impact was insignificant in the pseudo experiment with technical education but significant for university education. We find that states with higher shares of Mission Sucre students had a larger decline in the returns to university education. Specifically, a 1% increase in the share of Mission Sucre students led to a 5.7% decline in the returns to university education. We do not see a similar trend with respect to technical education. Although we provide ample evidence of the impact of Mission Sucre, we cannot state whether our noted effect of the program on returns is driven solely by an excess supply of skilled labor, or a combination of the excess supply and reduction of quality impact. We suggest the effect is a response to a combination of the two factors but cannot reject based on our results the possibility that it could be due solely to the excess supply argument. However, we can deduce from our results that reduction in quality cannot be the sole factor.

This paper contributes to the literature in three ways: first, it shows that after increases in returns from 2000 to 2002, returns to education is declining again in Venezuela despite the growth in GDP

over the same period. This result provides support to the conclusion first made by Psacharopoulos and Steier (1988), that returns to education is volatile in Venezuela. Second, the paper adds to the limited literature that documents the impact of policy reform on labor market outcomes, such as returns to education. Finally, to the best of our knowledge, this is the first paper to document the potential impact of the Mission Sucre education program on returns to university education.

The remainder of this paper is organized as follows: In the next section, we highlight some relevant literature. In section 3, we describe the data we are using for this analysis. Section 4 focuses on our preliminary analysis of the question of whether returns to education have declined over time in Venezuela. Section 5 focuses on possible explanations for the decline and section 6 provides empirical evidence in support of our hypothesized explanation. Conclusions and inferences are in the last section.

2 Literature Review

Previous studies suggest that the rates of return to education in Venezuela had been declining since the 1970s. Specifically, Psacharopoulos and Steier (1988), using cross-sections from the Encuesta de Hogares por Muestra for the 1975 and 1984 period, found that the returns to schooling had declined from about 13.7% to 11.2%. They suggest that the changing returns to education are due to faster supply shifts of educated labor than demand shifts. However, they note that the decline over this decade was only of 2.5 percentage points, despite this period being characterized by rapid educational expansion. Psacharopoulos and Alam (1991) further check on a continued downward trend in returns to education over time. They reconsider returns to education in Venezuela in the late 1980s using the 1987 cross-section of the previously used household survey. The results indicate that returns to education had been relatively stable between 1984 and 1987, despite continued educational expansion.

The interest in the trend in returns to education in Venezuela continued with Fiszbein and Psacharopoulos's (1993) evaluation of returns using the 1989 cross-section survey. They find that returns to education had declined again from 10.7% in 1987 to 9.6% for every extra year of schooling in 1989. Hence, between 1974 and 1989, the returns to education had declined by about 4.1%, which is quite significant. The consistent declining trend, however, changed in the 1990s. In a study

estimating the returns to education in Venezuela using later cross-sections of the same survey for the period 1992 to 2002, Patrinos and Sakellariou (2006) noted continued falling returns to schooling and educational levels until the mid-1990s, followed by increasing returns thereafter. In 1992, the returns to education were 8.8% for every extra year of schooling, dropping to a low of 7.6% in 1996. The following year, however, returns increased to 9.2% and did not change much during the rest of the decade. In 2000, they fell back to 8.0%, but in 2001 and 2002 increased to 9.4% and 10.4%, respectively. Patrinos and Sakellariou try to explain this trend in returns to education by focusing on the role of changes in real wages and fluctuations in the returns to tertiary education. They argue that these changes in returns are the effect of the swings in economic activity in Venezuela on the demand and supply of education and skills. Specifically, they highlight that the returns to tertiary education fluctuate sharply with the level of economic activity. On the other hand, they state that returns to primary and secondary education have been relatively stable. They also mention that there is emerging evidence that demand for educated labor is on the increase in Venezuela and this might explain the increase in returns to tertiary education (and to some extent, secondary education) between 2000 and 2002.

Table 1: Returns to Education Across Latin America

| Country | Year | Return | Source |
|--------------------|------|--------|-----------------------------|
| Argentina | 2003 | 11 | Patrinos et al (2006) |
| Bolivia | 2002 | 10.3 | Patrinos et al (2006) |
| Brazil | 2002 | 15.7 | Patrinos et al (2006) |
| Chile | 2003 | 12 | Patrinos et al (2006) |
| Colombia | 2003 | 10.4 | Patrinos et al (2006) |
| Costa Rica | 1989 | 10.9 | Psacharapoulos et al (1994) |
| Dominican Republic | 1989 | 9.4 | Psacharapoulos et al (1994) |
| Ecuador | 1987 | 10.8 | Psacharapoulos et al (1994) |
| El Salvador | 1990 | 9.7 | Psacharapoulos et al (1994) |
| Guatemala | 2000 | 12.6 | Patrinos et al (2006) |
| Honduras | 1989 | 17.6 | Psacharapoulos et al (1994) |
| Mexico | 2002 | 11.3 | Patrinos et al (2006) |
| Panama | 1989 | 13.7 | Psacharapoulos et al (1994) |
| Paraguay | 1990 | 11.5 | Psacharapoulos et al (1994) |
| Peru | 1989 | 8.1 | Psacharapoulos et al (1994) |
| Uruguay | 1989 | 9.7 | Psacharapoulos et al (1994) |
| Venezuela | 2002 | 10.4 | Patrinos et al (2006) |
| Latin America | 2002 | 11.6 | Patrinos et al (2006) |

These developments in returns to education in Venezuela from 2000 to 2002 are consistent with happenings in the 1990s in other middle-income Latin American countries such as Brazil, Mexico, Chile and Argentina (e.g., Kugler and Psacharopoulos, 1989; Lachler, 1998; Blom et al., 2001; Fiszbein et al., 2004 and Psacharopoulos et al, 1996). In these countries, the returns to secondary and tertiary education were also increasing along with the overall return to schooling. Table 1 is a summary of some of the findings of these studies with respect to overall returns to education in Latin America. Notice that returns to education are above 9% in most countries in Latin America and most of these countries have been experiencing increasing returns to tertiary education. The difference with the Venezuelan story is that despite an expected increase in returns to tertiary education given the increased demand for educated labor noted by Patrinos and Sakellariou (2006), anecdotal evidence points to a falling standard of living for the educated over the last five years. This claim of falling living standards is unexpected, since Venezuela experienced an economic boom between 2003 and 2008. This paradox is one reason why we investigate the trends in returns to education during this period.

Declining returns to education and volatile changes to returns to education as noted in the 1990s is not peculiar to Venezuela. Uwaifo Oyelere (2009) finds that returns to education rose significantly in Nigeria post democratic reform, especially for those with tertiary education. This period of rising returns was preceded by a period of low, declining returns, which Uwaifo Oyelere (2009b) documents. She concludes that returns to education respond to changing policies and institutional reform. Other authors have also tried to explain changing returns to education, whether rising or falling. For example, Fleisher et al (2005) explore the pace of increase in returns to schooling during the transition from planning to market economies over time and across several Central and Eastern European countries, Russia, and China. They find that under post-economic reform and change in institutions consistent with a move towards a market economy, returns to education rose significantly in these countries. Similarly, Gorodnichenko and Sabirianova (2005) investigate why returns to schooling in Russia and Ukraine diverged over the same transition despite identical initial conditions and similar skill composition of employment. They conclude based on rigorous semi-parametric analysis that lower demand for educated labor, more limited labor mobility, higher separation costs, and the larger role played by trade unions in Ukraine might have had a role to play.

Fuenta and Jimeno (2005) also link low returns to education in Sweden to the country's compressed wage structure. This wage structure is similar to the wage grid situation in most of Eastern Europe and Russia before the transition reforms. The above papers all highlight how returns to education can change or why they are low and what could be responsible. In the same vein, we focus on the trend in returns to education over the last six years in Venezuela and try to provide concrete evidence of what could have led to changes.

3 Data

In this paper, we use a consistent cross-sections government conducted household survey known as the Encuesta de Hogares por Muestro, collected by the National Institute of Statistics of Venezuela (INE). It is the only survey in Venezuela that resembles the Living Standards Measurement Survey (LSMS) of the World Bank, but with a much smaller variable coverage. The INE conducts this survey twice per year. Data are collected from randomly selected households all over the country. Households are retained in the survey sample for six consecutive semesters in a rotating panel, although the data suffers from very high attrition rates (41% across three semesters and 90% across all six semesters in a similar sample of years, according to Hsieh, et al 2009). We use data for the last six months of 2002 through the end of 2003, and from 2007 through the first six months of 2008. To ensure that the data are comparable over time and across regions, current monetary values are deflated to 2007 base year prices. The Encuesta de Hogares por Muestro data set is appropriate for the analysis since it consists of detailed information on several demographic and economic indicators of all individuals within the household, including income, location and other individual and household characteristics. A drawback in our approach to using this data is that the panel dimension of the survey is ignored. The sub-sample of the data used in deriving returns to schooling and education levels consists of adults earning income. Table 1 is a summary of the main variables used in the analysis. We summarize these variables for all individuals in the sample and separately for earners.

Table 2: Descriptive Statistics

| Variables | All | | | | Earners | | | |
|-------------------------|-------|-------|-------|-------|---------|--------|--------|--------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | 2002 | 2003 | 2007 | 2008 | 2002 | 2003 | 2007 | 2008 |
| Age | 26.33 | 26.68 | 28.14 | 28.45 | 36.71 | 31.79 | 32.66 | 38.12 |
| Female | 0.51 | 0.51 | 0.51 | 0.51 | 0.40 | 0.45 | 0.46 | 0.40 |
| Literate | 0.85 | 0.84 | 0.86 | 0.87 | 0.94 | 0.87 | 0.89 | 0.96 |
| Years of schooling | 6.70 | 6.77 | 7.38 | 7.46 | 9.00 | 7.86 | 8.36 | 9.69 |
| Completed primary | 0.31 | 0.31 | 0.37 | 0.38 | 0.48 | 0.39 | 0.44 | 0.54 |
| Completed secondary | 0.20 | 0.21 | 0.26 | 0.27 | 0.34 | 0.28 | 0.33 | 0.42 |
| Completed technical | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.03 | 0.04 | 0.05 |
| Completed university | 0.03 | 0.03 | 0.04 | 0.04 | 0.07 | 0.05 | 0.06 | 0.08 |
| Log monthly income | | | | | 12.93 | 12.78 | 13.35 | 6.55 |
| Deflated monthly income | | | | | 600932 | 509351 | 791521 | 854714 |

4 Preliminary Analysis: Estimating the Overall Average Returns to Education

Question 1a: Are Average Returns to Education on the Decline?

The first question we address is whether the returns to education have declined over time in Venezuela. To address this question, we estimate a Mincer (1974) standard wage equation. The Mincer wage equation is the basis of most of the basic empirical analysis in this paper. Equation 1 is a prototype of the equation we estimate to answer this first question. We are interested in the estimate of the average returns to an extra year of schooling, β , using this equation. To estimate equation 1, we employ ordinary least squares (OLS) technique.

$$\log(y_i) = \beta_0 + \beta_1 S_i + \beta_2 X_i + \beta_2 X_i^2 + \beta_3 D_i + \epsilon_i \quad (1)$$

In equation 1, y_i is wages/earnings, which could either be hourly or monthly. X_i is age of individual i , S_i is years of schooling of individual i , D_i is a vector of all other possible exogenous/control variables, including dummies for individual i , ϵ_i is the error term, β_0 is the intercept term and β_1 is the estimate of the average return to education.¹

¹As we discuss later on in this section, an OLS estimate of the returns to school may not be consistent but is still adequate for our analysis under certain conditions.

We estimate equation 1 separately for each year of data we have (2002, 2003, 2007, and 2008). We use both measures of earnings (hourly earnings and monthly earnings) in our estimation of equation 1. Table 3 presents basic estimates of a simple Mincer equation. Panel A provides results using log of earnings per hour. Each column presents returns for a year (2002, 2003, 2007, and 2008). The second panel summarizes results using log of monthly earnings. To answer a related question of whether returns have declined for both men and women, we also estimate the returns for men and women separately. Table 4 presents average returns to education estimates by gender in 2002 and 2008. Once again, we use the two measures of earnings (monthly and hourly). We present this analysis by gender to check for significant gender differences in the way returns to education are changing over time.

First we compare our 2002 results in Table 3 to that of Patrinos and Sakellariou (2006), and the estimates are very similar. We do not expect identical estimates because we use other controls like state dummies not used by Patrinos and Sakellariou (2006) and we only use data from the second semester while the former use data for the first and second semester. The results highlight two main trends. First, returns to education in Venezuela have declined significantly over time, from 9.5% for every extra year of schooling in 2002 to 9.1% the next year, to 7.4% in 2007 and 6.4% in 2008. There has been a 3.1 point fall (33% decline). We also obtain a similar downward trend if we use hourly wages as the dependent variable, but the magnitudes are smaller. Returns to education in Venezuela have declined significantly over time, from 8.5% in 2002 to 8.2% in 2003, to 7.0% in 2007 and 6.1% in 2008 (a 2.4 point fall between 2002 and 2008). Whether using log of hourly wage or monthly income, the difference in returns to education between 2002 and 2008 is statistically significant. The results also show a decline in returns for men and women, with a 2.7 and 2.4 percentage point decline for men depending on the measure of income used and a 3.7 and 2.6 percentage point decline for women.² Although the fall in returns for women is slightly higher than for men over the period using log of monthly income, the fall is not statistically different for men and women when using log of hourly wage. More importantly, the gender analysis provides support that the fall was not substantially different across genders.

²There is a potential selectivity bias for the estimates of returns to education for women because of the selection into labor force participation. This selectivity bias can be addressed using a Heckman correction model for selectivity. We do not present results with this correction in Tables 2 and 3 because the focus of our paper is not male-female differences.

Table 3: Basic Regression: Estimating Return to Education

| Variables | 2002 | | 2003 | | 2007 | | 2008 | |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| years of schooling | 0.095*** (0.001) | 0.085*** (0.001) | 0.091*** (0.001) | 0.082*** (0.001) | 0.074*** (0.001) | 0.070*** (0.001) | 0.064*** (0.001) | 0.061*** (0.001) |
| age | 0.087*** (0.003) | 0.054*** (0.003) | 0.078*** (0.004) | 0.047*** (0.003) | 0.046*** (0.003) | 0.030*** (0.003) | 0.046*** (0.003) | 0.028*** (0.003) |
| age squared | -0.001*** (0.000) | -0.001*** (0.000) | -0.001*** (0.000) | -0.000*** (0.000) | -0.001*** (0.000) | -0.000*** (0.000) | -0.000*** (0.000) | -0.000*** (0.000) |
| Gender | -0.464*** (0.006) | -0.195*** (0.006) | -0.451*** (0.006) | -0.190*** (0.006) | -0.441*** (0.006) | -0.241*** (0.006) | -0.385*** (0.006) | -0.180*** (0.006) |
| illiteracy | -0.207*** (0.016) | -0.192*** (0.016) | -0.210*** (0.016) | -0.183*** (0.016) | -0.112*** (0.017) | -0.143*** (0.016) | -0.137*** (0.016) | -0.180*** (0.017) |
| States | yes |
| Cohorts | yes |
| N | 79194 | 73722 | 87022 | 81306 | 83480 | 82326 | 60589 | 60589 |
| R-Squared | 0.304 | 0.240 | 0.291 | 0.226 | 0.263 | 0.211 | 0.265 | 0.179 |

Note: Dependent variable in regressions (1), (3), (5), (7) is log of monthly earnings; (2), (4),(6) and (8) are on log of hourly earnings.

** signifies statistical significance at the 1% significance level

Given the fact that we have not controlled for the endogenous nature of schooling in the wage regression, there is a possibility that our estimates of returns to education are not consistent. Ability is correlated with education attainment and not controlling for it may upwardly bias our estimate of returns. We searched for appropriate instruments for schooling in Venezuela but none could meet the necessary criterion for a good instrument: relevance and exogenous criterions. Given this constraint, we decide to remain with OLS instead of implementing an IV that could give even more biased results (See Staiger and Stock (1997) for potential issues of weak instruments).

We are not too concerned about the potential bias in the estimate of schooling using OLS for two reasons. First, there appears to be little evidence in Latin America on the upward bias in OLS estimates of returns to education (See for example Psacharopoulos and Velez's 1992 Columbia study). Some of the recent conclusions have been that the effect of ability on wages is negligible and the basic Mincerian earnings function is reliable. This finding is not peculiar to Latin America. Uwaifo Oyelere (2009) estimates returns to education in Nigeria noting also no difference between the OLS and IV estimates. Given the aforementioned and other recent articles with similar trends

(some mentioned in the literature review), it is quite likely that OLS average returns to schooling estimates may not be biased.³

The second and more important reason why we do not worry much about the possible inconsistency in the OLS estimates is because our focus in this paper is on differences or changes in average returns to education over time and not on returns to education estimates per se. We are more interested in having a consistent estimate of the change in returns than obtaining consistent estimates of average returns to education. The measure of the change in average returns to education between two time periods would be consistent as long as the potential bias in the OLS estimate of returns to education is time invariant. Without an intervention, there is no reason to believe the potential bias in OLS should be time variant. Why? Ability is the missing variable we do not control for that could create a potential bias in the OLS estimation of average returns to education. However, without an intervention, we do not expect the impact of ability, if any, to differ across years, and so the potential bias in the estimate of β_1 without a control for ability should be time invariant generally. In the case of Venezuela, however, there was a policy intervention that has the potential to cause a time varying ability bias, which could make the estimate of the change in returns inconsistent. The possibility of an inconsistent estimate of the change in returns is especially relevant for tertiary education, which is the level of education directly affected by the intervention. It is unlikely given the way the program was implemented that the program could cause the potential bias in the average returns to education to vary.⁴ Hence, our estimate of a change in average returns should still be consistent. However, just as a precaution, we estimate average returns to education dropping the sample of observations at the tertiary level that could cause this change in bias (we highlight more about this sample later on in the paper). To check for the potential impact of these observations, we compare the estimated returns each year without these observations to our original results in Table 3, noting no significant difference. Given this result, we do not have to worry about a time varying ability bias for our average returns to education estimates, meaning that our estimate of the change in average returns to education based on these estimates should be consistent.

³However, we do acknowledge that there is a real possibility that estimates of returns could be upwardly biased and not consistent.

⁴More details on the program are highlighted later on in the paper.

Table 4: Basic Regression: Estimating Return to Education by Gender 2002 vs 2008

| Dependent | 2002 | | | | 2008 | | | |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | Men | | Women | | Men | | Women | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| years of schooling | 0.079*** (0.001) | 0.077*** (0.001) | 0.118*** (0.001) | 0.098*** (0.001) | 0.052*** (0.001) | 0.053*** (0.001) | 0.081*** (0.001) | 0.072*** (0.001) |
| Age | 0.097*** (0.004) | 0.063*** (0.004) | 0.068*** (0.006) | 0.038*** (0.006) | 0.051*** (0.004) | 0.030*** (0.004) | 0.040*** (0.005) | 0.025*** (0.006) |
| Age ² | -0.001*** (0.000) | -0.001*** (0.000) | -0.001*** (0.000) | -0.000*** (0.000) | -0.001*** (0.000) | -0.000*** (0.000) | -0.000*** (0.000) | -0.000** (0.000) |
| Literate | -0.115*** (0.018) | -0.129*** (0.018) | -0.329*** (0.032) | -0.293*** (0.031) | -0.026 (0.018) | -0.072*** (0.019) | -0.314*** (0.032) | -0.394*** (0.038) |
| States | yes |
| Cohorts | yes |
| N | 47534 | 45007 | 31660 | 28715 | 36215 | 36215 | 24374 | 24374 |
| R ² | 0.288 | 0.245 | 0.303 | 0.239 | 0.236 | 0.185 | 0.266 | 0.182 |

Note: Dependent variable in column (1), (3), (5) and (7) are on log of monthly income; (2), (4), (6) and (8) are on log of hourly wage as a robustness check.

*significant at 10%; ** significant at 5%; *** significant at 1%,

Question 1b: Are Returns to Education Declining Across All States?

One important point that could be raised with regards to the above highlighted decline is that it could be driven by heterogeneity across states. For example, if returns to education dropped drastically in a few states, the average returns to education might decline, but returns may still be high in a few states. Uwaifo (2008) highlights the importance of looking at returns for different regions or states in a country because average returns to education might hide significant differences across regions. We investigate this possibility by estimating the basic Mincer regression equation by state for the four periods of data we have. We focus on three interlinked questions: Do the returns to education differ across states in Venezuela? Second, have the returns to education declined across all states? Finally, is the decline uniform?

Figure 1 is a simple map of Venezuela showing all the states. Figure 2 is a collection of maps of Venezuela showing the evolution in average returns to education from 2002 to 2008. The estimates



Figure 1: Map of Venezuela showing states

on which these tables are made are in Table 11 in the appendix. In response to the question on differences across states in returns to education, it is clear that there is a statistical difference in the returns to education across some states in Venezuela. For example, in 2002 Aragua had an average return of 0.094, while Miranda had a return of 0.11. In addition, the variation in the differences across states varies across time periods. Secondly, Figure 2 shows us that returns to education have been declining across every state in Venezuela. Note the evolution as depicted by changing colors over time. In response to the question on whether the decline is uniform across states, the answer is no. The decline or changes in the returns to education have been non-uniform. For example, the average returns to education in the state of Aragua fell quickly over time (from 0.094 to 0.058) by over 3 percentage points. In contrast, the capital district only had a 1.3 percentage point decrease in returns between 2002 and 2008 (from 0.077 to 0.064). As long as we believe that ability does not vary across states in Venezuela, these results provide evidence of a disparity in reduction in average returns to education over time and across states in the country. However, returns to education have declined significantly across all states in Venezuela, and so the overall decline is not driven by huge changes in a few states. The differential changes in returns across states in Venezuela are further explored in the later parts of this paper.

5 Explanation for the Decline in Returns to Education

Our preliminary analysis has led to two main facts. First, we know that the average returns to education have declined over time in Venezuela and second, that the decline is not restricted to a particular gender or a particular state. The next question we focus on is what explains this decline.

There are two possible reasons why returns to education can be on the decline in Venezuela despite the rise in returns from 2000 to 2002 and the economic boom during the last six years. These possible explanations are based on specific events in this nation over the last decade. The first reason is linked with a resource curse story. The second reason, which is the one we believe is more relevant for Venezuela, is the impact of education expansion programs, in particular Mission Sucre.

Returns to education by state

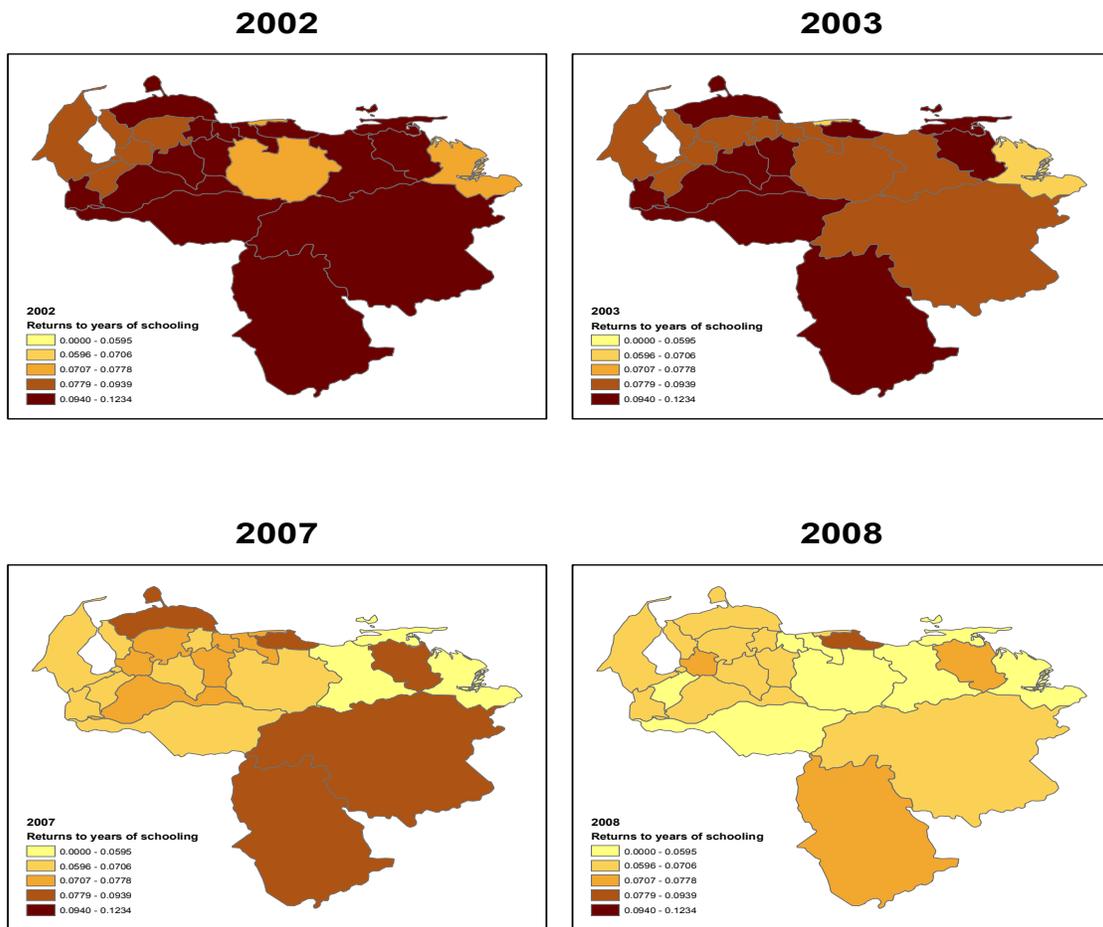


Figure 2: Evolution of Returns to Education across States in Venezuela

5.1 The Resource Curse Explanation

The first possible explanation for the fall in returns to education is the oil boom. Although this might sound surprising, during a resource boom there could be an increase in rent-seeking activities and an increase in opportunities to earn money not linked with specific skill sets or higher education. If beyond a threshold level of education there is a negative correlation between more education and rent-seeking prospects, one might notice a significant drop in the returns to tertiary education during a resource boom and a drop to overall returns to education. Resource booms tend to lead to activities and programs that encourage rent seeking and reward cronyism, which can lead to decreases in the economic returns to education. Lane and Tornell (1996) and (1999) show that booms can increase rent seeking and lower growth rates. Similarly, Baland and Francois (2000) provide evidence from a model that suggests a resource boom can lower returns to activities that demand more human capital relative to rent seeking, and could lead to a fall in the demand for such activities. If demand for activities that employ more human capital drops, then returns to education will decline. Uwaifo Oyelere (2009) also argues that the ability to shift to rent-seeking activities could be negatively correlated with education levels, meaning that the higher the level of education, the more difficult it is to transition out of one's job (which usually comes with a lot of experience) in pursuit of rent-seeking activities during an oil boom. Hence, during an oil boom individuals with lower levels of education or no education at all may find it easier to transition to rent-seeking activities and experience a boost in their income relative to those with higher levels of education. This attenuates the returns to education because the opportunity cost or increased benefits for an extra year of schooling drops as individuals with lower levels of education now have higher earnings potential, courtesy of the resource boom.

We know there is plenty of empirical evidence, like Gallagher (1991), that documents the more than proportionate rise in rents with increases in income or booms over the African continent. The question is whether this scenario can also be possible for Venezuela and whether there is evidence for this effect. It is important to mention that Africa is not the the only place where negative impacts of resource booms have been noted. Hilaire (1992) documents the labor market effect of an oil boom on Trinidad and Tobago. In addition, Baland and Francois (2000) highlight countries that have seemed to use most of the gains from booms to finance increased consumption and rent seeking. These

include Trinidad, Nigeria, Kuwait, the United Arab Emirates, Saudi Arabia, Venezuela, Mexico and Algeria. However, according to the authors, Venezuela, Mexico, and Algeria have done this to a lesser extent. Given that Venezuela is one of these countries (even though evidence of rent seeking from booms is not as strong as for the countries in the Middle East and Nigeria), the scenario of returns to education declining because of the boom is plausible. Venezuela experienced an oil boom from 2002 to mid 2008, which is similar to our period of analysis. This means the oil boom attenuating effect on returns to education is a plausible explanation. In this paper we provide evidence for why the fall in returns to education cannot be explained solely by this resource boom.

5.2 Supply-Demand and Quality Explanation: Mission Sucre

The second possible explanation for the fall in returns to education is linked with two important factors that can affect returns to education. The first is quality and the second is the supply of labor. If the quality of education drops, this means that less human capital will be accumulated. If the marginal productivity of skilled labor is linked with the amount of human capital acquired, and if marginal productivity determines wages, then a fall in the quality of education will lead to a fall in marginal productivity, a decline in the wages an individual can earn in the labor market, and a decline in the average returns to education.

Similarly, assuming the skilled labor market is at an equilibrium, if the supply of skilled labor increases, this leads to a rightward shift in the labor supply curve. Without a commensurate increase in the demand for skilled labor, wages will fall. As long as similar changes do not occur for unskilled labor, the returns to education will decline. We believe the combination of a fall in quality and increase in supply of skilled labor generated by Mission Sucre can explain a significant part of the decrease in returns to education in Venezuela from 2003 to 2008.

Mission Sucre was enacted in September 2003 by President Hugo Chavez to provide free mass tertiary education, targeting the poor and marginalized. In the past, the absence of scholarship and loan programs, in addition to a centralized admissions process, had caused inequity in access, resulting in high-income families being over-represented in Venezuela's tuition-free public universities. Mission Sucre does away with the centralized entrance exam and thus accepts all students who have completed secondary education, giving special priority to students coming from the poorest sectors, those who graduated in or before 1990, and those who are unemployed or underemployed

heads of households. The first cohort of students participated in a 6-8 month preparatory course, the Programa de Iniciaci on Universitaria (PIU), but this sole requirement was later eliminated in 2005. Mission Sucre created the Bolivarian University of Venezuela (UBV), with campuses in Caracas and Zulia and Bolivar states, as the primary medium for its reformed tertiary education program. The UBV shortened the traditional college curriculum from five years to three to four years, and provided scholarships to the poor. It also opened the doors of 11 experimental universities and 28 colleges. In 2004, about 1,000 provisional campuses were also founded with an aim of bringing higher education to the community level. Today, the UBV boasts over 1,700 satellite campuses all around the country. These campuses are known as Aldeas, a word for campus which as an acronym stands for "Local Scopes of Alternative Socialist Education." Degrees offered in Mission Sucre campuses are limited to those deemed of national priority by the government and began with a select number in 2003. In 2005, the program expanded with 24 new majors and the construction of 37 new campuses in a number of states.

By 2007, gross enrollment in tertiary education had increased to 41%, from 29% in 1995. In 2007, there were 612,000 students enrolled in regular public and private universities, 449,177 enrolled in colleges and institutes, and 336,499 enrolled in Mission Sucre, making up 24% of the total.

One of the striking features of Mission Sucre universities is the significantly less stringent academic requirements for entry into these universities. In the past, all college-aspiring graduating high school students took a general exam like the SAT called the Prueba de Aptitud Academica (PAA), or Academic Aptitude Test. Private universities have other additional screening criteria, while public university applicants had to go through the national admissions process, known as CNU-OPSU. The CNU-OPSU based admission on an academic index (based on high school grades, PAA score, etc.), region, graduation year and socioeconomic factors. However, Mission Sucre campuses, including the UBV (Chavez's new flagship university), can bypass this process and alternatively admit students who are accepted into the program and, prior to 2005, had completed the PIU. The only requirement for entry is a high school diploma. This lack of screening clearly leads to a reduction in the quality of the students admitted. This reduction in the quality of the students admitted has the potential of changing the distribution of ability among students at the tertiary level. As mentioned earlier in the paper, this potential change in the distribution is important because of

the OLS empirical strategy we employ to identify changes in returns over time. We are able to identify consistent estimates of the change in returns as long as potential ability bias in our OLS estimates are not time variant. However, the presence of Sucre university graduates in the work force from 2007 on could change the ability distribution of university graduates, leading to a time variant ability bias and inconsistent estimates of the change in return.

Apart from the decline in the quality of students admitted, there is evidence that the quality of education in these Sucre universities or satellite campuses is much lower than other existing universities. One potential signal of this problem is that the program also shortens the traditional college curriculum from five years to three to four years. According to D'Elia and Cabezas (2008), "quality has been one of the most critical problems of the educational missions, which is reinforced by the absence of supervision and evaluation mechanisms." These authors document that the most reported complaints with Mission Sucre have been the low academic and pedagogic quality of the faculty and staff and their high rates of absenteeism and low rates of retention, often attributed to the irregularity of salary payments. Other concerns include failure to complete the established academic periods, high absenteeism rates of students, lack of teaching and support materials, and poor conditions of equipment and infrastructure. All of the above issues increase the possibility of a decline in quality (whether of students or the education they acquire), making a fall in returns to education due to a decline in quality possible.

Apart from issues of quality, Mission Sucre led to a massive increase in skilled labor. In 2003, approximately 400,000 students enrolled in the program and began taking classes in the PIU program. Of these, about 196,000 completed the program in 2005 and 53,000 enrolled in university programs. As mentioned above, tertiary enrollment has increased significantly over time. Notice that over 300,000 students are enrolled in Mission Sucre and that these students will transition into the work force. The transition of these students and the regular cohort of students from other universities into the work force will cause a rapid increase in the labor force of college graduates. The first alumni of the program graduated in mid-late 2007⁵ Our hypothesis is that the documented decrease in the returns to education can be explained in part by Mission Sucre, which led to a rapid expansion in skilled labor and a fall in the quality of tertiary education. However, Mission Sucre was

⁵Some estimates claim that about 50,000 students had graduated by 2008.

not the only education program implemented by President Chavez. We highlight the other programs implemented in the next section. These programs specifically could affect returns to education via a sudden expansion in the labor supply with primary or secondary education.

5.3 Other Programs Implemented by Hugo Chavez That Can Affect Returns to Primary and Secondary education

Since coming to power in 1999, President Hugo Chavez has developed a number of educational, anti-poverty, social welfare and electoral and military recruiting programs known as the “Bolivarian Missions.” The educational component is comprised of three Mission programs—Robinson, Ribas, and Sucre—which provide primary, secondary and tertiary levels of education, respectively, to the poor and marginalized segments of the population that have been denied access to education. These programs are designed to feed into each other sequentially. According to government officials, approximately 2.7 million people have participated in this system of education programs. External analysis has confirmed this number, finding that about 10% of the population has participated, approximately 80% of them adults.

Mission Robinson, launched in July 2003, uses volunteers, who are paid a minor sum, to teach reading, writing and basic math to adults with the aim of ending illiteracy and preparing students to participate in the next level of adult education through Mission Ribas. After graduating 1,400,000 students, the country declared itself “illiteracy free” in October 2005, claiming the program had raised the literacy rate to 99%. However, using the same INE household surveys, Ortega and Rodriguez (2008) find at most a small positive effect of Mission Robinson on literacy rates. In many specifications, they find the program impact to be statistically indistinguishable from zero. The implications of these findings go beyond the success of Mission Robinson, because the program is designed as an entry point to the education network that is followed by Missions Robinson 2, Ribas and Sucre. The next step for those who complete Mission Robinson is Mission Robinson 2, which provides adults with the equivalent of a primary education.

Mission Ribas, launched in November 2003, offers evening remedial high school education to adults who previously dropped out of high school, along with a small stipend to help offset the opportunity cost of taking classes. In 2004, about 600,000 students were enrolled. By 2007, however, there were public concerns about the effectiveness and results of the program, even from official

sources. In a March 2007 article in the *El Universal* newspaper, Representative Pastora Medina, head of the education committee of the National Assembly, said: "There is little commitment on the part of students and teachers of Mission Ribas, which has led to devolution. Just in Caracas, in the Caricuao area, there are 300 pupils enrolled, but only eight attend classes. Another anomaly regards the lack of academic and teaching materials, which still have not been given to students." President Chavez also stated in an address to a new graduating class of the program that of 418,000 people who had completed the program at the time, only 25,000 had gone on to pursue higher education. Many of those who have gone to higher education have gone to Mission Sucre universities.

Just as we argue that Mission Sucre could lead to a decrease in returns, it is quite easy to envisage why these other programs will have similar declining effects on returns to education at the secondary and primary levels. However, unlike Mission Sucre, for which issues of quality are of significance because of the change in the criteria for university entry, Mission Ribas and Robinson did not really create a quality crisis at the primary and secondary level. Rather, these programs created a massive increase in the supply of labor with primary and secondary education, which could cause a fall in returns as long as the demand for labor at these levels of education does not expand. Given that secondary education experienced the greatest decline, it is possible to hypothesize that the demand for secondary education increased less than other levels of education or that the supply expanded more than other levels of education post the program. However, this explanation is speculative and other factors may explain this significant decline.

In the next section we provide the different tests we carry out to provide support for the impact of Mission Sucre.

Can the Decline in Returns Be Just a General Trend?

As noted in the literature review, returns to education were on a decline from the mid 1970s to the mid 1990s. Hence, it is possible to argue that the decline between 2002 and 2008 is just a continuation of that past decline, while the period between 2000 and 2002 with increasing returns was simply an aberration. A general downward trend in returns to education is possible, but the decline in the 1970s and early 1980s was explained by education expansion and not just a trend. In addition, given that Patrinos and Sakellariou (2006) noted that average returns stabilized in the mid 1990s and then began to rise post 2000, and provided reasons for these changes, it is less likely

that the unexpected downward movement in returns to education is simply a trend effect. Though we cannot reject that part of the decline in returns may be linked with general trends, in the rest of the paper we present evidence of the role of Mission Sucre on declining returns.

6 Empirical Evidence for the Impact of Mission Sucre

6.1 Evidence from Differences Across Levels of Education

If truly the fall in returns to education is being driven by Mission Sucre and not the oil boom, other programs, or a general trend, we should see differential changes in returns to education across education levels. Differential changes are expected because Mission Sucre only creates an expansion in skilled labor at the tertiary level and hence the fall in returns should be only at that level. Even if the returns to education is trending downward in general, the fall in returns should be higher at the tertiary level if Mission Sucre has an impact. Hence, *ceteris paribus*, if the fall in returns to education is similar across levels of education, it is less likely that Mission Sucre has any impact.

We estimate the returns to each level of education using equation 2. ς , ϖ and ϱ are the estimates of the returns or premium to different levels of education for the four years of data available. We break down tertiary graduates into two groups.

$$\log(Y) = \theta + \gamma X + \delta X^2 + \varrho \text{dumpri} + \varphi \text{dumsec} + \varpi \text{techdum} + \varsigma \text{univdum} + \lambda_2 Z + \varepsilon \quad (2)$$

In this equation, Y is monthly earnings, Z is the matrix of all relevant control variables and year dummies, pri is a dummy variable equal to one for all who completed primary school and 0 otherwise, sec is a dummy variable equal to one for all who completed secondary school and 0 otherwise, tech is a dummy variable equal to one for those who have postsecondary technical training and 0 for all others, and univ is a dummy variable equal to one if an individual has at least a bachelor degree. ς can be interpreted as the returns to university education in comparison to those who have secondary education, while ϖ is the returns to technical education in comparison to those with secondary education.

Our rationale for breaking down tertiary education is linked with our identification strategy, which we will highlight in the coming sections. Mission Sucre originally created only universities, but in May 2005 the program was also extended into technical education. However, the main focus

today is still providing free university education.⁶ These differences in timing of Mission Sucre universities and technical schools, along with the focus of Mission Sucre on university education, can create differential changes in returns for these two types of tertiary education over time. Also, our division of tertiary graduates into those with technical education and those with university education allows us to compare the payoff of each type of tertiary education in comparison to those with secondary education.

Given the similarities in findings using both log of hourly earnings and log of monthly earnings in previous analysis, we use only log of monthly earnings for the rest of the paper. In addition, monthly earnings are less likely to be measured with error, unlike the number of hours worked. The result of the estimation of equation 2 is summarized in Table 5. Given the possibility of a change in the ability bias at the tertiary level beginning in late 2007 and 2008 with the inclusion of Mission Sucre graduates, we present the results with and without these observations.⁷ Given that the results with or without this sample are not statistically significantly different, we conclude that by 2008, we can still assume time invariant ability bias using the whole sample.⁸

Table 5 presents the estimates of the returns to each level of education for our four years of data. These estimates provide the payoff or benefit of obtaining the next level of education. Also, with these results we can compute the decline in payoffs to each level of education between 2002 and 2008. We find that the benefit of primary education declined by 10.7 percentage points; the returns to secondary education declined by 10.5 percentage points; the returns to technical education declined by 6.3 percentage points; and the returns to university education declined by 16.9 percentage points. This result highlights three issues. First, declines in returns to education have occurred across all levels over time. Second, we notice that at each level where the government has instituted a concrete program to expand enrollment or increase access, returns to education have fallen even more (primary, secondary, and university). Technical education, the only level that did not have a concrete government program intervention, had the lowest decline over time. As mentioned above, even though from 2005 Mission Sucre started providing technical education, the focus of Mission

⁶Enrollment in Mission Sucre technical education in 2005 was only 20.8% of total Mission Sucre students.

⁷We explain in more detail the identification of the Mission Sucre students in the later part of the paper.

⁸For the rest of the paper we will present results using the whole sample, assuming that potential ability bias is time invariant. It is possible that in later years (2009 and beyond) this assumption may no longer be valid as even more Sucre students transition into the work force.

Sucre is free university education, and it is at the university level that most of the program's expansion has taken place. More importantly, in our 2007 and 2008 data, there are no technical graduates from Sucre Mission. Hence, falling returns at this level are independent of any program intervention. The change in returns at this level may capture the pure downward trend effect in returns to education in Venezuela while the changes at the other levels capture both the general trend effect and the impact of the respective programs. Notice also that the payoff of primary and secondary education declined at similar rates. In contrast, the results from Table 5 show that the greatest fall in the returns to a level of education occurred at the university level. This finding is in consonance with our expectation. We expect the greatest decline in returns at the university level because of the strong potential effect of the implementation of Mission Sucre (quality and quantity effects) on returns. The interventions at the primary and secondary levels, although they increased the supply of labor at those levels, did not reduce or change the criteria for education at the primary and secondary level, and hence should have a lesser human capital effect.

Also, the significant and larger decline in returns at the primary and secondary levels in comparison to the technical education level raises doubts of these changes being a result of an oil boom. If this decline was linked with the oil boom explanation, we should not see significant declines at the lower levels of education. Rather, the larger declines should be at the tertiary level both technical and university. However, consistent with program impacts, we note that at each level where the government implemented a program that can create an excess supply of labor and/or fall in quality, there is a more dramatic decline in returns. We reiterate that we do not claim that the entire decline can be attributed to the programs. The change in returns at the technical level is proof of a general trend effect. It is unrealistic to assume that over the span of seven years returns to education cannot trend upward or downward. Why? Over time in Venezuela, the number of people with each of the levels of education has increased, and if labor markets do not produce similar increases in demand, then even without any policy or program, returns may slowly decline.

We earlier showed that the average returns to education changed differently across states (Figure 2). It may be useful to see if returns to different levels of education changed similarly across states. We re-estimate equation 3 by state for 2002, 2003, 2007, and 2008 (see appendix for estimates). However, we focus on the changes in returns to university education versus technical education in

Table 5: Basic Regression: Estimating Return to Education by Level 2002- 2008

| | 2002 | 2003 | 2007 | 2008 |
|--|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) |
| Returns to levels of education (Panel B) | | | | |
| primary dummy | 0.242*** (0.009) | 0.216*** (0.009) | 0.170*** (0.008) | 0.135*** (0.008) |
| secondary dummy | 0.235*** (0.010) | 0.240*** (0.010) | 0.157*** (0.009) | 0.130*** (0.009) |
| technical dummy | 0.379*** (0.013) | 0.343*** (0.014) | 0.312*** (0.011) | 0.316*** (0.011) |
| university dummy | 0.769*** (0.012) | 0.754*** (0.012) | 0.637*** (0.010) | 0.600*** (0.010) |
| university dummy (drop Sucre) | 0.769*** (0.012) | 0.754*** (0.012) | 0.638*** (0.010) | 0.601*** (0.010) |
| R-Squared | 0.324 | 0.312 | 0.280 | 0.295 |
| N | 79194 | 87022 | 83480 | 60589 |

Note: Dependent variable: log of monthly income *significant at 10%; ** significant at 5%; *** significant at 1%,

our mapping analysis. The rationale for focusing on these two groups is linked with our identification strategy and our focus only on the role of Mission Sucre on the decline in returns. Given the direct impact of Mission Sucre on the labor force for university graduates and the lack of impact on those with technical education by 2008, we use those with technical education as the control group in our analysis. Technical graduates are a good control group also because it is more likely that both types of tertiary education will have similar general trends over time without the intervention that primarily affected university education. The goal of Figure 2 is to capture the transition in returns to university and technical education over time and the differences in changes over time and across states. Figure 2 highlights two main results if we compare 2002 to 2008. First, returns to university education in comparison to secondary education are falling across all states, but not uniformly. The returns to technical education in comparison to secondary education have also declined in most states, but in a few states, the returns have actually increased, and in some states, the returns have not changed. This is in contrast to the change in returns to university education, which have declined across all states. In addition, the extent of the drop in returns at the university level is

higher than the drop in returns at the technical level. This result provides additional evidence for our hypothesis. Erratic changes in decline as are noted for the control group are less likely linked with a policy change, while a consistent drop across states in returns to university education is more suggestive of a policy effect. In the next section we search for more specific evidence in support of our hypothesis and the impact of Mission Sucre on returns to education.

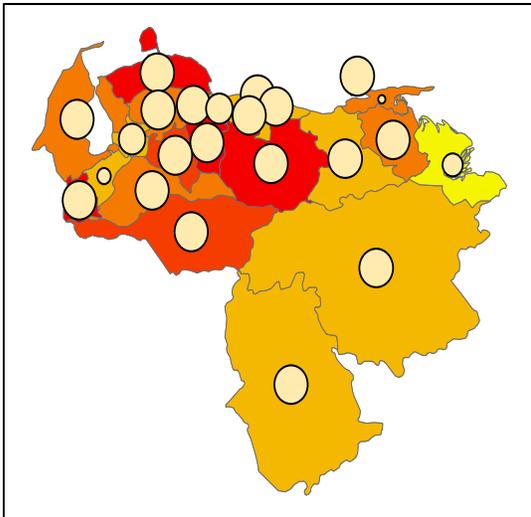
6.2 Evidence From Sectors of Employment

We investigate returns to education across sectors of employment for two reasons. First, if the fall in returns is in response to a fall in the quality of graduates or an increase in the labor supply, then we expect a market response to this change and much less of a general change. What this means is that those who work for the government should be less likely to experience a fall in their returns to education because wages are fixed, while those who work for the private sector are more likely to experience the fall in returns because wages are market determined, and could fall with an increase in labor supply. Second, if the quality of education leads to less human capital being accumulated, then a fall in the returns to self employment could also be expected because the knowledge and human capital acquired in school are used by those who are self employed in their business enterprizes. In contrast, if the fall in returns is due to the oil boom, then we should expect no decreases in the returns in the public sector. A fall in returns in the government sector is only likely if wages were increased non-uniformly with higher increases at the lower levels of education. There is no evidence of such nonuniform wage increase post the boom in Venezuela.⁹ For wage workers in private enterprizes, we should also expect no reduction in returns to education given that wages are linked with productivity. During an oil boom, we should actually expect an increase in return to education for wage workers driven by rising returns for those workers in companies benefitting from the oil boom, unless such companies tend to employ more of those with less schooling. Also, average returns to education in the wage sector would only decline if the oil boom caused a decline in productivity. There is also no evidence of this kind of trend in Venezuela. It is only for those who are self employed that a decline in returns from an oil boom is possible. This can happen because many who are self employed can get involved in high-paying rent-seeking activities during a boom

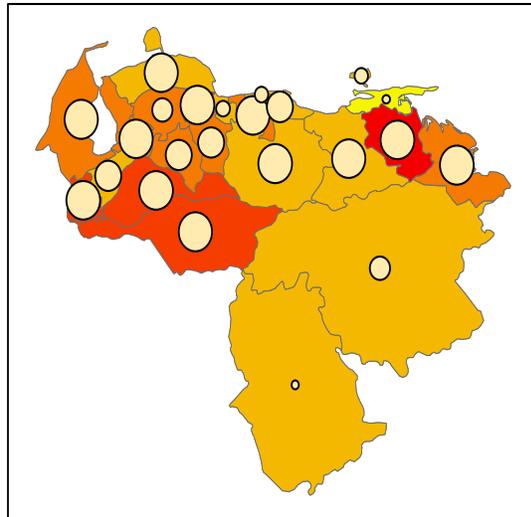
⁹It is important to mention that those who work for the government might benefit from an increase in rent-seeking activities during an oil boom through increased bribe taking or corruption, but that these illegal payments would not be captured by our data.

Returns to higher education by state

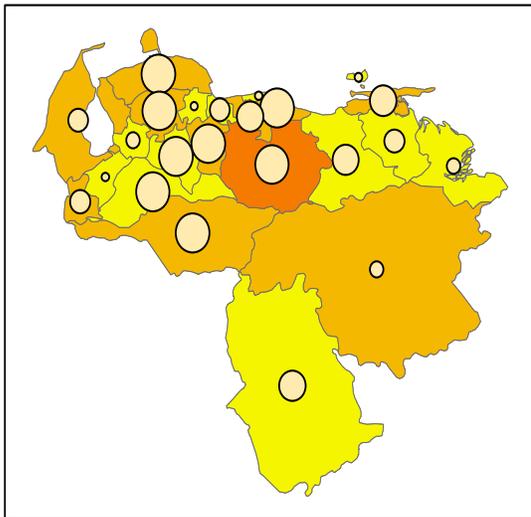
2002



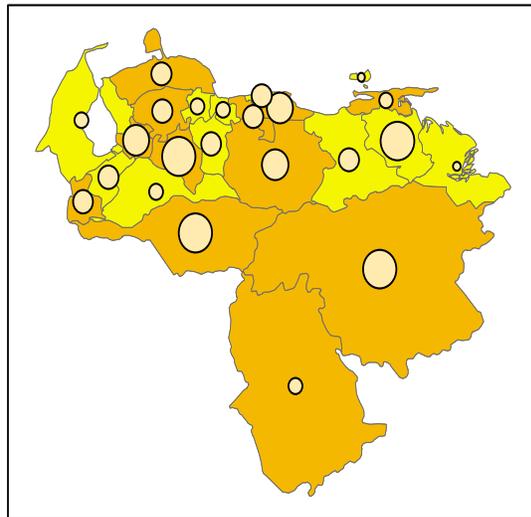
2003



2007

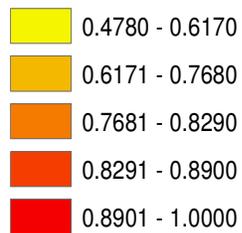


2008

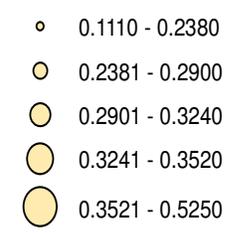


Legend

Returns to university education



Returns to technical education



and the ease of move to these kinds of business activities could be inversely correlated with years of schooling.

We investigate the possibility of either argument by estimating equation one by sector for each year of available data, focusing on the change in returns between 2002 and 2008. We break up occupation types into four categories: public employees, public laborers, the self-employed and other groups (private enterprise). The results are summarized in Table 6 (Panel A). First, the results highlight statistically identical returns for the three comparable groups in 2002 (public employees, private employees, and the self-employed). The returns to public laborers are much lower and come as no surprise given the selectiveness of this group in terms of education and job permanence. Public laborers are temporary government labor and we ignore this group and make comparisons over the other three groups. Notice that by 2008, the returns to all the groups have fallen, but unlike in 2002, the returns are no longer statistically identical across the three comparable groups. The average returns to education have fallen more among those in the private sector and those who are self-employed and fallen less among those who are public sector employees. (2.8 percentage points versus 1.6). This result is consistent with the impact of an education expansion program and at variance with an oil boom or general trend explanation. Hence, the results of the sector of employment analysis provide further evidence in support of the education reform thesis versus any other. Again, even though these estimated returns may not be consistent, since our focus is on changes in returns, as long as ability is time invariant our estimated changes in returns will be consistent and our inferences valid.¹⁰

6.3 Evidence from Occupation Categories

In our continued search for more evidence in support of our thesis, we consider differences in the average returns to education across occupation categories. One of the unique features of Mission Sucre is that students enrolled in the program can only choose from a select number of majors deemed by the government to be of national priority. There are specific majors that the program entrants can choose between. At inception, Mission Sucre offered university degrees in the following fields: social communications, social and community management, telecommunications, ecological and environmental studies, and political and judicial studies. These fields were later extended, and in

¹⁰We highlighted earlier why we can assume time invariant bias between 2002-2008.

Table 6: Average Returns to an Extra Year of Education by Sector

| Group | 2002 | 2003 | 2007 | 2008 |
|--|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) |
| (Panel A: Average returns to education by occupation type) | | | | |
| All other groups | 0.078*** (0.001) | 0.073*** (0.001) | 0.055*** (0.001) | 0.050*** (0.001) |
| Public employees | 0.080*** (0.002) | 0.078*** (0.003) | 0.069*** (0.002) | 0.064*** (0.002) |
| Public laborers | 0.040*** (0.003) | 0.041*** (0.004) | 0.034*** (0.003) | 0.029*** (0.003) |
| Self-employed/business owners | 0.080*** (0.003) | 0.071*** (0.003) | 0.064*** (0.002) | 0.052*** (0.002) |
| (Panel B: Average returns to education by occupation categories) | | | | |
| All others | 0.071*** (0.001) | 0.068*** (0.001) | 0.056*** (0.001) | 0.047*** (0.004) |
| Educators | 0.098*** (0.006) | 0.088*** (0.006) | 0.115*** (0.007) | 0.102*** (0.004) |
| Other Sucre Mission occupations | 0.085*** (0.004) | 0.082*** (0.006) | 0.078*** (0.004) | 0.073*** (0.004) |
| Management & other professionals | 0.027*** (0.005) | 0.050*** (0.005) | 0.061*** (0.004) | 0.051*** (0.004) |
| Elected officials & public admin employees | 0.049*** (0.013) | 0.050*** (0.005) | 0.044*** (0.016) | 0.045*** (0.016) |

Note: Dependent variable: log of monthly earnings

*significant at 10%; ** significant at 5%; *** significant at 1%,

2005, 24 new majors were added. The program fields now include agro-ecology, education, political studies, environmental management, health management, computer science, integral medicine and hydrocarbons.

We explore the uniqueness of the Mission Sucre fields in our attempt to identify whether the program has caused the decline in returns to education, versus a general trend effect or the oil boom. If the fall in returns is in response to a decrease in the quality of graduates from fields with Mission Sucre students, then we expect a greater market response, in terms of decline in returns, in the occupations that Mission Sucre program is focused on. In addition, the expansion in skilled labor should not be uniform across fields. Rather, the fields that Mission Sucre is focused on are where

the increase in the labor supply should occur, meaning that in comparison to other fields, returns to education should decrease more in these fields. To test this hypothesis, we divide all occupations into five categories: educators (a Mission Sucre major), other Mission Sucre occupations, management and other professionals (non Mission Sucre majors), and elected officials and public administration employees (non Mission Sucre majors). The potential problem we face with this analysis is with the sectors that these employees end up working in. As highlighted above, individuals who work in the public sector are less likely to see much change in returns to education, whereas those who work in the private sector are more likely to see a decline. In addition, classifying individuals into occupation groups based on Mission Sucre fields may be noisy and prone to measurement error because individuals may take a major in a particular field but end up in an occupation category that is different from that major. For example, an individual could have been a business major in college, which is not one of the Mission Sucre mission fields, but end up becoming an educator, which is an area of focus of the program. Despite these potential limitations, we still estimate the average returns across these occupational groupings.

We investigate the above possibility by estimating equation 1 separately for the aforementioned occupation categories over the four years of data. Table 6 (Panel B) is the summary of the average returns to education for each occupation group. The results show that returns to education have not changed uniformly across groups. The returns to education also consistently differ across groups over time, with educators as a group having the highest returns to their education in each period of time considered. With respect to changes over time, we notice that returns to education declined for some groups, increased for the management group, and remained the same for educators, which is a focus field of Mission Sucre. The returns to education declined in the other Mission Sucre occupation group by 1.2 points but declined even more among all other fields (by 2.4 points). The erratic nature of these results may point to some of the issues highlighted earlier with respect to the public versus the private sector, or noise in the classification of majors into these occupation categories. Another potential problem is that the average returns to education might hide significant information on changes at the different levels of education. Recall that Mission Sucre is only focused on tertiary education, and hence changes in the returns at other levels of education might affect the average returns to education, even though the returns to university education are declining. For

each of the occupation categories highlighted above, we re-estimate the returns to levels of education using equation 3. We focus on estimates for university and technical education in 2002 and 2008, and compute the changes between these two periods. Table 7 is a summary of the results from this analysis.

The results in Table 7 are more consistent with our thesis. For the non Mission Sucre occupation categories, we note a similarity in the direction of change in returns to education at both the technical and university level. In contrast, for the Mission Sucre occupations we note differences in trends for the technical and university levels. Specifically, if we look at the category called "Others," we note no significant differences in the returns to technical or university education over the 2002-2008 period. For the management category, we note an increase in returns at both the technical (11 points) and university (17 points) levels. When we look at the Mission Sucre affected occupations, the result is different for educators. For this group, we note a rise in the returns to technical education of about 8.4 percentage points, while we note a drop of 4.0 points at the university level. For the other Mission Sucre affected occupations, we note no change in the returns to technical education, while we see a 4.8 percentage point drop in returns to university education.¹¹ These results again provide evidence that Mission Sucre had an impact on returns to education. Notice that only occupations that could be affected by the program experienced a significant drop in returns, and only at the university level. Interestingly, returns for university graduates were rising and stable for all other professions.

6.4 Evidence From Different Age Groups

Another reason why the identification techniques highlighted above could be noisy is our lack of account for age cohorts.

Even though a fall in the quality of education may cause employers to pay already employed skilled workers less, this is unlikely. What is more feasible is a decrease in wages for new workers because of a fall in productivity. If graduating cohorts since 2007 are receiving lower quality education, and low quality education leads to lower productivity, then these cohorts are likely to earn less than what a newly graduated cohort could have earned in the past with a higher quality education.

¹¹The difference between 2002 and 2008 is significantly different at the 90% but not at the 95% level for both Mission Sucre affected occupations.

Table 7: Basic Regression: Differences in Technical and University Returns by Occupation

| | Technical | | | University | | |
|--|---------------------|---------------------|---------|---------------------|---------------------|---------|
| | 2002 | 2008 | Diff | 2002 | 2008 | Diff |
| All others | 0.291*** (0.018) | 0.280*** (0.015) | -0.011 | 0.432*** (0.029) | 0.452*** (0.024) | 0.02 |
| Educators | 0.282*** (0.039) | 0.367*** (0.034) | 0.085** | 0.633*** (0.028) | 0.593*** (0.028) | -0.04* |
| Other Sucre Mission occupations | 0.233*** (0.039) | 0.228*** (0.031) | -0.005 | 0.569*** (0.030) | 0.521*** (0.026) | -0.048* |
| Management & other professionals | 0.047 (0.040) | 0.158*** (0.030) | 0.111** | 0.213*** (0.038) | 0.384*** (0.026) | 0.171** |
| Elected officials & public admin employees | 0.037 (0.141) | 0.219 (0.129) | 0.179 | 0.198 (0.108) | 0.402*** (0.091) | 0.204** |

Note: Dependent variable: log of monthly income

*** 99% significance level ** 95% significance level * 90% significance level

Also, if the demand and supply of labor argument is accurate, the increase in the skilled labor force would occur at the younger, recently graduated cohorts. It is this age cohort that should see a greater decline in returns to education in comparison to other age cohorts over time. In contrast, if the decline in returns is simply a trend downwards, then we should see similar trending across all age groups. Also, if the effect is due to the oil boom, we may see increases in returns or lower declines in returns for younger cohorts, who may find it easier to transition into rent-seeking activities in comparison to those who are already established in their careers. To check for evidence of the impact of Mission Sucre using differences across age groups, we estimate the returns to education using equation 1 for seven age groups. We believe the age cohorts above 71 and below 23 are less likely to be in the labor force full time, so we do not focus on the results from these groups. We estimate the returns for each group in each year of available data. We compare the change in returns from 2002 to 2003 with the change from 2007 to 2008. The rationale is that if this is simply a trend, the differences should be similar. In contrast, if there is an impact of Mission Sucre, there should be a larger change between 2007 and 2008, as graduates of the program enter the work force.

The results in Table 8 provide evidence in support of this thesis.¹² First, the declines in returns to education between 2002 and 2003 are in most cases insignificant. Only at the 41-50 and 29-40

¹²Notice that as expected, returns to education vary over the age profile, with a rise in returns up to the 60s cohorts and a decline afterward.

Table 8: Basic Regression: Estimating Return to Education by Age Groups 2002-2008

| Age group | 2002 | 2003 | Diff 2002-03 | 2007 | 2008 | Diff 2007-08 |
|-----------|---------|---------|---------------|---------|---------|--------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| >71 | 0.090* | 0.083* | -0.007 | 0.103* | 0.050* | -0.053 |
| | (0.012) | (0.013) | | (0.008) | (0.008) | |
| 61-70 | 0.096* | 0.098* | 0.002 | 0.087* | 0.074* | -0.013 |
| | (0.005) | (0.005) | | (0.004) | (0.004) | |
| 51-60 | 0.105* | 0.101* | -0.004 | 0.084* | 0.072* | -0.012 |
| | (0.003) | (0.003) | | (0.002) | (0.002) | |
| 41-50 | 0.105* | 0.100* | -0.005 | 0.078* | 0.072* | -0.006 |
| | (0.002) | (0.002) | | (0.001) | (0.002) | |
| 29-40 | 0.103* | 0.097* | -0.006 | 0.075* | 0.064* | -0.011 |
| | (0.001) | (0.002) | | (0.001) | (0.001) | |
| 23-28 | 0.079* | 0.077* | -0.002 | 0.059* | 0.052* | -0.007 |
| | (0.002) | (0.002) | | (0.002) | (0.002) | |
| <23 | 0.034* | 0.030* | -0.004 | 0.* | 0.025* | 0.001 |
| | (0.003) | (0.003) | | (0.003) | (0.003) | |

Note: Dependent variable: log of monthly income. All coefficient estimates significant at the 1% level.

groups are the changes significant but not substantial. However, the changes in the returns to education between 2007 and 2008 are substantial and significant in most cases. We hesitate to talk about the 61-70 group and older because it is possible the average age of retirement could be changing over time, which could explain the fall in returns. Even the 51-60 age group might also be problematic because the national retirement age (NRA) in Venezuela is below 60 years. Rather, we focus on the results of the 23-28 cohort, which contains the new entrants to the work force and Mission Sucre graduates. The interesting thing to note is that although the returns for this cohort were constant between 2002 and 2003, the returns for this age group dropped between 2007 and 2008 by 0.7 points. It is important to mention that the returns to education for some other groups dropped more, but as is the case for the 29-40 and 41-50 groups, their returns also dropped between 2002 and 2003. The fall between 2002 and 2003 for these cohorts may indicate a steady downward trend in these groups.¹³ The result in Table 8 provides some suggestive evidence for the potential impact of Mission Sucre on returns to education. Again, a possible limitation of the age analysis is

¹³There is some evidence that Mission Sucre graduates are on average older than non Sucre university graduates. According to a government press release, the average age of Mission Sucre students is 35 years. However, Mission Sucre students being older cannot explain the increased decline in average returns for the 29-40 age group. This is because even when the Mission Sucre students are dropped the decline in average return still exists.

the focus on average returns to education and not returns at the level which was directly impacted by the program, university education.

7 Difference in Difference Strategy

In the next two sections, we present our most compelling evidence for the impact of Mission Sucre on returns to tertiary education. We explore the fact that Mission Sucre focused solely on university education versus technical education at its inception, even though both levels are tertiary education. Although the program implemented technical education programs in 2005, we still feel returns to technical education is a good control for our analysis for three reasons.

First, technical schools, whether Mission Sucre or regular, are still three years in duration. This is in contrast to university education, where the length was shortened in the Mission Sucre universities, resulting in a potential source of falling quality. Second, technical schools have not had the significant supply constraint that universities have had because of the difficult screening exams and other entry criteria. Though technical schools had an entrance exam, this exam is not viewed as a large constraint like the university entrance exams. What this means with respect to Mission Sucre technical institutes is that we do not expect as much of a decline in the quality of students at these institutes in contrast to students at Mission Sucre universities. In addition, as mentioned above, Mission Sucre is primarily focused on university education, and almost 80% of Mission Sucre students are in university programs. Third and most importantly, the technical Mission Sucre programs started in 2005, so graduates from this program will only graduate and enter the work force beginning fall 2008. The data we are using is from the first semester of 2008, so technical students in Mission Sucre were yet to graduate. Hence, individuals with technical education in the sample are not impacted by Mission Sucre and can still be an appropriate control group. Based on these three reasons and the time period we are considering, we do not expect returns to technical education to change as a result of Mission Sucre, while we do expect the returns to university education to decline. Even if the Mission Sucre technical schools will have an impact on returns to technical education, these changes will not occur until these graduates transition into the work force in 2009. Thus, technical education is a good control for the data period we use for this analysis. Any change in returns to technical education over this period can be attributed to

other factors that can affect returns to tertiary education (for example, a general trend or oil boom). It is fair to assume that such trends are similar across university and technical education given that both are higher levels of education.

To be as precise as possible, we estimate using equation 2 the returns to technical and university education for the age group 23-28. As mentioned above, this age group is the cohort likely to be directly impacted by the policy because they are the new entrants into the work force. New entrant into the work force are more likely affected by Mission Sucre because the increase supply of labor is at the entry level and not at higher levels. Hence, wages for older age cohorts who are already in the work force are less likely going to be impacted significantly. Returns are estimated for the year 2007 and 2008 at the technical and university level and a difference in difference in returns is computed. Keep in mind that those with technical education are the control group. Assuming that no other change occurred that could affect university education solely between 2007 and 2008, our difference in difference estimation captures the direct immediate effect of Mission Sucre on returns to university education. Recall that we focus on the period post the entrance of Mission Sucre graduates into the work force and compare it to the period immediately preceding entrance. To confirm that we are not just capturing differences in trends for university and technical graduates, we do a similar pseudo analysis. Here we compute the difference in difference estimate using 2002 and 2003 estimates of returns to university and technical education instead of 2007 and 2008 estimates. The results are summarized in Table 9. The pseudo analysis is in Panel A, while the real analysis is in Panel B. Note that the diff-in-diff estimate using the pseudo analysis is not significantly different from 0, while similar analysis comparing 2007 and 2008 suggests that Mission Sucre led to a 2.7 percentage point decline in the returns to university education for the 23-28 age cohort.¹⁴ As mentioned earlier, we achieve identification because even though each estimate of returns to education may not be consistent, the change in returns and difference in difference estimate is consistent. We present both the difference in difference estimate using the whole sample and the sample that excludes all Mission Sucre graduates and possible Mission Sucre graduates.¹⁵

¹⁴This estimate of the impact of the program is for the 23-28 age cohort. It is a lower bound on the total program impact because by focusing on the 23-28 age cohort, we may exclude people who participated in the program. In the previous section we mention that there is some evidence that many Mission Sucre graduates belong to the 29-40 age cohort.

¹⁵We are able to identify Sucre graduates because they have four years of university education while other university graduates have five years of university education. Potential Sucre graduates are the sample of those who are university

Table 9: Basic Regression: Return to Technical and University Levels for Affected Age Group, 2002-2008

| | 2002 | 2003 | Difference | 2007 | 2008 | Difference |
|--|---------------------|---------------------|------------|---------------------|---------------------|----------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Panel A | | | Panel B | | |
| University (Age grp. 23-28) | 0.702*** (0.033) | 0.670*** (0.032) | -0.032 | 0.628*** (0.025) | 0.569*** (0.025) | -0.059** |
| Technical (Age grp 23-28) | 0.372*** (0.024) | 0.345*** (0.024) | -0.027 | 0.341*** (0.021) | 0.309*** (0.021) | -0.032 |
| Difference | 0.33** | 0.325** | 0.005 | 0.287** | 0.26** | 0.027** |
| N | 13030 | 13994 | | 13247 | 9595 | |
| R ² | 0.233 | 0.225 | | 0.202 | 0.222 | |
| non Sucre University (Age grp. 23-28) | 0.702*** (0.033) | 0.670*** (0.032) | -0.032 | 0.625*** (0.025) | 0.566*** (0.025) | -0.059** |
| Technical (Age grp 23-28) | 0.372*** (0.024) | 0.345*** (0.024) | -0.027 | 0.341*** (0.021) | 0.31*** (0.021) | -0.032 |
| Difference | 0.33** | 0.325** | 0.005 | 0.284** | 0.256** | 0.028** |
| R ² | 0.233 | 0.225 | | 0.202 | 0.222 | |

Note: Dependent variable: log of monthly income.
 significant at 10%; ** significant at 5%; *** significant at 1%,

8 Identification Using a Regression Analysis

As a final robustness check on the impact of Mission Sucre on returns to university education, we exploit the differences in program impact across states. We know that the number of students enrolled in the program differed across states. If the supply-demand argument we highlighted above is applicable in the Mission Sucre case, then in states with higher enrollment impacts there should be larger increases in the supply of skilled labor, which should lead to higher declines in the returns to education. Similarly, in states with higher Mission Sucre enrollment impacts, the decline in the quality of education and students should be more acute, leading to a more severe decline in the returns to education. What the above theoretical predication implies is that we expect the decline in returns to education to be nonuniform across states given that the increase in enrollment share of Mission Sucre students was nonuniform across states. Of course, if individuals can move across states with ease after graduation, this argument will be less tenable. In the Venezuelan case, internal migration rates are low and chiefly eastward from the far northwest (Tachira, Merida, and

graduates but did not indicate the number of years of university education, such that they could be regular or Mission Sucre university graduates.

Trujillo) to Caracas.¹⁶ To test for a relationship between the enrollment share of Mission Sucre students in a state and the fall in returns to education across states, we once again focus on the returns to university education and use the returns to technical education for the control group or placebo analysis. First, we estimate the returns to education across each state in Venezuela for the first semester of 2007 and the first semester of 2008.¹⁷ Next, we calculate the percent of Mission Sucre students in the population in each state. The summary of these shares are in Table 13 in the appendix. We then find the change in returns to education in each state for the two periods. Finally, we run a simple OLS regression on equation 4.

$$\beta_{i,t} - \beta_{i,t-1} = \lambda X_i + \epsilon \quad (3)$$

Where $\beta_{i,t}$ is the returns to university education in state i in 2008 and $\beta_{i,t-1}$ is the returns to university education in state i in the first semester of 2007. We focus on the first semester of 2007 and compare it to 2008 because this data is just before the entrance into the work force of any Mission Sucre students (the first round graduated mid-2007). In addition, we choose 2008 and not fall of 2007 as the comparison period to maximize capture of new entrants into the work force, leaving some room for transition into the work force, which can take a few months. X_i is the share or percent of Mission Sucre students in the population in state i . Next, we estimate equation 4 replacing the change in returns to university education for each state with the change in returns to technical education. This is our control group analysis. We expect that $\lambda = 0$ for this analysis, while $\lambda < 0$ for the analysis using university education. This is because an increase in the share of Mission Sucre student enrollment in a state should lead to a decline in returns to university education, with an even more negative change in the return. We do not include a constant term in this estimation because we believe that over a short period like 2007-2008, any significant change in returns has to be linked with the impact of Mission Sucre students' school-to-work transition. Of course, this assumption would be flawed if there was a shock or policy change that coincided with this period that could affect returns to tertiary education, but there was none. However, this modeling strategy is less tenable in the long run. To check the long run relationship, we estimate equation 5.

¹⁶According to the CIA fact book, Venezuela has -0.42 migrant(s)/1,000 population (2009 est.), a low figure.

¹⁷We do not restrict ourselves to the 23-28 cohort because the data sample of this cohort for some states is small and regression could be noisy. In addition, Mission Sucre graduates are also in older age cohorts.

$$\beta_{i,2008} - \beta_{i,2002} = \alpha + \gamma X_i + \epsilon \quad (4)$$

Where *beta* can either be returns to university or technical education.

The problem with this longer term analysis is the potential endogeneity of X . This is because the change in returns over six years could be driven by several factors, including general trends and oil booms, and it is possible that the share of enrollment in Mission Sucre across states could be correlated with other things about the states that changed over these 8 years, which also affected returns to education. For example, states with higher shares of Mission Sucre students might be states that embrace Hugo Chavez's policies more readily and intervene more in the labor market, which can lead to an exogenous decline in returns to education over time in such states not linked with Mission Sucre. Hence, the impact of Mission Sucre could be overstated. One easy way to check if this possible reason for endogeneity is valid is to check the estimate of γ when we use change in returns to technical education over 2002 to 2008. If there is a significant relationship between the shares and the changes in returns to technical education between 2002 and 2008, then the endogeneity of X is more likely. However, if there is no relationship, then it is less likely that this variable would lead to a inconsistent estimate of the effect. We estimate γ in a regression with and without a constant term in this longer term analysis. However, in this case, including a constant is the correct specification because of the possibility of a change in returns to education over six years (2002-2008) that has nothing to do with a change in the X variable (share of Mission Sucre students) but could be linked to factors like the oil boom, general population trends, or a general decline in the quality of education.

The results in Table 10 confirm our earlier results. Columns (1) and (2) focus on the results for the 2007 semester one and 2008 comparison. Columns (3)-(6) focus on the longer term analysis for 2002 to 2008, and columns (7) and (8) serve as evidence for the choice of the first semester of 2007 and also as a robustness check. The results from column (1) show that an increase in the percentage of Mission Sucre student enrollment led to a higher decrease in returns to education in 2008 and hence a more negative difference in returns between 2007 semester one and 2008. Specifically, a 1% increase in the share of Mission Sucre students in a state led to a decline of 5.6 percentage points in returns to university education between 2007 and 2008. In contrast, we see no impact on returns

Table 10: Regression: Impact of Mission Sucre enrollment on decline in returns to education

| | 2008- 2007 (1) | | 2008-2002 | | | | 2008-2007 | |
|--------------|----------------|-----------|------------|-----------|------------|-----------|------------|-----------|
| | University | Technical | University | Technical | University | Technical | University | Technical |
| | Treatment | Control | Treatment | Control | Treatment | Control | Treatment | Control |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| % Enrollment | -0.056** | -0.005 | -0.082* | -0.001 | -0.150** | -0.045** | -0.029** | -0.0001 |
| | (0.016) | (0.021) | (0.04) | (0.032) | (0.017) | (0.014) | (0.0096) | (0.012) |
| Constant | NA | NA | -0.105* | -0.068 | NA | NA | NA | NA |
| | | | (0.057) | (0.046) | | | | |
| R^2 | 0.324 | -0.04 | 0.124 | -0.048 | 0.761 | 0.299 | 0.253 | -0.045 |
| N | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Note: Dependent variable: (Returns to university or technical education in period t) - (Returns to university or technical education in period f) Where f is either 2007 semester one, 2007 or 2002
*significant at 10%;** significant at 1%.

to technical education, the control group. As a robustness check, we compare the entire 2007 year to 2008. As mentioned above, the comparison of all of 2007 with 2008 may not allow us to isolate properly the impact of the program, which will require a pre treatment period and a post treatment period. Fall 2007 does not make a good pre treatment period because some of the Mission Sucre students could be in the work force. Notice that even with this analysis, the impact of Mission Sucre enrollment is negative and significant, though smaller, while again the control group is not significant.

The results for the longer time analysis are summarized in columns (3)-(6). Focusing on the estimate including a constant, we notice that the constant is significant at the 10% level in the university change regression (column (3)), which indicates that it is possible that even without any Mission Sucre enrollment impact, returns to university education would still have dropped over the period. Interestingly, we do not obtain a similar trend for technical education. This may suggest that the result of a significant constant term might not be robust. Notice also that γ is insignificant in column (4), the control group, while it is significant in column (3), the treatment group (university education).¹⁸ The results in columns (5) and (6) assuming no constant are much larger than other estimates and are the only time the impact on the control group is significant. As mentioned above, assuming no constant is unrealistic over the 2002-2008 period and we ignore these estimates. This

¹⁸The estimates of γ in columns (1) and (3) are numerically but not statistically different (0.056 and 0.082), which further reinforces our results.

analysis provides concrete evidence of the impact of Mission Sucre. As reflected by the significant constant term in column (3), returns to university education declined over 2002 to 2008 for reasons apart from Mission Sucre, but the driver of the recent decline in returns to university education is Mission Sucre and the entrance of Mission Sucre graduates into the work force.

9 Inferences, Conclusion and Future Work

From the beginning of this analysis, our goal has been to document the changes in returns to education in Venezuela, provide explanations for these changes, and provide evidence using micro-data.

We started asking the question of whether returns to education had declined in Venezuela between 2002 and 2008. We were able to confirm quite easily that the returns to education had declined over this period, with this result being consistent across gender. However, we noted quite early in the paper that the decline in returns to education across states was nonuniform, which provided the foundation for some of our further analysis.

Our goal was to explain the fall in returns to education in Venezuela. We started out by stating our two possible main explanations for this decline. We then provided a theoretical argument for why Mission Sucre is more likely the explanatory variable for this decline. We describe the Mission Sucre program implemented by Hugo Chavez and highlight why we feel this program could lead to a decline in the returns to education. Specifically, an exogenous increase in university enrollment will lead to an increase in the supply of skilled labor. Without a matching increase in demand for skilled labor, returns to education will decline. In a similar vein, a removal of the quality constraint on university education, as was implemented through Mission Sucre, leads to a decline in the quality of university graduates. If returns to university education depend on productivity, which is linked with the quality of students, then a decline in returns to education is not unexpected. Finally, there is clear evidence that Mission Sucre universities provided a lower quality of education. If quality of education affects returns, then lower returns to university education are once again expected.

We searched for evidence of the impact of this program using different techniques, some better than others, but we present all of these results to show that there is overwhelming evidence that the decline in returns to education at the university level in Venezuela can be linked with Mission Sucre.

We do not focus much on the other levels of education, but show that declines in returns at the primary and secondary levels could also be due to other similar programs implemented by President Chavez at those levels. Our main identification strategy relies on a difference in difference analysis and regression analysis estimating the impact of Mission Sucre enrollment differences across states on the decline in returns to education. We find that Mission Sucre led to a 2.7 percentage point decrease in returns to university education among the 23-28 age cohort between 2007 and 2008. We also find that a 1% increase in the share of Mission Sucre students led to a 5.7% decline in the returns to university education.

Why do these results matter? Falling returns to university education can lead to a lower demand for college education, which may be detrimental for Venezuela in the long run. Also, there is a potential for the Mission Sucre graduates to create a negative externality on all future graduates because employers may view new graduates as being of lower quality than former graduates, and reduce wages. More importantly, if Mission Sucre, which was founded on a premise of welfare improvement, led to declines in welfare for some, then it might be necessary to implement alternative policies to mitigate these problems. Expanding the demand for labor can only help partially, and an overhaul to the Mission Sucre program with respect to issues of quality of education and quality of students might be important. What we do not know is whether the social and private benefits of Mission Sucre exceed the costs of the program, both social and private (including the decline in returns). This is a future area of research we hope to explore. In addition, we do not exploit the panel aspect of this survey because of the rotating nature of the panel, the limited match to the years of data we have, and its high attrition rate. We hope to reexamine the impact of Mission Sucre and other educational mission as more cohorts of graduates transition into the work force. We also hope with more sequential years of data to exploit the panel nature of the dataset in the future.

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Appendix

Table 11: Basic Regression: Return to Schooling by States, 2002-2008

| | 2002 | 2003 | 2007 | 2008 |
|------------------|---------------------|---------------------|---------------------|---------------------|
| Federal District | 0.077*** (0.004) | 0.069*** (0.004) | 0.078*** (0.003) | 0.064*** (0.003) |
| Amazonas | 0.108*** (0.006) | 0.123*** (0.007) | 0.085*** (0.004) | 0.077*** (0.005) |
| Anzoategui | 0.097*** (0.005) | 0.085*** (0.005) | 0.056*** (0.004) | 0.044*** (0.004) |
| Apure | 0.100*** (0.005) | 0.098*** (0.006) | 0.069*** (0.004) | 0.056*** (0.004) |
| Aragua | 0.094*** (0.004) | 0.088*** (0.004) | 0.073*** (0.005) | 0.058*** (0.004) |
| Barinas | 0.113*** (0.005) | 0.106*** (0.004) | 0.078*** (0.004) | 0.067*** (0.003) |
| Bolivar | 0.095*** (0.004) | 0.091*** (0.005) | 0.089*** (0.005) | 0.067*** (0.005) |
| Carabobo | 0.095*** (0.003) | 0.088*** (0.003) | 0.075*** (0.003) | 0.056*** (0.003) |
| Cojedes | 0.112*** (0.006) | 0.102*** (0.005) | 0.071*** (0.006) | 0.060*** (0.005) |
| Delta Amacuro | 0.075*** (0.004) | 0.063*** (0.004) | 0.055*** (0.005) | 0.056*** (0.004) |
| Falcon | 0.118*** (0.004) | 0.115*** (0.004) | 0.092*** (0.004) | 0.070*** (0.004) |
| Guarico | 0.076*** (0.005) | 0.078*** (0.005) | 0.068*** (0.004) | 0.058*** (0.005) |
| Lara | 0.092*** (0.003) | 0.087*** (0.003) | 0.075*** (0.002) | 0.063*** (0.002) |
| Merida | 0.082*** (0.003) | 0.078*** (0.003) | 0.060*** (0.003) | 0.057*** (0.003) |
| Miranda | 0.113*** (0.003) | 0.110*** (0.004) | 0.087*** (0.003) | 0.082*** (0.003) |
| Monagas | 0.108*** (0.004) | 0.109*** (0.004) | 0.088*** (0.004) | 0.074*** (0.004) |
| Nueva Esparta | 0.107*** (0.007) | 0.095*** (0.006) | 0.047*** (0.004) | 0.049*** (0.005) |
| Portuguesa | 0.099*** (0.004) | 0.097*** (0.004) | 0.068*** (0.003) | 0.070*** (0.003) |
| Sucre | 0.107*** (0.004) | 0.109*** (0.004) | 0.058*** (0.004) | 0.055*** (0.003) |
| Tachira | 0.098*** (0.003) | 0.098*** (0.003) | 0.070*** (0.004) | 0.063*** (0.004) |
| Trujillo | 0.092*** (0.005) | 0.084*** (0.005) | 0.077*** (0.003) | 0.073*** (0.004) |
| Yaracuy | 0.100*** (0.004) | 0.092*** (0.004) | 0.063*** (0.005) | 0.060*** (0.006) |
| Zulia | 0.085*** (0.003) | 0.082*** (0.003) | 0.066*** (0.002) | 0.063*** (0.002) |
| Vargas | 0.110*** (0.008) | 0.094*** (0.007) | 0.064*** (0.005) | 0.055*** (0.005) |

Table 12: Basic Regression: Estimating Returns to Technical and University Levels by State, 2002-2008

| | 2002 | | 2003 | | 2007 | | 2008 | |
|------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | Technical | University | Technical | Technical | Technical | University | Technical | University |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Federal District | 0.393*** (0.038) | 0.618*** (0.041) | 0.246*** (0.040) | 0.629*** (0.037) | 0.221*** (0.032) | 0.516*** (0.033) | 0.307*** (0.033) | 0.495*** (0.034) |
| Amazonas | 0.408*** (0.085) | 0.768*** (0.078) | 0.226 (0.119) | 0.659*** (0.081) | 0.324*** (0.073) | 0.603*** (0.044) | 0.273** (0.100) | 0.624*** (0.052) |
| Anzoategui | 0.389*** (0.079) | 0.755*** (0.062) | 0.523*** (0.061) | 0.760*** (0.057) | 0.352*** (0.046) | 0.584*** (0.046) | 0.297*** (0.047) | 0.520*** (0.059) |
| Apure | 0.441*** (0.093) | 0.890*** (0.076) | 0.383** (0.131) | 0.871*** (0.084) | 0.416*** (0.070) | 0.660*** (0.047) | 0.441*** (0.086) | 0.695*** (0.047) |
| Aragua | 0.365*** (0.047) | 0.732*** (0.050) | 0.387*** (0.045) | 0.773*** (0.046) | 0.335*** (0.049) | 0.685*** (0.042) | 0.316*** (0.044) | 0.658*** (0.050) |
| Barinas | 0.438*** (0.076) | 0.829*** (0.067) | 0.380*** (0.071) | 0.876*** (0.060) | 0.402*** (0.057) | 0.599*** (0.050) | 0.284*** (0.060) | 0.478*** (0.046) |
| Bolivar | 0.360*** (0.056) | 0.754*** (0.051) | 0.306*** (0.051) | 0.726*** (0.056) | 0.246*** (0.048) | 0.714*** (0.042) | 0.400*** (0.049) | 0.656*** (0.045) |
| Carabobo | 0.346*** (0.039) | 0.734*** (0.042) | 0.286*** (0.043) | 0.709*** (0.037) | 0.318*** (0.041) | 0.608*** (0.043) | 0.281*** (0.040) | 0.539*** (0.036) |
| Cojedes | 0.521*** (0.082) | 0.973*** (0.066) | 0.344*** (0.100) | 0.769*** (0.066) | 0.355*** (0.081) | 0.683*** (0.073) | 0.324*** (0.078) | 0.524*** (0.076) |
| Delta Amacuro | 0.299*** (0.055) | 0.577*** (0.066) | 0.410*** (0.040) | 0.788*** (0.057) | 0.290*** (0.066) | 0.463*** (0.052) | 0.238*** (0.040) | 0.488*** (0.044) |
| Falcon | 0.419*** (0.073) | 1.003*** (0.053) | 0.386*** (0.089) | 0.952*** (0.059) | 0.446*** (0.052) | 0.752*** (0.042) | 0.304*** (0.062) | 0.628*** (0.045) |
| Guarico | 0.373** (0.113) | 0.959*** (0.081) | 0.525*** (0.093) | 0.765*** (0.078) | 0.456*** (0.085) | 0.788*** (0.057) | 0.352*** (0.082) | 0.630*** (0.058) |
| Lara | 0.356*** (0.061) | 0.805*** (0.046) | 0.318*** (0.055) | 0.775*** (0.041) | 0.418*** (0.032) | 0.691*** (0.027) | 0.308*** (0.032) | 0.621*** (0.030) |
| Merida | 0.270*** (0.056) | 0.730*** (0.043) | 0.331*** (0.053) | 0.694*** (0.038) | 0.215*** (0.049) | 0.594*** (0.034) | 0.320*** (0.051) | 0.600*** (0.033) |
| Miranda | 0.388*** (0.039) | 0.716*** (0.036) | 0.346*** (0.047) | 0.751*** (0.036) | 0.353*** (0.029) | 0.713*** (0.030) | 0.350*** (0.037) | 0.689*** (0.029) |
| Monagas | 0.419*** (0.067) | 0.806*** (0.066) | 0.406*** (0.087) | 0.911*** (0.052) | 0.319*** (0.074) | 0.586*** (0.042) | 0.384*** (0.062) | 0.550*** (0.049) |
| Nueva Esparta | 0.490*** (0.072) | 0.688*** (0.097) | 0.265*** (0.074) | 0.722*** (0.088) | 0.111 (0.059) | 0.433*** (0.054) | 0.210** (0.076) | 0.511*** (0.056) |
| Portuguesa | 0.392*** (0.065) | 0.868*** (0.059) | 0.325*** (0.071) | 0.813*** (0.054) | 0.353*** (0.043) | 0.594*** (0.034) | 0.402*** (0.045) | 0.675*** (0.043) |
| Sucre | 0.197** (0.072) | 0.817*** (0.049) | 0.213** (0.073) | 0.607*** (0.054) | 0.347*** (0.074) | 0.762*** (0.053) | 0.279*** (0.064) | 0.696*** (0.045) |
| Tachira | 0.470*** (0.053) | 0.945*** (0.047) | 0.360*** (0.052) | 0.890*** (0.046) | 0.306*** (0.050) | 0.699*** (0.049) | 0.322*** (0.049) | 0.619*** (0.050) |
| Trujillo | 0.324*** (0.068) | 0.764*** (0.060) | 0.426*** (0.065) | 0.800*** (0.053) | 0.255*** (0.063) | 0.615*** (0.043) | 0.349*** (0.054) | 0.674*** (0.052) |
| Yaracuy | 0.451*** (0.063) | 0.948*** (0.050) | 0.380*** (0.074) | 0.919*** (0.059) | 0.233*** (0.063) | 0.520*** (0.074) | 0.269*** (0.055) | 0.501*** (0.056) |
| Zulia | 0.380*** (0.050) | 0.821*** (0.040) | 0.406*** (0.053) | 0.799*** (0.044) | 0.299*** (0.041) | 0.620*** (0.034) | 0.291*** (0.038) | 0.590*** (0.037) |
| Vargas | 0.355*** (0.070) | 0.735*** (0.060) | 0.275*** (0.082) | 0.706*** (0.086) | 0.333*** (0.055) | 0.504*** (0.071) | 0.326*** (0.047) | 0.517*** (0.063) |

Table 13: Data for Basic Regression: Sucre Mission Share and Differences in Returns to Higher Education by State

| State | total pop | Sucre Enroll | (%) Sucre | RTTE [08-02] | RTUE [08-02] | RTTE [08-07/1] | RTUE [08-07/1] |
|------------------|-----------|--------------|-----------|--------------|--------------|----------------|----------------|
| Amazonas | 142220 | 2391 | 1.681 | -0.135 | -0.144 | -0.154 | 0.016 |
| Anzoategui | 1477926 | 16431 | 1.112 | -0.092 | -0.235 | -0.187 | -0.090 |
| Apure | 473941 | 7229 | 1.525 | 0.000 | -0.195 | 0.062 | -0.067 |
| Aragua | 1665247 | 21448 | 1.288 | -0.049 | -0.074 | 0.139 | -0.142 |
| Barinas | 756581 | 2968 | 0.392 | -0.154 | -0.351 | -0.163 | -0.131 |
| Bolivar | 1534825 | 18751 | 1.222 | 0.040 | -0.098 | 0.100 | -0.218 |
| Carabobo | 2226982 | 20499 | 0.920 | -0.065 | -0.195 | -0.043 | -0.068 |
| Cojedes | 300288 | 9172 | 3.054 | -0.197 | -0.449 | -0.099 | -0.079 |
| Delta Amacuro | 152679 | 1240 | 0.812 | -0.061 | -0.089 | 0.044 | 0.073 |
| Distrito Capital | 2085488 | 13768 | 0.660 | -0.086 | -0.122 | 0.117 | 0.083 |
| Falcon | 901518 | 13525 | 1.500 | -0.115 | -0.372 | -0.305 | -0.279 |
| Guarico | 745124 | 14180 | 1.903 | -0.021 | -0.329 | -0.133 | -0.161 |
| Lara | 1795069 | 17463 | 0.973 | -0.048 | -0.184 | -0.103 | -0.102 |
| Merida | 843830 | 17492 | 2.073 | 0.050 | -0.130 | 0.002 | -0.029 |
| Miranda | 2857943 | 18939 | 0.663 | -0.038 | -0.027 | -0.074 | 0.002 |
| Monagas | 855322 | 18515 | 2.165 | -0.035 | -0.256 | 0.267 | -0.168 |
| Nueva Esparta | 436944 | 4291 | 0.982 | -0.280 | -0.177 | 0.068 | 0.109 |
| Portuguesa | 873375 | 10116 | 1.158 | 0.010 | -0.193 | 0.068 | 0.099 |
| Sucre | 916646 | 11171 | 1.219 | 0.082 | -0.121 | -0.149 | -0.239 |
| Tachira | 1177255 | 13589 | 1.154 | -0.148 | -0.326 | 0.198 | -0.077 |
| Trujillo | 711392 | 7138 | 1.003 | 0.025 | -0.090 | 0.067 | -0.029 |
| Yaracuy | 597721 | 7762 | 1.299 | -0.182 | -0.447 | 0.075 | -0.237 |
| Zulia | 3620189 | 30357 | 0.839 | -0.090 | -0.231 | 0.091 | 0.048 |
| Total | 27483208 | 302023 | 0.011 | | | | |

Note: Total pop- Population in the state RTTE [08-02] - difference in return to technical education between 2002 and 2008.
RTUE [08-02] - Difference in return to university education between 2002 and 2008.
RTTE [08-07/1] - difference in return to technical education between 2007 (first half) and 2008.
RTUE [08-07/1] - Difference in return to university education between 2007 (first half) and 2008.