The Invisible Victims: The Long-Term Educational Impacts of Growing up in Recessions

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Abstract

Economic recessions affect families mainly through the reduction of family incomes. The decline in family incomes has several important implications for children development. Physically, parents find it more difficult to meet children's nutritional requirements, therefore, leaving children in food insecurity. Moreover, recessions are a stressful time for parents. The stress has negative impacts on effective parenting. As a result, recessions increase the risk of parental maltreatments. Furthermore, recessions also increase probabilities of frequent moves, loss of proper health care, and less supportive learning environment. The combined effects of these factors reduce children's educational attainments and performances. In this paper, I look at the long-term effects of recessions on educational attainments, specifically the probability of completing high school. I focus on two aspects: the age effect and the severity effect. The age effect concerns with whether the exposure to recessions at an earlier age increase the risk of high school dropout. The severity effect concerns with whether more severe recessions increase the risk of high school dropout. The results show that exposures to recessions at age 5 to 10 increase the probability of high school dropout. However, this sample does not show recession severity have a statistically significant effect.

I. Introduction

An economic recession is short-term slowdown in economic activities that usually manifest in high unemployment and declining household income. However, a plethora of economic researches show that consequences of recessions can be long-lasting even after recovery. For example, the Great Recession in 2008 was associated with large-scale loss of jobs, drop in income, and the situation was worse for poorer households leading to an increased inequality within each state. This result is especially significant for communities that are characterized by historically disadvantaged groups, minorities, and people with low educational levels (Thieda and Monnat 2017). More importantly, recessions also have multidimensional impacts on families. Recessions reduce family's investments in education, job opportunities, and entrepreneurial activities (Irons 2009). The most direct consequence of recessions on families is

the reduction of incomes which results mainly from job loss and decreased salaries. For example, in the 2 years of the Great Recession from 2007 to 2009, the unemployment rate increased by 5.3 percentage points since November 2007 and reached a peak in October 2009 at 10.0 percent (Bureau of Labor Statistics). The massive scale of job loss decreases household incomes significantly. In the United States, extreme child poverty increases more during the Great Recession than it did in the recession of 1982 (UNICEF). Globally, the median income for families with children decreased considerably during the Great Recession. Figure 1 shows the changes of median income for European families with children. It shows that for countries that were most affected by the recession, the median income for households with children is significant lower compared to that of moderately effected and least effected countries.

Economic recessions threaten children's developmental outcomes through the sharply reduced family income. Recessions affect children in both subtle and evident ways. Children from financially disadvantaged families could suffered from light or major humiliations from friends and peers, changes in diets that are less beneficial for growth, inability to afford school materials, and forgo educational opportunities such as college education. Furthermore, in a 9-year follow-up survey, it is found that the Great Recession increases the risk of maternal child abuse (Schneider et al. 2016). High unemployment rates are also associated with the increased risk of child overweight and obesity. A one percent increases in the unemployment rate is associated with 1.4 percent increase in the likelihood of overweight (Oddo et al, 2016). Recessions also have profound impacts on family structure. During the Great Recession, the fertility rate declined by 9 to 11 percent, and the decline was even greater in states with higher unemployment rates (Cherlin, et al. 2013).

Given important consequences of recessions on families, in this paper, I look at long-term impacts of economic downturns on children's educational attainments, specifically, the probability of high school dropout. Instead of using family level characteristics, such as family incomes or parental job losses, I focus on the "aggregate" effect — using state unemployment rate to predict educational attainment. I mainly focus on two potentially important factors: the age of exposure and the severity of recession.

In general, the consequences of unsatisfactory parenting, diets, and cognitive stimulations have graver impacts when a child is younger (Anderson, et al., 2003). Therefore, the age of exposure effect is to see whether the risk of high school dropout is greater if a child was exposed to

recessions at an earlier stage of development. Second, more severe recessions tend to be more destructive for families and potentially lead to a less desirable environment for children. The severity effect is, therefore, to see whether a more severe recession affect high school dropout probability differently. The key explanatory variables are the average state unemployment rates when a child is at different stage of development: toddler phase (roughly between age 1 to 4), school-aged phase (roughly age 5 to 10), and adolescent phase (roughly age 11 to 16). I also constructed two additional variables that indicate whether a state is in severe recession. A state is marked as a severe recession state for a given year if its unemployment rate is above 75 percentiles. The unemployment rate threshold for a severe recession in a given state is 7.12% for age 5 to 10 average unemployment rate and 6.09% from age 11 to 16 average unemployment rate.

II. Literature Review

There is a rich literature examining the effect of recessions on children outcomes and education. Using data Canadian Survey of Labour and Income Dynamics (CSLD), Coelli (2011) showed that young adults at age 16 - 17 whose parents lose jobs at that time are less likely to attend colleges. Kind and Haisken-Denew (2012), using data from the German SOEP, found that parental job loss when sons were 17 to 25 years old had a negative impact on son's subjective well-being. This study, however, did not found impacts on daughters' subjective well-being. Recessions can also have negative impacts on students' prospective careers. Oreopoulos et al. (2012) show that "unlucky" college students who graduated amid a recession can suffer from persistent earning declines that could last for ten years. Situations can be worse for those from a disadvantaged background. Gregg (2012) shows also shows that father's job loss is highly correlated with children's educational outcomes. He also found that father job loss has effects on children's early labor market outcomes, however, the effects on children's earrings disappear at age 30 - 40.

It is well-established that high school completion status is highly correlated with a person's family and socioeconomic background. It is shown that children from backgrounds of poverty are highly associated with high school dropout rate (Esinger and Slusarick 1992). Kalil and Wightman (2011b), show that parental job loss is associated with a reduced likelihood of youth's high school graduation, and find the strongest association with low-income families.

High school dropout rates are less correlated with students' sex. It is correlated with race/ethnicity: Hispanic and Black students have higher dropout rates than their white peers. It is also correlated with family incomes (Chapman et al. 2011).

Despite the rich literature examining the impacts of economic downturns on educational performances and attainments, these researches mostly focus on using parental job losses as the explanatory variable and little research on the effect of the overall unemployment rate. The benefits of using aggregated measures reflects the fact that recessions are rarely individual or family events. This also allows me to capture state-level economic conditions. However, state unemployment rates also come at a cost. Unemployment rates can be too general that do not take into consideration of how recessions effect families differently. Within a state, recessions effect families differently despite the fact that all families in that state experience the same economic condition.

In addition, little research is done to see the how recessions may affect children development differently at different stages of child development. Therefore, this paper distinguishes itself for using the overall state unemployment rate at different stages of child development as explanatory variables to explain the high school completion outcomes.

III. Framework

The primary focus of this paper is to see the effects of recessions on high school dropout rates. I use unemployment rates as proxies for economic conditions. A high unemployment rate implies a recession.

The channels through which recessions affect children development is not well understood. The likely mechanisms by which economic downturns affect children are family emotional and behavioral processes, and family investments (Kalil 2013). Economic recessions are stressful for adults. Such stress could lead to cognitive and mental dullness for parents. Ineffective parenting increases the risk of child obesity and maternal maltreats which are detrimental to child growth. As family incomes decrease during a recession, it will limit the family's ability to purchase resources, such as food, health care, and education that are crucial for child development. The negative impacts of recessions are also evident in all stages of child development (Kaili 2013).

In addition, manufacturing and construction industries are more responsive to layoffs during economic shocks, whereas women-concentrated service industry is less effected by recessions (Otobe 2011). Despite the fact that women are less affected by recessions directly, during a recession, women who had previously been out of labor force tend to seek job opportunities to compensate for the loss of family earnings. This is the "additional worker effect" (Sabarwal et al 2012). As mothers are engaged in more work, girls in a family face high risk of dropping out school as they are likely to assume the role of mother: taking care younger siblings and undertake unpaid house work (Otobe 2011). Given the gender differentials in response to recession, in this paper, I also look at whether recessions affect males and females' education separately.

In this paper, I use OLS regressions to determine the relationship between state unemployment rates and high school completion status. Figure 2 shows the high school dropout rate for each birth cohort against the average unemployment rate they experienced from age 5 to 16. For example, for the first birth cohort, the high school dropout rate at age 25 is 7.38% and the overall unemployment rate they were exposed to from 1980 to 1991 was 7.69%. This generic scatter plot does not show the different effect of being exposed to recessions at different stages of developments. However, Figure 2 does provide us with useful insights into the correlation between educational outcomes and recession. Even without controlling for other potentially confounding factors, the average unemployment rate and high school dropout seem to share a relatively strong positive correlation.

Figure 2 shows that more severe the recession is correlated with higher high school dropout rate. However, the correlation seems to be weaker at high unemployment rates. The high school dropout rate reaches its peak at about 9.6% when the unemployment rate at 7.33%. One would expect to see the high school dropout rate to increase more as the unemployment rate increases if the two variables follow a strictly linear relationship. However, we do not observe this pattern for unemployment rates higher than 7.33%. High school dropout rates seem to decrease with unemployment rates following the peak. One possible explanation could be that unemployment rates have a non-linear relationship with the high school dropout rate; once the unemployment rate reaches a certain threshold high school dropout rate could potential decreases. Another possible explanation is potential confounding factors that affect that outcomes. The first three birth cohorts, born in 1976, 1977 and 1978, experienced the highest

unemployment rates among all cohorts at over 7.3% on average. However, the high school dropout rate is better than expected. It could be factors such as the fundamental differences in the perceptions of the value of education for the first three cohorts and later cohort that caused this seemingly non-linear relationship.

It is important to point out that there is no single measurement for recessions. Besides unemployment rates, there are other measurements that can also reflect economic conditions, such as asset prices, household income, and real output gap. Figure 4 shows the relationship between unemployment and percent of real output out[1]. From the plot, we see that output gap moves closely with unemployment rate: the larger the output gap, the higher the unemployment rate. Therefore, it is reasonable to conclude that unemployment rates are sensible "proxies" for recessions and other recession indicators would produce similar results.

IV. Data Description

The primary data used in this paper is the October Current Population Survey (CPS) from the year 2000 to 2016 and state unemployment rates from 1980 to 2007 from the Bureau of Labor Statistics. The focus of the paper is the correlation between the high school completion status at age 25 and the unemployment rates experienced at age 5 to 10 and age 11 to 16 in the state where the child grew up. There are 17 birth cohorts in the sample. The first birth cohort was 25 years old in 2000 and was born in 1976. The last birth cohort was 25 years old in 2016 and was born in 1992. Note that the year 1980 corresponds to the year when the first birth cohort (born in 1976) was five years old, and the year 2007 corresponds to the year when the last birth cohort (born in 1992) was 16 years old.

[1] The formula is $100 * (real\ domestic\ product - real\ potential\ domestic\ product) / real\ potential\ domestic\ product)$.

Table 1 Summary Statistics

	All (n = 24,633)	White (n = 20,402)	Nonwhite (n= 4,231)
General Characteristics			
Age	25	25	25
Median Income (in $)	35,000 ~ 39,999	40,000 ~ 49,999	25,000 ~ 29,999
% Male	49.12	49.88	45.45
% White	82.82	100	0
% Black	11.25	0	65.47
% Hispanic	10.05	10.95	5.72
% Asian	2.24	0	0
% Married	29.08	31.58	17.06
Unemployment Rates (in %)			
Age 1 to 4	6.620	6.592	6.756
Age 5 to 10	6.195	6.182	6.245
Age 11 to 16	5.285	5.391	5.2634

	All (n = 24,633)	White (n = 20,402)	Nonwhite (n = 4,231)	Female (n = 11,639)	Male (n = 11,263)
Educational Characteristics					
% High School Dropout	7.54	6.71	11.56	7.09	7.77
% Some College	23.20	22.64	25.88	23.53	23.02
% Bachelor's Degree	25.92	27.50	18.32	27.96	24.02

A. Comparing High School Dropout Rates

The sample contains 24,633 observations for individuals who were natives born in the United States at exactly the age of 25 from 2000 to 2016. Table 1 shows the summary statistics for the sample. This sample has predominantly white populations; around 82% of the sample is white. The overall high school dropout rate is at 7.54% and the median income is at around $35,000 to $39,999. From Table 1, we see that high school dropout is noticeably higher for the non-white population at 11.56% compared with 6.71% for the white population. The non-white population also has a lower percentage of people who have bachelor's degree compared to their white peers. Non-whites also have significantly lower median income at around $25,000 to $29,999, compared with white population at $40,000 to $49,999. This reflects the findings that disadvantaged groups, such as low incomes and minorities have higher high school dropout rates, and lower educational outcomes in general.

B. Comparing Unemployment Rate Across States and Time

I combine the individual observations with unemployment rates across 50 states in the U.S. from 1980 to 2007. Unemployment rates are the main independent variables that explain the variations in high school dropout rate across different birth cohorts. In this paper, I am interested in learning whether the impact on education differ if a person was exposed to high unemployment at an earlier stage of development. Therefore, I constructed two unemployment rate variables; the first one is the average unemployment rate for a given cohort at age 5 to 10, and the other is the average unemployment rate for the cohort at age 11 to 16. 1980 corresponds the year when the first birth cohort was five years old, and 2007 corresponds to the year when the last cohort was 16 years old. The time span of the data reflects all the different unemployment rates experienced by all groups in the sample.

Unemployment rates vary across states and years. On average, the U.S. unemployment rate during this 28-year span was 5.83%. The minimum unemployment occurred was 2.325% in the year 2004 in New Hampshire, and the maximum unemployment occurred was 17.80% in the year 1983 in West Virginia. In any given year, there is a large difference in unemployment rates across states. Some states display higher and more volatile changes on unemployment rates than other states. For example, from 1980 to 2007, West Virginia has the highest unemployment rate across all states persistently, on average, at 8.542%. Compared to Nebraska, the state with the

lowest and most stable unemployment rate, on average, at 3.52%. West Virginia also has the most volatile changes among all states ranging from the highest at 17.80% in 1983 to the lowest at 4.56% in 2007. Michigan has consistently high unemployment second to West Virginia. Figure 3 displays the time-series plot of annual unemployment rates for six states that are representative of the overall unemployment rate changes across states. West Virginia and Michigan had the highest and least stable unemployment rate. Rhode Island and Ohio had average overall unemployment rates during the 28-year span. However, it is visible that both states have experienced large variations across the years. Utah and Nebraska had the lowest and most stable unemployment rates among all states. There are some common trends for all states. All states reached the highest unemployment around 1982 and 1983, and then followed by a significant decline until around 1992. Nearly all states experience the lowest unemployment around 2000. The exception is Nebraska which always had the lowest unemployment rate and minimal variation across years.

Large variations exist across states for a given year. For example, in 1982, West Virginia has the highest unemployment rate at 17.80%, however, Nebraska only had an unemployment rate at 5.55% in the same year. The difference is great between these two states. Figure 4 shows the detailed unemployment variation across years.

From Figure 5, it is evident that unemployment rates had the largest variations during the 1980s. Noticeably, 1983 and 1982 had the highest unemployment rate both in terms of the median value and individual observation. The interquartile ranges decrease gradually after 1983 signaling a more stable economy across the country. Although the median unemployment rate varies across years, it displays a declining overall trend and the variations decrease each year. After 2000, the unemployment rate stayed at a relatively low level and was more stable compared to previous years.

V. Model Specifications

In order to examine the relationship between childhood unemployment rate and future educational attainment rigorously, I use OLS regression of high school completion status on average unemployment rate experienced between age 5 to 10 and between age 11 to 16. The empirical model has the following form:

$$Y_{ist} = \beta_0 + \beta_1 UR1_{st} + \beta_2 UR2_{st} + S_t + T_s + \mathrm{X} + \varepsilon_i \quad (1)$$

$$Y_{ist} = \beta_0 + \beta_1 UR1_{st} + \beta_2 UR2_{st} + \beta_3 EX1_{st} + \beta_4 EX2_{st} + S_t + T_s + \mathrm{X} + \varepsilon_i \quad (2)$$

where Y_{ist} is the educational outcome, a binary variable indicating the high school completion status for ith individual at age 25, in states s, survey year t ; $UR1_{st}$ is the average unemployment rate when age 5 to age 10 in state s, and year t. $UR2_{st}$ is the average unemployment rate when age 11 to age 16 in state s, and survey year t; S_t is the state control for survey year t; T_s is the survey year control for state s; X is a set of personal characteristics controls, which includes race, family income, marital status, gender, current employment status, and survey year state unemployment rate. In equation (2), $EX1_{st}$ is an extreme recession indicator which takes value 1 if for survey year t birth cohort had an average unemployment rate from age 5 to 10 above 75 percentiles in state s; $EX2_{st}$ is an extreme recession indicator for age 11 to 16.

Equation (1) focuses on answering whether there is an age effect. β_1 and β_2 are coefficients of interest. A significant and positive coefficient suggests that unemployment rate increase the probability of dropping out high school. Equation (2) focuses on answering the question whether a severe recession affects high school completion differently. The variables of interest are $EX1_{st}$ and $EX2_{st}$. Since $EX1_{st}$ and $EX2_{st}$ are binary variables, a positive and significant coefficient on either variable indicates an intercept shift which translates in this case to the high school dropout rate is higher in states with severe recessions.

A. Multicollinearity

It is important to note that both equation (1) and (2) suffer from multicollinearity in variables of interest by construction. Despite the fact that state unemployment rates do vary from year to year as seen in Figure 3, however, it undeniable that state unemployment rates are not independent of time. As Figure 3 shows, state unemployment rates tend to increase in a given year if the previous year also had an increasing trend. Therefore, in this case $UR1_{st}$ and $UR2_{st}$ are highly correlated.[2] Having multicollinearity in variables of interest does not affect the overall

[2] The correlation coefficient between $UR1_{st}$ and $UR2_{st}$ is 0.7348.

statistical power of the models, however, it does affect the unbiasedness and precision of the effected variables which can cause inflated standard errors and lead to potential Type II errors.

B. State of Resident Assumption

Another important note is that CPS data does not include information on subject's state of birth. In the following regression analysis, I assumed the state of residence is the state of birth. This assumption can be problematic, because residential movements are not random. People tend to move in pursuit of better living conditions. And movers and non-movers are two different kind of people. These confounding factors can introduce bias in the estimates. To address the concern, I use additional 2016 American Community Survey (ACS) data (state of birth included) as robustness checks.

VI. Estimation Results

A. Overall Effects

Table 2 shows the regression results for the whole sample. Panel A displays the regression results for Equation (1) which focuses on the age effect; and Panel B is the results for Equation (2) which focuses on the recession severity effect. In each case, I first regress variables of interests without controls (first row), then I include state and survey year controls (second row), and finally I include extended controls which consist of state, survey years, and personal characteristics as discussed above (third row).

Table 2 Regression Outputs for Overall Effects

	(1)	(2)	(3)	(4)
	Average UR at age 5 to 10 (β_1)	Average UR at age 11 to 16 (β_2)	Extreme Recession at age 5 to 10 (β_3)	Extreme Recession at age 11 to 16 (β_4)
Panel A: The Age Effect				
No Control	0.00428***	0.0025		
	(0.002)	(0.002)		
State & Survey Year Controls	0.00511**	0.0033		
	(0.002)	(0.003)		
All Controls	0.00507***	0.0024		
	(0.002)	(0.003)		
Panel B: The Severity Effect				
No Control	0.00397**	0.0037	0.0014	-0.0046
	(0.002)	(0.002)	(0.006)	(0.006)
State & Survey Year Controls	0.00508**	0.0051	-0.0005	-0.0067

	(0.003)	(0.003)	(0.007)	(0.007)
All Controls	0.00505	0.0042	0.0005	-0.0069
	(0.002)	(0.003)	(0.007)	(0.007)

**significant at 5% level
***significant at 1% level

We first look at Panel A. All coefficients in column (1) are positive and highly significant, which translates to that the average unemployment rate from age 5 to 10 increases the probability of dropping out high schools for all levels of controls. This sample, however, does not show a statistically significant effects of unemployment rates on high school graduation for later ages (age 11 to 16). From the third row of Panel A, we see that every percentage increase in the unemployment rate from age 5 to 10 is associated with 0.46% increased probability of dropping out high school. Given the sample size of 24,633 observations and 1,700 high school dropouts, we expect to see 113.6 more high school dropouts for this sample for one percentage increase. This increases the number of high school dropouts by 6.68% (113.6 / 1700).

Panel B, in general, does not show significant results for recession severity. Due to high multicollinearity, we cannot accurately capture the individual effect due to multicollinearity.

B. Gender-specific Effects

The regression results for gender-specific effects are reported in Table 3. The setup of Table 3 is similar to that of Table 2 where Panel A is regression results of Equation (1) for females and Panel B is results for males.[3]

Table 3 Regression Outputs by Gender

	(1)	(2)
	Average UR at age 5 to 10 (β_1)	Average UR at age 11 to 16 (β_2)
Panel A: Female		
No Control	0.00594***	-0.00226
	(0.002)	(0.003)
State & Survey Year Controls	0.00607**	0.0006
	(0.0028)	(0.004)
All Controls	0.0058**	-0.00005
	(0.003)	(0.004)
Panel B: Male		
No Control	0.00249	0.0077***
	(0.002)	(0.003)
State & Survey Year Controls	0.00387	0.00672

[3] Results for Equation (2) are not reported because Table 2 suggests that recession severity may not have an effect for this sample.

	(0.003)	(0.004)
All Controls	0.00351	0.0066
	(0.003)	(0.004)

**significant at 5% level
***significant at 1% level

Similar to results in Table 2, unemployment rates from age 5 to 10 are highly significant and positive for females for all levels of controls. The coefficient for female for all controls is 0.0054. This suggests that every percentage increase in unemployment rate from age 5 to 10 is associated with 0.54% increased probability of dropping out high school for females. Given the number of total females is 10,814 and 825 female high school dropouts, this suggests that 1% increase in unemployment rate is expected to have 58.4 more female high school dropouts. The percentage increase of female dropouts is 7.08%, compare to 6.68% — the increase for the overall sample. This suggests that unemployment rates have a greater impact for females. It is an interesting result. In the sample, females have a statistically significant lower high school drop rate than their male peers. The regression results suggest that despite the fact that females, in general, are less likely to dropout high schools given the same environment as males, however, economic shocks such as higher unemployment rates have larger negative effects on their educational attainments. On contrary, the results in general do not show statistically significant results for males.

However, we must be cautious of the multicollinearity problem. The coefficients are jointly significant for both females and males. It is possible that some or all coefficients are actually significant for males. The inflated standard errors lead to Type II errors.

C. Race-specific Effect

Table 4 reports regression results for white in panel A and non-white in panel B. Similar to previous findings, unemployment rates between at later ages are not significant for both racial groups. However, unemployment rates at age 5 to 10 have significant positive relationship with high school dropout rate for whites. Surprisingly, this relationship is not statistically significant for minorities. This result is puzzling as many researches have repeatedly confirmed that racially disadvantaged groups are more at risk for dropping out schools.

Despite the fact that results for minorities are non-significant, we cannot conclude that recessions impact whites more and do not affect minorities. When we look closely at the table,

we see that coefficients for minorities are, in fact, larger than that of the whites. This implies that recessions may actually affect minorities more. However, these coefficients also have larger standard errors. The large standard errors result from small size for minorities. This sample contains only 17.1% (4,231) non-white population. Therefore, the conclusion would be more informative with an increased sample size.

Table 4 Regression Outputs by Race

	(1)	(2)
	Average UR at age 5 to 10 (β_1)	Average UR at age 11 to 16 (β_2)
Panel A: Whites		
No Control	0.00408**	0.00277
	(0.002)	(0.002)
State & Survey Year Controls	0.00446**	0.00294
	(0.002)	(0.003)
All Controls	0.0043**	-0.00305
	(0.002)	(0.003)
Panel B: Minorities		
No Control	0.007*	-0.0036
	(0.004)	(0.0054)
State & Survey Year Controls	0.0066	0.00405
	(0.006)	(0.008)
All Controls	0.00647	0.0044
	(0.006)	(0.008)

**significant at 5% level
***significant at 1% level

VII. Robustness Check

A. Estimating Bias in State of Birth Assumption

Due to the lack of information on subjects' state of birth, the regression analysis performed above made a crucial assumption: subject's state of residence is the state of birth for a given subject. This assumption has important drawbacks. Residential movements are not random. People who move tend to move in pursuit of higher wage, better schools, better job opportunities. Therefore, the estimates in above analysis can be biased because the omitted variable bias. To address the concerns, I use 2016 ACS data with information on state of birth to estimate the scale and direction of the bias. Table 5 shows the regression results using 2016 ACS data.

Table 5 Regression Results for ACS 2016

	All
Average UR at age 5 to 10 (β_1)	.0363***
	(0.015)
Average UR at age 11 to 16 (β_2)	0.0125
	(0.015)

**significant at 5% level

***significant at 1% level

The regression model used in Table 5 follows the same idea in Equation (1) with all controls included. Similar to results with CPS data, the ACS data also only shows significant effects of unemployment rate at age 5 to 10 and non-insignificant effect at age 11 to 16. One noticeable difference is that the coefficients for much larger compared to CPS data. This implies that the assuming state of residence as state of birth underestimates the effect of recessions.

B. Estimating Effects on Younger Ages

All regression estimates up to now show a strong evidence between recessions experienced at age 5 to 10 and high school dropout probability. A natural question to ask at this point is that what about even younger? Would the impact of recessions affect younger children more? To address this question, I add in average unemployment rate between age 1 to 4 for a given birth cohort in a given state in the Equation (1). This resulting model as follows:

$$Y_{ist} = \beta_0 + \beta_1 UR1-4_{st} + \beta_2 UR5-10_{st} + \beta_2 UR11-16_{st} + S_t + T_s + \mathrm{X} + \varepsilon_i \qquad (3)$$

where $UR1-4_{st}$ is the new variable representing the average unemployment rate between age 1 to 4 in survey year t, and state s.

Table 6 Comparison with UR between age 1 and 4

	(1)	(2)	(3)
	Average UR at age 1 to 4	Average UR at age 5 to 10	Average UR at age 11 to 16
Panel A: With UR from age 1 to age 4			
No Control	0.00402***	0.00494***	0.0003
	(0.001)	(0.002)	(0.002)
State & Survey Year Controls	0.00184	0.0508**	0.0033
	(0.002)	(0.002)	(0.003)
All Controls	0.00161	0.0053***	0.0026
	(0.002)	(0.002)	(0.0027)
Panel B: Without UR from age 1 to age 4			
No Control		0.00428***	0.0025
		(0.002)	(0.002)
State & Survey Year Controls		0.00511**	0.0033
		(0.002)	(0.003)
All Controls		0.00507***	0.0024
		(0.002)	(0.003)

Table 6 panel A reports the regression results for Equation (3), and panel B is the results from Table 2 panel A for comparison purpose. All coefficients display a positive relationship between recessions and high school dropout rates. When we only focusing on the third row. We again see that only average unemployment rate between age 5 and 10 have a statistically significant effect and the effect is slightly higher than panel B. There is no significant effect both younger and older age.

The result is intriguing because a large number of reaches and experiments have found that early childhood development is a power predictor of one's adulthood success (Engle and Black, 2008). Finding the average unemployment rate at age 1 to 4 does not significantly contribute to one's education attainment seems somewhat contradicting these researches. However, age 5 to 10 is still a relatively young age and this stage of development correspond to the time when a child first enters school system. Therefore, the results suggest early schooling education has a strong and significant effect on educational attainments.

VIII. Conclusion

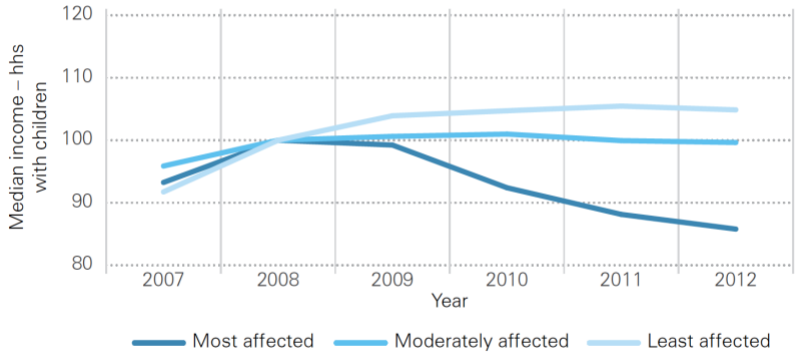
It is widely established that early childhood development has profound impacts on adult life. Mastery of cognitive, social, and emotional competency in early childhood is self-reinforcing

motivation for more learning and more effective learning. Many major economic and social problems, such as high crime rate, can be traced to low level of skills and education. Our society bears high cost of crimes, for example, it costs on average $8 million per homicide (Heaton 2010).

In this paper, I focused on one of many aspects that would negatively affect educational attainments — aggregate economic conditions. Using unemployment rate as "proxies" for recessions, in my analysis, I found that strong evidence that average unemployment rate when a subject was age 5 to 10 is positively correlated with high school dropout rate, while age 1 to 4 and 11 to 16 is also positive but not statistically significant. Specifically, 1% increase in unemployment rate from age 5 to 10 is associated with 0.5% increase in the probability of dropping out high school. To put the results into context, in the sample of 25,000 subjects, we expect to see 110 more high school dropouts one percentage increase. This increases the number of high school dropouts by 6.68%.

Appendix. Figures

Figure 1 Median income in European households with children (per exposure)



Source: Eurostat. Median income is expressed in 2007 prices, national currency.
Note: No data for Cyprus, Croatia, Slovakia and Turkey.

Figure 2 State Employment Rate over Time

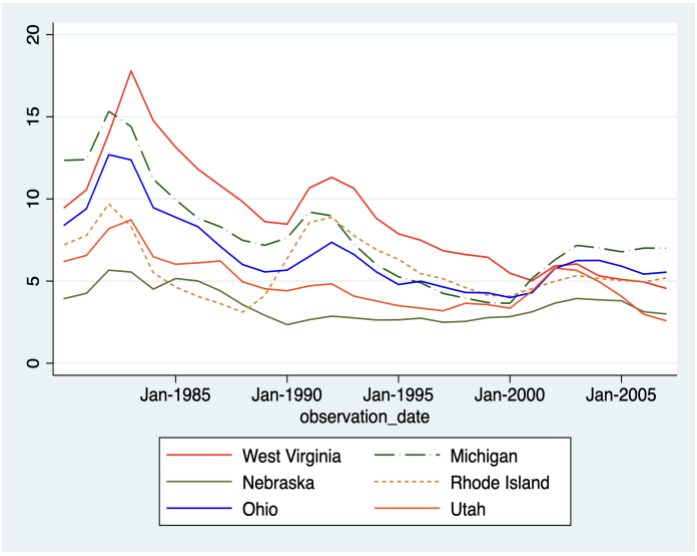


Figure 3 Unemployment Rate Variation over Time

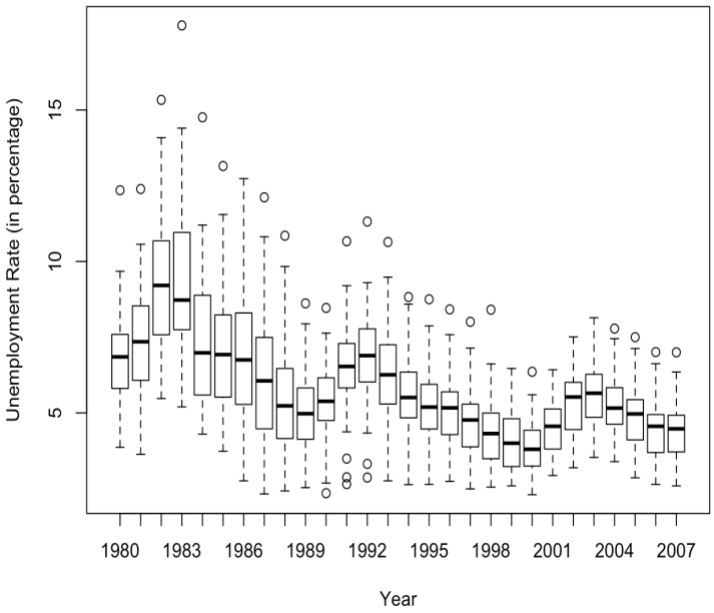


Figure 4 Variations of UR over Time

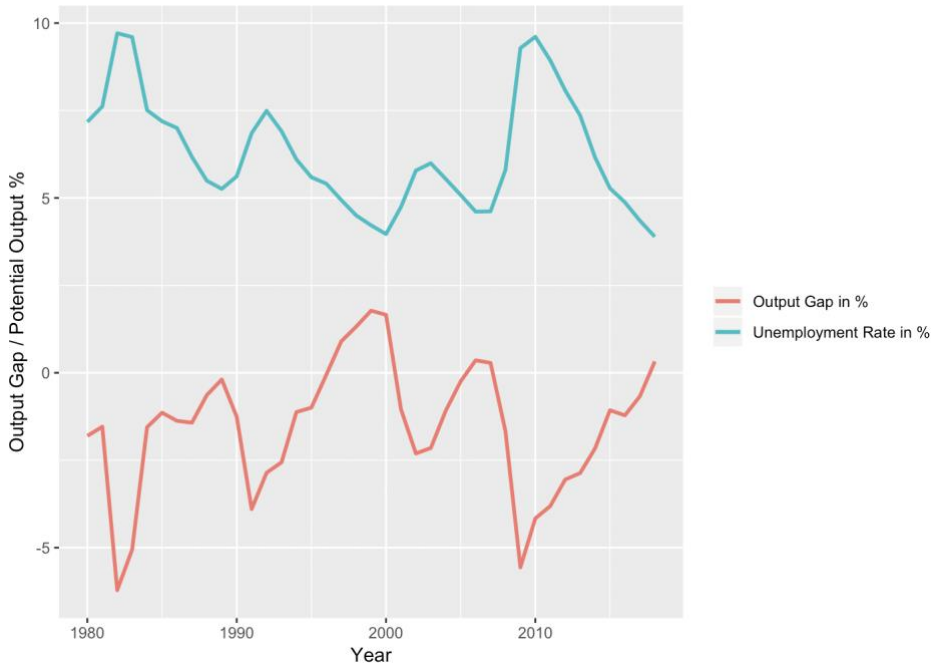
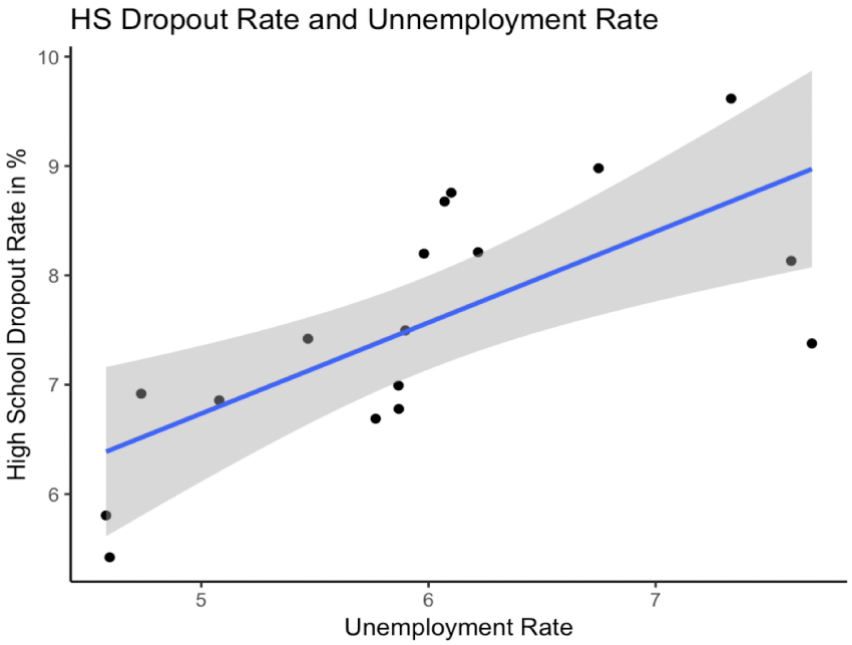


Figure 5 The Relationship Between Unemployment and High School Dropout Rate



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