Essays on Family Economics

by

Marco Mangini

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Graduate Supervisory Committee:

Daniel Silverman, Chair
Esteban Aucejo
Alvin Murphy

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ABSTRACT

The presence of children can influence importantly how households respond to income risk. The aim of this dissertation is to study how different aspects of families' life-cycle decisions are affected by different sources of income fluctuation. In the first part of this dissertation, I study the relationships between fertility choices, consumption, and labor supply, by developing a model with endogenous fertility decisions and income volatility. Within this framework, fertility choices act as a mechanism to smooth utility over time. In this context, I analyze the insurance value of fertility choices. I use a structural model that combines two features underexplored by the literature: children as consumption commitments, and nonseparabilities of family size and consumption. Having children in the household affects consumption and labor marginal utilities, changing the insurance value of fertility decisions and generating incentives to avoid childbearing during low-income spells. I find that the welfare loss of a negative transitory income shock is 34 to 38 times larger if households are not able to choose when to have their children. These results underscore how costly unplanned childbearing can be to the household in terms of welfare.

The second part of this dissertation evaluates the impact of being born under negative conditions in the labor market on human capital formation, and what parental behavior could be leading to those effects. I estimate the impact of the unemployment rates on children assessment outcomes in cognitive and noncognitive skills. Counter-intuitively, the results suggest that higher unemployment rates are linked to positive child development outcomes later in childhood. In my main specification, an increase of 1 percentage point in state unemployment causes an increase of 2.5% of a standard deviation in cognitive test scores after controlling for income at birth, hours worked at birth, and other variables.

DEDICATION

A Amelia, por ser mi luz en la noche más oscura.

A Rocío, mamá y papá, por darme todo.

A mis amigos, por entenderme.

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When one sets sails to start a PhD program, it is impossible to conceive the sheer size of the journey ahead. I found that even though the objective is, as my advisor would put it, to modify the distribution of knowledge, getting a PhD ends up being mostly a process of self-discovery.

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Chapter 1

INTRODUCTION

The economic conditions and the decisions taken around childbirth are relevant for the welfare of the children and their families. This dissertation focuses on this period of the household life cycle. I explore how the interaction between labor and employment uncertainty with life-cycle decisions such as child rearing and parental investment affects families' welfare and children's human capital accumulation process.

In Chapter 2, I study fertility decisions and their value to families as insurance mechanisms against labor income shocks. More concretely, I ask what the insurance value of the decision of having an extra child is, in a context of labor income uncertainty and children as consumption commitments. In this sense, I develop a novel approach to the idea of children as consumption commitments, where parents can potentially decide to emancipate their children after they come of age. Before that, children are a part of their parents' household. Using a structural life-cycle model and the Panel Study of Income Dynamics, I find that, if parents cannot choose if or when to have a child, the welfare loss of a negative labor income shock is more than 35 times larger than when they can perfectly decide the timing of fertility.

In Chapter 3, I evaluate the impact of macroeconomic conditions around birth on children human capital accumulation. Using different reduced form strategies I estimate the impact of state unemployment rate on early childhood. An increase of one percentage point in unemployment rates leads to an increase 2.5 percent of a standard deviation in cognitive skills at age four. Even though other results seem to suggest that this phenomenon is driven by an increase in time investment in children,

the results are still present after controlling by hours worked and wages, which could suggest heterogeneous quality or price effects.

Finally, in Chapter 4, I conclude and present future steps in my research agenda.

Chapter 2

THE INSURANCE VALUE OF FERTILITY CHOICES: CHILDREN AS CONSUMPTION COMMITMENTS

2.1 Introduction

From the moment they are born and at least until they come of age, children's welfare is their parents' responsibility. In particular, parents need to provide consumption for an extra individual without an extra source of income. If the household faces a low income spell, parents still must provide for their children, sometimes depriving themselves in the process. Standard economic treatment of fertility does not account thoroughly for this commitment to children in the analysis of family decisions about consumption, savings, and fertility. Taking account of the commitment to children, this chapter calculates the insurance value of the timing of fertility choices against idiosyncratic income shocks to the household. To accomplish this, I use a structural life-cycle model with stochastic wage processes and endogenous female labor supply and family planning. Contrary to the bulk of the literature, my model allows for non-separabilities in the utility function between household size, consumption and female labor supply. It also allows for endogenous emancipation choices.[1]

Parents spend large amounts of resources on their children. Lino et al. (2017) estimated that, by the end of a child's first 17 years of life, a middle-income household ($59,200-$107,400) will have spent $233,610 (US Dollars in 2015) on their first child.

[1] "Emancipation" is usually the legal mechanism by which minors become free from the control of their parents and, in turn, parents relinquish any responsibility towards their children. I am using it here to denote young adults splitting from their parents' household as a decision of the household.

Furthermore, throughout those first years of life, children's consumption and general welfare almost fully depends on their parents. Parents, then, are willing to incur the aforementioned expenses to increase their children's welfare, even during low income spells. Consequently, kids act as consumption commitments, a concept generally associated with durable goods.

This connection between children and durable goods is not new: Becker (1960, 1965) provides the first modern theoretical framework that analyzes fertility decisions by comparing children to durable goods. The key distinction is that durable goods are typically purchased once and deliver services over time. Children must be supported throughout their childhood. The commitment to children's consumption can make a household more averse to at least moderate income risk, but the mere presence of children also has the effect of smoothing household utility over time. In the traditional Becker framework, the presence of children is a form of household consumption that makes commitments to expenditures on consumption relatively smaller in the household bundle. How do these competing effects interact to influence fertility and consumption choices?

Theoretical explanations of the economic determinants of fertility focus on two main channels: substitution and income effects. When wages decrease, households face a lower opportunity cost of having children. This is due to the fact that raising a child is a relatively time intensive activity. Lower wages, then, cause an incentive to invest more time in children and this makes children less costly. Another effect of lower wages is lower income: this is the income effect. As mentioned above, raising a child is expensive and a negative shock to income implies less resources to invest in children and, in turn, leads to fewer children.

In a dynamic environment with uncertainty, these effects are more nuanced. First, the introduction of a temporal dimension implies that the decision over *when* to have

children becomes relevant along with the decision of how many children to have. Second, whether capital markets are accessible and whether shocks are permanent become key to understanding households' reactions to income fluctuations in terms of fertility. It is not hard to rationalize a negative reaction of total fertility to a negative income shock. However, the effect of temporary income shocks on fertility is more elusive. In a context of perfect capital markets, the realization of a negative transitory shock will not have large consequences on fertility decisions. In this environment, households can borrow against their future income, which should contribute to keeping family plans the same. In a setting with imperfect capital markets, the reaction to income shocks may be different. Not being able to transfer resources from the future, households have to find other ways to smooth utility. In particular, they could change their family planning to adjust to shocks. In what direction and with what intensity the households will react to risk is part of the empirical question this chapter addresses. It will depend on the magnitude of the effects described in the previous paragraph, which in my model are represented by an increased marginal utility of consumption when there are children in the household and in the constant stream of utility children provide. I find that the welfare loss of a negative transitory income shock is 35 to 39 times larger if households are not able to choose when to have their children. These results underscore the importance of children as consumption commitments. When parents cannot choose when to have children, a negative transitory income shocks becomes much harder to smooth, and therefore much more costly in terms of welfare. When a transitory shock happens, the household would like to bring resources from the future to the present by consuming extra savings.[2] However, the possibility of having an extra individual in the household for at least the next 18 periods makes of bringing consumption from the future to the present

[2]Or borrowing, but in the framework of this chapter, households cannot be net borrowers.

considerably more welfare-decreasing. Furthermore, when there is a child is in the household, it is harder for the families to supply female labor, which weakens another smoothing mechanism for the next few years.

Many papers have focused on the impact of motherhood on female labor supply (Ghez et al., 1975; Francesconi, 2002; Gayle et al., 2006; Sheran, 2007; Keane and Wolpin, 2010; Adda et al., 2017; Ejrnæs and Jørgensen, 2020, to mention just a few). As described above, raising children is a time-intensive activity and women still endure the lion-share of the burden today.[3] I incorporate this element into my model by endogenizing female labor supply and introducing a nonseparability with the number of children in such a way that working is more costly as the number of children in the household grows. Nonseparabilities between labor and children are relevant because it has been shown that family labor supply plays an important role in smoothing shocks (Blundell et al., 2016, for example). In an environment in which households cannot adjust labor supply, the insurance value of fertility choices will surely change. This element is compatible with the fact that availability of contraceptive pills positively affected female labor force participation (Bailey, 2006). The experiment I set up to calculate the insurance value of fertility can be rationalized through the lens of birth control. Using the model, I set up an environment in which households cannot control when they have a child: they appear in the family unit with a certain probability compatible with fertility rates registered before the emergence of the first widely available contraceptive pill. This allows me to compare the welfare loss caused by a negative income shock in the benchmark environment and in an environment in which a certain smoothing channel (e.g. fertility planning, emancipation) has been muted.

[3]Time investment by the parents is hard to substitute with money investment. See Agostinelli and Sorrenti (2018) for estimates on the elasticity of substitution.

Once childhood is over, households are able to split ways with their children. Endogenous emancipation is a feature of my model that accounts for the flexibility a household has in choosing its composition after their underage members legally become adults. This matters because not having this choice available could in theory affect the smoothing value of fertility choices. As long as children are in the family unit, their consumption is part of the total household consumption. At the same time, nonseparabilities between consumption and the number of children in the family unit increase the marginal utility of consumption per capita. This creates an incentive to emancipate young adults, which is countered by an emancipation utility cost. Nonseparabilities are yet another element which serves to capture the character of children as consumption commitments, in the sense that the number of children in the household carries an adjustment cost, even after they come of age (Chetty and Szeidl, 2007; Postlewaite et al., 2008). It is possible to interpret this adjustment cost as psychological cost of the emancipation, but it is also a reduced-form way to capture, for example, potential labor income that an adult child could bring into the household (Barro and Becker, 1989).

I present an empirical strategy to estimate my model using a simulated method on the Panel Study of Income Dynamics (PSID). Instead of selecting an arbitrary set of unconditional moments to match with the structural model, the method targets parameters from an auxiliary, simpler, model estimated directly from data. This parsimonious approach summarizes the complex dynamics of family planning and consumption predicted by the structural model.

The layout of the chapter is as follows. In Section 2.2, I present the model that includes the features described in this section. In Section 2.3, I describe the data. In Section 2.4, I explain the identification strategy. In Section 2.5, I put the model to

work. In this section I explain in detail the theoretical experiment I use to calculate my main results.

2.2 Model

In this section I discuss the life-cycle model I use to obtain the insurance value of fertility choices. I consider a framework in which the household derives utility from the total number of children it has ever had and consumption per capita. Children are public goods within the household. The age of the household goes from 25 to 65 and all households are married.[4] Fertility choices are taken in a period and realized in the next until the age of 44. Families can have up to two children. Emancipation choices can be taken until retirement, at age 65, as long as there is at least one adult child. Fertility and female labor supply change the marginal utility of consumption. I assume that female wages and male earnings are exogenous throughout and each follows its own stochastic process, and both have two types of shocks: transitory and permanent. Shocks to wages are allowed to be correlated across spouses within type.

2.2.1 Household Problem

Let β denote the intertemporal discount factor, A_t denote the stock of assets, n_t the total number of offspring the household has ever had and h_t the children currently in the family unit. Let w_t^w and W_t^h denote the wife's wage and the husbands earnings respectively. age_{jt} represents the age of child j at time t. The dynamic optimization problem solved by a household until age 44 (period 19 of the model) is as follows:

[4] I remain agnostic about the implications of the relationship between the timing of marriage and the timing of fertility decisions in this chapter, which simplifies the problem. Furthermore, it is more sensible to assume certainty on fertility decisions after marriage, which also contributes to simplify the model.

$$V_t(A_t, n_t, h_t, w_t^w, W_t^h, \{age_{jt}\}_{j=1}^2) =$$

$$\max_{c_t, A_{t+1}, p_t, \kappa_t, \iota_t} u(c_t, n_t, h_t) + \beta \mathbb{E}_t \left[V_{t+1}(A_{t+1}, n_{t+1}, h_{t+1}, w_t^w, W_t^h, \{age_{jt}\}_{j=1}^2) \right] \quad (2.1)$$

where c_t is household consumption per capita, p_t denotes a discrete $\{0, 1\}$ female labor supply decision, κ_t denotes the fertility choice and ι_t is the emancipation choice. The optimization problem is to choose consumption per capita, female labor supply, whether to have a child, and whether to emancipate a child, subject to a budget constraint (2.2).

$$C_t + A_{t+1} = (1 + r)A_t + W_t^h + w_t^w p_t \quad (2.2)$$

C_t is the total household consumption (as opposed to per capita consumption, c_t, which I describe below). r is a risk-free exogenous interest rate. The total number of children and the children currently in the family unit follow a law of motion each, which satisfy the following expressions:

$$n_{t+1} = n_t + \kappa_t \qquad \kappa_t \in \{0, 1\} \quad (2.3)$$

$$h_{t+1} = h_t + \kappa_t - \iota_t \qquad \iota_t \in \{0, 1\} \quad (2.4)$$

Child 1 becomes an adult with probability λ, given that she was born. The second child becomes an adult with probability λ if she was born and child 1 is already an adult.[5] $n_t - h_t$ represents how many adult children the household has out of their family unit.

[5]The reason for having only two children and two states for ages is due to the fact that a more realistic representation would render the model too computationally burdensome.

2.2.2 *Preferences*

The utility function satisfies:

$$u(c_t, p_t, \iota_t; n_t, h_t, \{age_{jt}\}_{j=1}^{2}) = \frac{[c_t \exp(\mu h_t + \theta p_t)]^{1-\eta_c}}{1-\eta_c} + \frac{(n_t)^{1-\eta_n}}{1-\eta_n} - \varphi \iota_t \qquad (2.5)$$

With the right parametrization, this functional form captures the features of parenthood I described above.

The second term of (2.5) reflects that children are public goods within the household. All family unit members enjoy the stream of services they provide. Children may also provide considerable economic benefits to their parents, besides the joy of parenthood, especially in low-income households (Caldwell, 1982; Altonji et al., 1996). Since the data I use do not include information on intergenerational transfers from children to parents,[6] this term will capture, at least in a reduced form way, the effect of these transfers. Even though children do not start working as young as they used to and the development of their human capital has given them larger levels of independence with respect to their parents' assets, both of which may have caused the weight of the aforementioned transfers in the household budget to dwindle, the increase in women's labor supply, and birth control, may have kept these transfers relatively relevant as Altonji et al. (1996) observe.

Children can also be a burden in the family unit, in spite of their character of public goods. While they are growing up, parents are responsible for the children's upbringing, and they usually go a long way to guarantee their welfare, even to the extent of depriving themselves. The parameter $\mu < 0$ on the utility function contributes to capturing this phenomenon. As the number of children in the family unit grows, the marginal utility of consumption increases. Children and consumption are,

[6] Altonji et al. (1996) also use data from PSID, but there are only two waves with data on upward intergenerational transfers (1988, 2013).

then, Frisch complements. In other words, the larger the number of kids in the family unit, the stronger the preference of the household will be for moving resources from the periods in which they don't have children, to the one in which they do.[7] The household is more risk averse in the presence of children. Consequently, the cost of children comes through an increased marginal utility of consumption and not through the budget constraint.

Parental efforts to provide for children's welfare do not involve only goods, but they also require time. This time is hard to replace with money investments, such as daycare (Agostinelli and Sorrenti, 2018). In particular, women have historically participated more actively in child-rearing activities, which has lead to damage their careers (Adda et al., 2017), not only in terms of job choice and atttendance, but also in terms of human capital accumulation (Klepinger et al., 1999, for example,). The parameter $\theta < 0$ captures these aspects of childbearing and plays two roles in the model. First, it represents the disutility of working. Second, because both μ and θ are negative, an increase in the number of children in the family unit will impact negatively in the marginal utility of labor. This is to say that as the household size increases, supplying female labor will become more costly to the household. A larger marginal disutility of labor when having children implies that children make more costly one of the potential channels the households count on to smooth utility which will have consequences on the insurance value of the timing of fertility choices. Similar to children, female labor supply will also increase marginal utility of consumption.

[7] As it is, the model does not capture heterogeneities of the children that could potentially affect how marginal utility improves with their presence. For example, health conditions or a higher human capital development could magnify or mitigate the effects on the marginal utility or the stream of utility as a public good. At this point, I abstract from these details.

This assumption capture the fact that working incurs an increase in the demand of consumption goods such as transportation, or dining out.

Households could potentially emancipate their adult children as a way to mitigate the effect of children at home. I allow for households to split from their children after the children come of age. In the model, this decision to split, reflected by ι_t, will affect only the number of children in the family unit, h_t, but not the total number of children the household has ever had, n_t. The difference can be understood as reflecting that parents care about their kids and their mere existence provide, potentially, a source of consumption insurance but, while in the household, parents have to provide for their kids. Given the incentives implied by this framework, households will want to emancipate their children as soon as they can, which is not realistic and may alter the insurance value of fertility choices. To prevent this automatic emancipation decision I introduce a fixed cost of emancipation, φ. This parameter can be thought of as a psychological cost of splitting, but there are other possible interpretations. In the first place, even though children may provide consumption insurance for their original households, the intensity with which they contribute to the household expenses will likely not be the same. Furthermore, if parents are altruistic, letting their children split from the household before college can be costly, although keeping them within the family unit implies college expenses. Also, there is evidence that the timing in which young adults enter the labor force matters in the long run for their career development (Kahn, 2010; Schwandt and Von Wachter, 2019). Kaplan (2012) finds that having the choice to returning to their parents family unit has an insurance value against unemployment for young adults.

2.2.3 *Earnings Process*

Following the bulk of the literature[8], I assume wage[9] processes have a permanent and a transitory component and they are exogenous throughout the life cycle. The permanent component is an auto-regressive process with a unitary root and the transitory component is serially uncorrelated, and independently and identically distributed (i.i.d.) across time. Each earner has their own income process, although they are not independent.

I assume that the wage process is exogenous throughout. In my specification, the log of real wages corresponding to the earner $j \in \{h, w\}$ of a household in period t is as follows:

$$\log w_t^j = x'_{jt}\xi^j + F_{jt} + \epsilon_{jt} \tag{2.6}$$

$$F_{jt} = F_{j,t-1} + \nu_{jt} \tag{2.7}$$

where x_{jt} represents a set of observables in time t, ϵ_{jt} denotes the transitory shock and F_{jt} represents the permanent component. ν_{jt} represents the innovation to the permanent component. A transitory shock is an even that affects labor productivity growth only temporally such as a short illness. A permanent shock is an event that affects productivity in a more persistent way such as a disability, technological change rendering the earners skills obsolete, etc. Wage shocks are serially uncorrelated and uncorrelated within individual. However, following Blundell et al. (2016, 2018), I allow for correlation in the wage shocks between spouses, within each kind of shock. The

[8] Although this is a standard structure, there are some caveats. Guvenen and Smith (2014), for example, refer to the importance of allowing for growth heterogeneity.

[9] Hourly wages. In the solution of the model, I assume that workers work full time (8 hours a week, 52 weeks a year). This is no different to the approach that, for example, Low and Pistaferri (2015) and Autor et al. (2017) take.

shocks follow a normal distribution with variance $\sigma^2_{\epsilon_j}$ and $\sigma^2_{\nu_j}$ respectively. Variance is constant across time. The covariances between spouses are $\sigma_{\epsilon_h \epsilon_w}$ and $\sigma_{\nu_h \nu_w}$ repectively.

2.3 Data

For the empirical analysis, I use the Panel Study of Income Dynamics (PSID). The surveys that compose the PSID started in 1968 and have been performed annually since then until 1997 and biennially since then. The original PSID sample was composed of around 5000 households and has, since then, followed also their descendants and split-offs. It is, as a result, a panel that includes rich variables on demographics and income.

I focus on the waves from 1999 to 2015. In 1999, PSID starts collecting rich data on consumption and assets besides demographics and income. This richness in consumption and assets data is an advantage of the PSID with respect to other databases that include fertility outcomes and demographics, such as the National Longitudinal Study of Youth in its two waves. As we will see in Section 2.4, this data contributes to the identification of the parameters of the model.

The sample selection includes married households in which the wives are between 25 and 65 years old. This chapter treats fertility choices as rational decisions that react to economic fluctuations, which can be rationalized better in a household with adult, married parents. Analysing the economic incentives of teenage and young adults' pregnancies goes beyond the scope of this study, given the particular characteristics of this phenomenon in the United States (Kearney and Levine, 2012). Furthermore, I keep only observations for which the demographics used for the estimation are nonmissing (education of adults, age, state of residence and age of the children). I dropped outlier observations with assets worth more than 20 million dollars and

performed a standard winsorization of the top and bottom one percent of the hourly wage distribution.

2.4 Identification

The proposed identification strategy of the parameters in this model has two steps. First, I choose a set of parameters following established findings from the literature. Second, I obtain the rest of the parameters using a simulated method.

2.4.1 Calibration

The first step towards the identifications of the parameters of interest is to fix some parameters using previous established findings in the literature. I set the risk aversion coefficient[10] to $\eta_c = 1.5$ and the discount factor to $\beta = 0.96$. The household maximizes per capita consumption. I apply the OECD-modified scale to adjust total household consumption to consumption per capita.[11]

Table 2.1 shows the rest of the parameters fixed outside of the model. The parameters involved in the income process, they all come from Blundell et al. (2018, 2016).[12] Notice that the covariance between spouses' wage shocks, specially the covariance of the transitory shocks, are relatively small. $d_{0,w_j}, d_{1,w_j}, d_{2,w_j}$ denote the age profile of the wage growth. This wage profile takes a quadratic form and each subindex represents the order of the term in the polynomial. I also include the initial distribution of

[10]Following Low and Pistaferri (2015), I choose the estimation found in Attanasio and Weber (1995)

[11]It is beyond the scope of this study to estimate scale effects. The estimation of μ will absorb the scale effects not capture by my scale adjustment method of choice.

[12]Blundell et al. (2018) study the smoothing properties of time investments in children within the household. Their framework is very similar, which allows me to take these estimates with confidence, but they do not consider endogenous fertility choices.

Table 2.1: Parameters Fixed out of the Model

Parameter	Value	Source
$\sigma^2_{\nu_h}$	.0303	Blundell et al. 2016
$\sigma^2_{\nu_w}$	.0382	Blundell et al. 2016
$\sigma^2_{u_h}$	.0275	Blundell et al. 2016
$\sigma^2_{u_w}$	.0125	Blundell et al. 2016
$\sigma_{\nu_h\nu_w}$	.0058	Blundell et al. 2016
$\sigma_{u_h u_w}$	.0027	Blundell et al. 2016
σ^2_{0,w_h}	.256	Blundell et al. 2018
σ^2_{0,w_w}	.258	Blundell et al. 2018
$d_{0,w_h}, d_{1,w_h}, d_{2,w_h}$	[1.54, .069, -.0007]	Blundell et al. 2018
$d_{0,w_w}, d_{1,w_w}, d_{2,w_w}$	[1.77, .045, -.0004]	Blundell et al. 2018
$\sigma^2_{\log A_0 \mid A_0>0}$	2.58	Blundell et al. 2018
$P(A_0 = 0)$	.23	Blundell et al. 2018
$P(n_0 = 0)$	.36	PSID
$P(n_0 = 1)$	.26	PSID

family size, which I compute directly from my PSID sample. At the age of 25, more than a third of the sample (36%) did not have any children and more than a quarter had one child (26%).

2.4.2 Estimation

The second part of my empirical strategy is the estimation of the rest of the structural parameters: μ, θ, φ and η_n. I use a simulated method (Gourieroux et al., 1993). I describe the sources of identification in the following subsections.

Moments: Consumption Regression

To identify μ and θ, I appeal to a simple linear model that approximates the variable relations established by the Euler equation that characterizes the optimal household decisions:

$$c_t^* = \exp(\mu h_t + \theta p_t)^{\frac{1-\eta_c}{\eta_c}} \mathbb{E}\left[(c_{t+1}^*)^{-\eta_c} \exp(\mu h_{t+1} + \theta p_{t+1})^{1-\eta_c}\right] \tag{2.8}$$

where c_t^* denotes the optimal consumption per capita allocation for period t for every combination of the expected state space. Applying logarithm to both sides, we obtain:

$$\log c_t^* = \frac{1-\eta_c}{\eta_c}(\mu h_t + \theta p_t) + \log\left\{\mathbb{E}\left[(c_{t+1}^*)^{-\eta_c} \exp(\mu h_{t+1} + \theta p_{t+1})^{1-\eta_c}\right]\right\} \tag{2.9}$$

The first term gives us a linear relation between present log-consumption per capita, the number of children in the family unit, and the labor supply. The expected marginal utility on the second term denotes the dynamic relation between present consumption and future consumption. Informed by equation (2.9), I choose a simple linear model as an auxiliary linear model to identify the parameters μ and θ, that captures the complex dynamics of the structural model. In the spirit of Guvenen and Smith (2014) or Low and Pistaferri (2015) I choose my linear model to be:

$$\log c_t = \pi_0 + \pi_1 p_t + \pi_2 h_t + \pi_3 \log W_t^w + \pi_4 \log W_t^h + \pi_5 t + \pi_6 t^2 + \pi_7 age_{1t} + \pi_8 age_{2t} + x_t'\pi + \epsilon_t \tag{2.10}$$

From this linear regression, π_1 and π_2 are the main sources of identification of μ and θ respectively. I also include controls for current state space variables, such as male and female earnings, household, and child age. In the estimation using PSID data I also included controls such as state of residence, race, and parental education.

Moments: Birth and Emancipation Regressions

The starting point to identify the rest of the relevant parameters for fertility and emancipation is similar to the effect of labor and children on marginal consumption. The differences between one and the other are given by the discrete characteristic of the former. In discrete choice models, only the elements that contribute to the difference between the values of taking and not taking a certain decision count (Train, 2009). In concrete, take the continuation value from (2.1). The household will decide to have an extra child and not emancipate ($\kappa_t = 1$ and $\iota_t = 0$) if and only if:

$$\mathbb{E}_t \left[V_{t+1}(A_{t+1}, n_t + 1, h_t + 1, w^w_{t+1}, W^h_{t+1}, \{age_{jt+1}\}^2_{j=1}) \right] - \mathbb{E}_t \left[V_{t+1}(A_{t+1}, n_t, h_t, w^w_{t+1}, W^h_{t+1}, \{age_{jt+1}\}^2_{j=1}) \right] > 0 \quad (2.11)$$

Notice that the comparison is between increasing by one or not the total number of children (n_t) and the number of children in the family unit (h_t). Because n_{t+1} and h_{t+1} are defined in t, it can be proved that (2.11) is equivalent to:

$$\left\{ \left[\frac{\exp\left[\mu(h_t + 1)\right]}{f(h_t + 1, \{age_{jt+1}\}^2_{j=1})} \right]^{1-\eta_c} - \left[\frac{\exp\left[\mu(h_t)\right]}{f(h_t, \{age_{jt+1}\}^2_{j=1})} \right]^{1-\eta_c} \right\} \times \mathbb{E}_t \left\{ \frac{[C_{t+1} \exp(\theta p_{t+1})]^{1-\eta_c}}{1 - \eta_c} \right\} + \frac{(n_t + 1)^{1-\eta_n} - (n_t)^{1-\eta_n}}{1 - \eta_n} +$$

$$\beta \mathbb{E}_{t+1} \Big[V_{t+2}(A_{t+2}, n_t + 1 + \kappa_{t+1}, h_t + 1 + \kappa_{t+1} - \iota_{t+1}, w^w_{t+2}, W^h_{t+2}, \{age_{jt+2}\}^2_{j=1}) - V_{t+2}(A_{t+2}, n_t + \kappa_{t+1}, h_t + \kappa_{t+1} - \iota_{t+1}, w^w_{t+2}, W^h_{t+2}, \{age_{jt+2}\}^2_{j=1}) \Big] > 0 \quad (2.12)$$

This inequality underscores the importance of adopting the indirect estimation.[13] The first line is negative. This means that, in general, this term tends Given a

[13]Notice that here I am assuming that children's age is not stochastic. This is the case because, empirically, it is not, and the point of this digression is ultimately empirical.

larger number of children already in the family unit, h_t, this difference becomes more negative. Therefore, the household becomes less likely to have an extra child as the family size grows. Through f, the age of the children will have a similar effect, *caeteris paribus*: an adult consumes more than a child, and intuitively this leaves less room for an extra household member. The term in the second line represents the stream of utility that children deliver throughout the household's life. This term is positive, but decreasing in n_t. This is given by the assumption of decreasing marginal utility on children. In other words, the more kids a household has ever had, the less likely it is to have an extra one. The complex interaction between these differences and the expected utility of the first line and the continuation values of the last line inform the choice of the following model, assumed to follow a logit specification:

$$P(\kappa_t = 1) = \frac{e^{\beta_1 n_{t|\kappa=1} + \beta_2 C_{t|\kappa=1} + \beta_3 W^h_{t|\kappa=1} + \beta_4 W^w_{t|\kappa=1} + \beta_5 S_{t|\kappa=1} + \beta_6 t_{\kappa=1} + \beta_7 t^2_{\kappa=1} + x'_{t|\kappa=1}\beta}}{\sum_{j=0}^{1} e^{\beta_1 n_{t|\kappa=j} + \beta_2 C_{t|\kappa=j} + \beta_3 W^h_{t|\kappa=j} + \beta_4 W^w_{t|\kappa=j} + \beta_5 S_{t|\kappa=j} + \beta_6 t_{\kappa=j} + \beta_7 t^2_{\kappa=j} + x'_{t|\kappa=j}\beta}} \tag{2.13}$$

In this model, β_1 will contribute to the identification of η_n. The logit model of $P(\iota_t = 1)$ will be analogous to 2.13. However, instead of its first term associated with h_t, there will be an intercept. This intercept will contribute to the identification of φ.[14]

Moments: Employment Rates over the Life Cycle and Number of Young Adults

I complement the moments described above with female employment rates by age of the household and household size; and number of young adults by household size. The first set of moments contribute to identifying labor related parameters, and the second, to identify λ, the probability of a born child of coming of age. For the

[14]For $\kappa_t = 0$ and $\iota_t = 1$, inequality 2.12 flips its sign and its second line becomes the parameter $-\phi$

employment rate, I separated the sample in two age groups (25-44 and 45-64), for a total of 6 moments.

2.4.3 Main Parameters

In this subsection, I present values[15] for the key parameters of my model, described in section 2.2, that I will use to compute the insurance value of fertility choices in section 2.5. Table 2.2 shows these values.

Table 2.2: Main Parameter Values

Parameter		Value
μ	Disutility of Children in the household	-1.742
θ	Disutility of Labor	-0.189
φ	Cost of Emancipation	3.461
η_n	Children Ut. Stream Curvature	0.143
λ	Probability of a child coming of age	0.21

The value of μ is negative. This implies that households want to transfer resources from periods in which they have fewer children, to periods in which they have more children. In other words, households want to save for when they will have more children and want to boost per capita consumption by consuming savings when they have more children. In the model, this is reflected by the fact that marginal utility of consumption is increasing in the number of children, via μ. This nonseparability, not found in the most traditional literature on fertility, capture the idea that parents go above and beyond to provide for their children.

θ represents the disutility of labor. Its magnitude, in combination with μ, informs

[15]The values presented here are a work in progress.

how harder it is to work while there are children in the household. Furthermore, the decision on labor supply, through θ, also modifies the marginal utility of consumption. When housholds decide to provide female labor supply, the marginal utility of per capita consumption increases. This captures the idea that going to work implies more consumption expenditure.

η_n and φ govern the stream of utility that children provide and the costs of emancipating them. The larger η_n, the less relevant this stream of services will be for welfare, relative to the household's own consumption expenditure. The larger φ is, the more costly it is for the household to let their children go. This could represent the potential resources that the household will not perceive by letting their children go in terms of goods or in terms of time.

2.5 Putting the Model to Work

In this section, I present a series of experiments and counterfactuals that allow me to answer the questions advanced in previous sections.

2.5.1 Timing of Fertility as Insurance

The main objective of this chapter is to measure the insurance value of the timing of fertility choices against income shocks. To do it, I use a similar methodology to Kaplan (2012) on my model.[16] Consider the problem of the household at period t, right after the realization of the shocks $(\nu_{jt}, u_{jt}, age_{st})$ with $j \in \{h, w\}$ and $s \in \{1, 2\}$. Let $x_t = (n_t, h_t, age_{st}, W_t^h, w_t^w)$ be given values for the state space in time t, with a continuation value $\bar{V}_t(x_t)$. Let δ_g with $g \in \{u, v\}$, which denote respectively a given transitive shock or a shock to the permanent component. Define, then, a state space in

[16]Kaplan (2012) measures the insurance value of young adults' choice of going back to their parents' home against income shocks.

which female earnings have been shocked as: $\tilde{x}_t = (n_t, h_t, age_{1t}, age_{2t}, W_t^h, w_t^w \delta_g)$. In my framework, insurance is defined as the degree to which a household is indifferent between particular realizations of a certain income shock. The difference in value between a state with a certain shock realization in the wife's wage and without it is:

$$\Delta_0 \equiv \bar{V}_0(A_0, x_0) - \bar{V}_0(A_0, \tilde{x}_0) \tag{2.14}$$

Notice that the identity (2.14) can be interpreted as the welfare loss (gain) caused by an income shock in female wages. The expression becomes straightforward after realizing that a household is fully insured when it is indifferent between having the shock and not having it (i.e. when $\Delta_0 = 0$). When the household is not fully insured against income shocks, following the environment in my model, I can define a degree of partial insurance, γ, such that:

$$\bar{V}_0(A_0 + \gamma, \tilde{x}_0) - \bar{V}_0(\tilde{x}_0) = \Delta_0 \tag{2.15}$$

In other words, γ is the size of a transfer in savings the household should receive (give up) so that, in a context in which the shock δ_g is realized, the welfare gain (loss) from that transfer is equivalent to the welfare loss (gain) caused by the shock. Notice that the first term on the RHS of (2.14) and the first term of the LHS of (2.15) must be equivalent for the latter equality to hold. In other words, γ is the compensating asset variation that the household needs to remain indifferent at the realization of δ.

To evaluate the insurance value of a certain choice, now we have to consider an environment in which that choice is not available. Let $\hat{\Delta}$ be analogous to (2.14) in this new environment:

$$\hat{\Delta}_0 \equiv \hat{V}_0(A_0, x_0) - \hat{V}_0(A_0, \tilde{x}_0) \tag{2.16}$$

However, let $\hat{\gamma}$ be such that:

$$\bar{V}_0(A_0 + \hat{\gamma}, \tilde{x}_0) - \bar{V}_0(\tilde{x}_0) = \hat{\Delta}_0 \tag{2.17}$$

Notice that the value functions on (2.17) are the same value functions found on (2.15). It would be incorrect to use the value function implied by the environment without choice, say $\hat{V}_0$. In an environment with no choice, savings gain value mechanically, just because there is one less option to smooth utility and, therefore, the value of the transfers becomes artificially higher. That is why I keep the use of $\bar{V}_t$ throughout. Because, by construction, $\hat{\gamma}_t(x_t) = \gamma_t(x_t)$ whenever $\hat{\Delta}_t(x_t) = \Delta_t(x_t)$, we can define:

$$\Gamma = \frac{\hat{\gamma}}{\gamma} \tag{2.18}$$

which is the increase in the cost of the income shock due to removing a smoothing channel. Γ is the insurance value of a particular channel against income shocks. Using consumption smoothing as opposed to utility smoothing to evaluate insurance value is not correct in this context. The study of consumption in this environment may still be interesting, but agents aim at smoothing utility. In this particular case, these approaches are far from equivalent, especially given the presence of children as public goods. This last feature underscores the importance of measuring welfare in terms of differences and not levels. In a world without shocks, depending on how the absence of fertility choices are defined, the household could be worse off just because they cannot choose to have a child as a public good in the household, even though they may be consuming more in per capita terms. Furthermore, the decision on how to suppress the timing of fertility is not obvious. I choose to change the environment in a way that households receive children in their households in a stochastic fashion, with a probability that adjusts to fertility rates between 25 and 44 years of age in the United States in 1960, the year when *Enovid*, the first broadly commercialized contraceptive pill, became available for women above 21 (Bailey, 2006)[17]. This allows

[17]Between 1960 and 1976 state legislation was sanctioned that increased the availability of the contraceptive pill for young adults between 18 and 21. I take 1960 because my sample is above 25 years of age.

me to put a value to contraceptive developments that took place in the decades after it[18]. I let households have only two children, which renders results comparable with the benchmark. In Table 2.3 we can find the results of this exercise. I used the model to evaluate the timing of fertility choices as an insurance channel against labor income shocks. As described above, I measure the cost of a negative shock, as the compensating asset transfer, γ, necessary to render the household indifferent to the shock. I evaluate the welfare cost using the median household asset holdings at age 25 ($10200), median male earnings at age 25 ($34123 yearly) and different levels of female wages, represented by each of the three columns of Table 2.3: percentile 25 ($20,789), median ($29,135), and percentile 75 ($39188). A transitory shock is here a one-time decrease in wages of 25%. To make it comparable, a permanent shock represents the same one-time fall (25%), but the subsequent realizations follow the stochastic process described in Section 2.2.

In the upper panel of Table 2.3 we find the results for a transitory shock. The first two rows show the welfare loss of a one-time reduction of 25% in female wages for each wage group. The transfer each family should receive in terms of assets to be remain indifferent to the shock goes from 8,278.4 to 15,267.2, depending on the female level of wages. This represents 1.81, 5.55 and 2.49 months of total earnings for families where both members work full-time and the female wage is low, median and high, respectively. This difference is not given only by a reduction in income, but also by the reaction of female labor supply to this kind of shock. When there is a reduction of wages, the household is free to adjust labor supply in that very same period and,

[18]Of course, stating that households are completely in control of the reproductive process right now would be an excess, especially in a context of disinformation and lack of accessibility to certain contraceptive tools. However, the sample analysed in this chapter (married adults of more than 25 years of age) seems to be reasonably close to it.

for this reason, there is a variation in the compensating differential across levels. The hump shape that we observe can be explained by substitution and wealth effects. On the one hand, larger wages imply that the amount that can be saved for future periods is larger and, therefore, the shock is not as painful. Smaller wages, on the other hand, imply less incentives to work. A marginal female earner may see a small reduction in welfare caused by a reduction in wages because she decides to stop supplying labor, which slightly compensates the fall in earnings. Since the household faces uncertainty in terms of whether they will have a child in the next period, a reduction in wages today has a large impact in terms of welfare. This explains the large insurance value of fertility timing decisions: they range from 35.2 to 38.6.[19] The increasing value of fertility choices in female wage is explained by the substitution effect. As wages grow larger, the outside option of fertility increases and, therefore, not being able to control when a child will appear in the household is more costly. When the household receives a negative transitory shock today, it smooths consumption through savings or by not supplying labor supply, depending on what the size of the shock is.

The lower panel of Table 2.3 shows the impact of a permanent shock of the same size as the transitory shock. As we can see, the compensating asset transfer is massive compared to what we saw for transitory shocks: it goes from \$217,984 to \$336,960. It is easy to rationalize if we take into account that the differential created by the shock will last for the rest of the household's life. The relatively small insurance value of the timing of fertility, compared to transitory shocks, is also something I predicted in previous sections. It does not matter as much *when* the household has its next child because the permanent shock affects all future periods: this is the wealth effect. The

[19]To have an idea of how large these effects are, Kaplan (2012) finds, using a very similar method, that the insurance value for young adults of being able to come back to their parents' home if they lose their job is between 12 and 20 times the value of not having that option.

utility stream provided by children gains relevance in terms of welfare in the presence of a permanent shock, which compensates the welfare loss caused by it.

Table 2.3: Cost of Shocks and Value of Insurance

	Initial Income Distribution		
	Percentile 25	Median	Percentile 75
	Transitory Shock		
Cost of a negative shock, γ_t:			
Compensating asset transfer	8278.4	11398.4	15,267.2
Number of months of total earnings	1.81	5.55	2.49
Value of insurance channel, Γ_t:			
Timing of fertility choice	35.2	36.7	38.6
	Permanent Shock		
Cost of a negative shock, γ_t:			
Compensating asset transfer	217,984	277,888	336,960
Number of months of total earnings	47.62	52.71	67.42
Value of insurance channel, Γ_t:			
Timing of fertility choice	3.16	3.25	2.38

Values are measured at age 25 of the household (wife), with median assets at age 25 ($10200), and median male earnings at age 25 ($34123 yearly), with no children. Female earnings: percentile 25 ($20,789), median ($29,135), and percentile 75 ($39188).

Chapter 3

UNDER A LUCKY STAR: THE CHILD DEVELOPMENT CONSEQUENCES OF BEING BORN IN A BAD ECONOMY

3.1 Introduction

Between December 2007 and June 2009, during the Great Recession, 6.6 million children were born in the United States. Despite a vast and increasing literature, the extent to which this recession has affected their lives is not fully understood by economists. Perhaps because of its multidimensionality and complexity, a comprehensive conclusion on the human capital consequences of being born under high unemployment is particularly underexplored. As discussed later in this section, some studies have investigated the consequences of low income in early childhood on later outcomes, and others have analyzed the contemporary economic conditions of the household on child development outcomes. None of these examples in the literature have pondered the effect of aggregate economic conditions at birth on the human capital accumulation process beyond individual labor status and income. This chapter attempts to fill that gap and offers an empirical analysis of the impact of state unemployment rates around birth on child development outcomes later in childhood.

In the main specification, I define the variable of interest as the 12-month unemployment rate average of the rolling year after birth in the child's state of birth. Child development is measured with standardized test scores performed later in childhood (between 4 and 15 years old). Unemployment rates are more likely to be exogenous to child development outcomes than individual characteristics, but concerns of endogeneity could occur; to address them, I use an instrumental variables approach. In the

main specification, results are estimated using the 7-month average unemployment rate in the state of birth centered 1 year before the presumed month of conception as an instrument.

The empirical analysis exploits the Current Population Survey (CPS) and the National Longitudinal Survey of Youth (NLSY). Unemployment rates are constructed from CPS data, and child outcomes are included in the NLSY Children and Young Adults (NLSYChild). The subjects of this survey are all the children of the women interviewed for the National Longitudinal Survey of Youth 79 (NLSY79). I match mothers with children and exploit family and mother characteristics as control variables. This method provides a measure of whether unemployment rate is relevant in addition to demographic and basic microeconomic variables such as hours worked and family income and what mechanisms could potentially explain the results. Furthermore, I gained access to the NLSY79 geocode data; thus, I could match mothers' states of residence at the time of the birth of their children to the corresponding unemployment rate.

Matching unemployment rates to states of residence to explore the impact of the business cycles on some individual outcome is not novel. Several papers have explored the impact of, for instance, unemployment rates around graduation on career outcomes, such as Kahn (2010), Oreopoulos et al. (2012), and Schwandt and von Wachter (2018). All of them have observed persistent negative effects of high unemployment rates at graduation on earnings. Additionally, Dehejia and Lleras-Muney (2004), Van den Berg et al. (2006), and also Schwandt and von Wachter (2018) explore the consequences of unemployment rates in mortality. Schwandt and von Wachter (2018) explore the effect of unemployment at graduation, Dehejia and Lleras-Muney (2004) study the relationship with unemployment at the time of conception, and Van den Berg et al. (2006), at the time of birth. On the one hand, in line with the ca-

reer results, Schwandt and von Wachter (2018) find that an increase in unemployment rates at graduation increases mortality; on the other hand, Dehejia and Lleras-Muney (2004) and Van den Berg et al. (2006) find the opposite outcome concerning unemployment rates at birth: an increase in unemployment reduces mortality both in childhood and later in life. They have suggested that this finding occurs because of selection into who has children under different levels of unemployment and behavioral changes. This study is the first, to the best of my knowledge, to focus directly on the impact of unemployment rates on child development outcomes. This study provides additional information on the timing and mechanisms with which business cycles around the early years of life affect the human capital accumulation process during childhood. Health is only one dimension of human capital and, as such, can affect child development; however, child development is also affected by other dimensions of human capital beyond health. Consequently, to expand the understanding of the individual effects of the business cycle, a study of its relationship with child development is critical.

Much of the literature has focused on one of the many aspects generally entangled with recessions and variations of the unemployment rate. In particular, the impact of family income and labor supply on child development has been widely debated. Early studies such as Duncan et al. (1994), Duncan et al. (1998) and Blau (1999), as well as more recent ones such as Løken et al. (2012) or Dahl and Lochner (2012) have demonstrated a positive relationship between family economic conditions during childhood and child achievements. Under a recession, family income tends to decrease, negatively affecting child development. However, I assert that these analyses are insufficient. Much of the income reduction in earnings during a recession is because of a reduced amount of hours worked, not wage rates. I consider that the impact of

unemployment rates, by definition, includes the effect of reduction of labor supply and income.

The literature has repeatedly linked increases in labor supply to negative effects on child development outcomes (see Baum II, 2003; Ruhm, 2004; Bernal, 2008; Carneiro and Rodrigues, 2009; Bernal and Keane, 2011; Hsin and Felfe, 2014; Carneiro et al., 2015; Del Boca and Flinn, 2014; Fort et al., 2017; Agostinelli and Sorrenti, 2018, among others). A reduction in hours worked has two effects. One effect is that given a certain wage rate, earnings decrease. The other effect is that as labor supply decreases, a substitution effect kicks in and anewly available time can be split between leisure and time investments in children. Regarding this phenomenon, Agostinelli and Sorrenti (2018) find that a yearly increase of 100 work hours negatively affects cognitive and noncognitive outcomes by approximately 6% of a standard deviation. They also show that of the two effects caused by working fewer hours, having more time to invest in children dominates that of earning less. These studies, however, have not captured other effects that could be encompassed by business cycles. For example, Brenner (1979) links recessions with higher levels of psychological stress, which would, over time, affect the quality of the time parents invest in children; Bhalotra et al. (2018) find domestic violence to be procyclical, which negatively affects child development. Through the estimations performed in this study, I measure the combined effects of all those channels. First, this measure allows policy makers to have an insight into what to expect for children born at different levels of the business cycles and act in consequence. Second, this measure complements Dehejia and Lleras-Muney (2004) by measuring the costs attached to business cycles.

Despite the relevance of my main results, I also perform extensions to explore the potential mechanisms behind the estimated effects. First, I estimate the effects of unemployment rates on maternal characteristics at birth to assess whether results

are being driven by selection. The estimates provide little evidence that selection on maternal characteristics is driving the result.

When the unemployment rate is higher, the probability of parents falling under an unemployment spell for any given child increases. Individual unemployment may lead to parents spending more hours with their children, which seems to have a positive impact on child development.[1] My results suggest this is potentially the channel that operates more strongly.

To explore potential mechanisms, I first analyze the heterogeneous effects of unemployment rates in different populations. The most remarkable results are for teenage mothers: This is the only population for which a higher unemployment rate is associated with a lower child development outcome.

NLSYChild has the components and scores of the Home Observation Measurement of the Environment (HOME) assessment among its variables. I use a subset of the items in HOME to create a standardized measure for parental investments of time and money for children aged up to 1 year. The first index comprises the items that imply time spent by the mother with the child, and the second index, by goods (books and toys) that the child owns at the time of the interview. Using an IV specification, I find that unemployment causes a considerable increase in the measure of goods and time investments.

The main results and the exploration of mechanisms suggest that policymakers should focus on certain groups during recessions and certain other groups during booms. Further refinement in understanding the mechanisms operating behind aggregate unemployment is required for robustness of policy implications, but the re-

[1]Notably, during a recession, prices tend to decrease. As a result, individuals who can remain in their jobs and maintain their earnings may see their purchase power on parental investment goods increase.

sults underscore that policies boosting child development at an early age may be as necessary during booms.[2]

The remainder of the chapter is as follows. In Section 3.2, I present the data. In Section 3.3 I present the empirical model. In Section 3.4 I present and discuss the results.

3.2 Data

The data sets I used are NLSY79[3], NLSYChild[4], and CPS, , and all are maintained by the Bureau of Labor Statistics. I obtained state unemployment data from CPS, and the remainder of the variables used are in—or constructed from—the NLSY cohorts. Additionally, I accessed the NLSY79 and NLSYChild geocode files to connect the state of residence of the mother, which I assume is the state of residence of her children, to the corresponding unemployment rates.

In particular, the information related to child outcomes, parental behavior, and family characteristics was taken from NLSY79 and NLSYChild. NLSY79 is a representative sample of the U.S. population aged between 14 and 22 years in 1979. The original sample size was 12,686. In the 2014 wave, the 7,071 individuals interviewed remained representative of the aforementioned cohort. Among the many topics covered by the survey, my interest was in the variables related to parental behavior and family characteristics. Most of the questions asked in this survey were performed annually until 1994 and biennially thereafter.

I used the mothers' unique identification number in NLSY79 to match them, their

[2]This, however, should be further explored too. The case may be that recessions are correlated with higher government expenditure in child development, driving the results. It does not make my results less valid but confounds the policy implications.

[3]Bureau of Labor Statistics, U.S. Department of Labor (2016a)

[4]Bureau of Labor Statistics, U.S. Department of Labor (2016b)

residency, and their family and behavior characteristics with their children in the NLSYChild. NLSYChild is a survey designed to follow the children of the women interviewed in the NLSY79 cohort. As such, NLSYChild is a representative sample of all the children delivered by women aged between 14 and 22 years in 1979 across the United States. The subjects of the survey were born between 1970 and 2014. This variability prompted the division of the sample into two subsamples, namely, children (aged between 0 and 15 years) and young adults (aged between 15 and 42 years),[5] and some questions were specific to each group. Among the members of the sample that were children, the main outcome variables used are as follows: the scores of the Peabody Individual Achievement Test (PIAT) and the Behavioral Problems Index (BPI). These measures have been widely used in the literature (Cunha and Heckman (2007), Currie (2011), Dahl and Lochner (2012) and Agostinelli and Sorrenti (2018) among others).

I measured cognitive development by using the PIAT, a set of tests assessing children's proficiency in mathematics (math), oral reading and word recognition (reading recognition), and reading comprehension. These tests measure "a child's attainment in mathematics as taught in mainstream education" (Bureau of Labor Statistics, U.S. Department of Labor, 2016b). The PIAT comprises 84 questions presented in age-appropriate items, and this is also the case with the word recognition subtest. This assessment is designed "to measure skills in translating sequences of printed alphabetic symbols which form words, into speech sounds that can be understood by others as words" (Bureau of Labor Statistics, U.S. Department of Labor, 2016b). The reading comprehension subtest is a set of 66 items of increasing difficulty. Each of these

[5] "Young Adults" is the name that BLS gives to this database when the subjects are 15 or more, even though a 42 years-old adult does not meet the common understanding of what a young adult is.

items asks the child to choose, among a set of four pictures, the picture that best matches a specific sentence. The children who take the three subtests were almost all aged between 5 and 15 years. For the main results, I used a combined measure of reading and math test scores. First, I standardized the scores of each of the subtests so the mean was zero and the standard deviation was one. Next, I averaged these standardized outcomes for each child and re-standardized the outcome to obtain the combined measure. In this manner, I used the same measures of cognitive skills in Dahl and Lochner (2012) and Agostinelli and Sorrenti (2018) to be able to perform a comparison in magnitudes to their results.

The BPI quantifies noncognitive skills. The BPI is an index that measures the frequency, range, and type of childhood behavioral problems for children aged 4 years and over created by Peterson and Zill (1986). The sample used in this study comprised children aged between 4 and 15 years. The version applied in NLSYChild comprises 28 questions that ask mothers about specific behaviors that their children have exhibited in the last 3 months. The questions are related to (1) antisocial behavior, (2) anxiousness/depression, (3) headstrongness, (4) hyperactivity, (5) immature dependency, and (6) peer conflict/social withdrawal. The response categories were (1) "*often true,*" (2) "*sometimes true,*" and (3) "*not true.*" The children measured by this index in the sample were aged between 4 and 15 years.

The sampling rule was straightforward. Observational units were the children in NLSYChild with information on cognitive and noncognitive outcomes, who had been interviewed every 2 years. Table 3.1 reflects the summary statistics for the sample with any of the cognitive measures, and Table 3.2 does it for the noncognitive measures.

Both samples have very similar characteristics. The average math score is slightly less than 45 (out of 100) points, the average reading comprehension is slightly less

Table 3.1: Summary Statistics for Cognitive Sample

	(1) Total		(2) High		(3) Mid		(4) Low	
	mean	sd	mean	sd	mean	sd	mean	sd
State Unemployment	6.85	2.06	8.25***	1.95	6.13***	1.04	4.74	0.93
Math Score	44.48	13.20	42.58***	13.30	45.28	12.54	45.77	12.94
Reading Comprehension Score	43.91	13.15	42.43***	13.36	44.78*	12.72	43.96	12.08
Word Recognition Score	48.36	15.34	46.59***	15.61	49.23	14.70	48.99	14.43
BPI Score	57.16	46.06	54.59***	44.32	58.47***	46.17	67.74	48.47
Share of Female	0.49	0.50	0.50	0.50	0.49	0.50	0.48	0.50
Share with H-S or More	0.80	0.40	0.77***	0.42	0.80***	0.40	0.84	0.36
Share with Some College	0.43	0.50	0.34***	0.48	0.45***	0.50	0.54	0.50
Share with College or More	0.27	0.45	0.19***	0.39	0.28***	0.45	0.36	0.48
Share of Married	0.68	0.47	0.66**	0.47	0.69*	0.46	0.72	0.45
Share of Teenage Mothers	0.12	0.33	0.12	0.32	0.11***	0.32	0.05	0.22
Share of African-Americans	0.28	0.45	0.29*	0.45	0.27*	0.44	0.24	0.43
Share of Hispanics	0.19	0.39	0.19	0.39	0.19	0.40	0.21	0.41
No siblings	0.43	0.50	0.45	0.50	0.43***	0.49	0.32	0.47
One sibling	0.33	0.47	0.35**	0.48	0.32	0.46	0.33	0.47
Two+ Siblings at Birth	0.24	0.43	0.20***	0.40	0.26***	0.44	0.34	0.47
Children	11511		5153		3778		2125	

Notes: This table shows the summary statistics of the estimating sample for cognitive outcomes. They include all the children that have outcomes for the three cognitive sub tests (math, reading recognition and reading comprehension). State Unemployment is the average monthly unemployment rate faced by each children in her first rolling year after birth. Levels are constructed using the series of monthly unemployment in each state (Low: bellow percentile 33; Mild: between percentiles 33 and 66; High: above percentile 66). Starts show statistical significance for the difference of means between high and mid in column (2) and mid and low in colum (3):

* p<0.10, ** p<0.05, *** p<0.01

than 44 points, and the average word recognition score is slightly greater than 48. The BPI average is 57 points. Being born under high unemployment seems to be associated with worse outcomes, except, perhaps, in the BPI, where the lowest unemployment has the highest score (the most problems). This finding is supported by statistically significant differences in means between individuals born under mid and high unemployment. Samples are balanced in gender. Average annual net income of the households with children participating in the samples is US$65,272 in 2014 (current dollars).

Regarding the mothers' education, 20% of the sample is born to a mother with less than a high-school diploma, and 27% of the sample is born to a mother with a college degree. I assert that shares seem to be correlated with unemployment rates: the higher the unemployment, the lower the education level of the mother.

Racial shares do not vary considerably across unemployment levels. Twenty-eight percent of children are born to Black mothers and 19 to Hispanic mothers. Sixty-eight percent of the children are born to married women, and 12% are born to adolescent mothers; the former does not present a significant variation across unemployment levels, but the latter does. During low unemployment periods, the share of children born to teenage mothers is 5%. In my sample, 43% were born as a single child, 33% were born with one sibling, and 24% were born with two or more siblings. The number of children in the sample[6] that have a measure of cognitive development is 11,511. Under high unemployment, 5,153 children were born: 3,778 under mild unemployment and 2,125 under low unemployment.[7]

[6] "Records" in most of the tables refers to the total number of records of cognitive outcomes each child

[7] To establish the level of unemployment rate, I took the percentiles 33 and 66 by state from 1976 to 2009 of monthly rates. Below percentile 33, it is considered low unemployment and above 66 is considered high unemployment. Mild unemployment is between these two values.

Table 3.2: Summary Statistics for Non-Cognitive Sample

	(1) Total		(2) High		(3) Mid		(4) Low	
	mean	sd	mean	sd	mean	sd	mean	sd
State Unemployment	6.86	2.07	8.26***	1.96	6.13***	1.04	4.74	0.93
Math Score	44.47	13.20	42.65***	13.26	45.23	12.60	45.73	12.89
Reading Comprehension Score	43.93	13.14	42.52***	13.32	44.76*	12.79	43.93	12.07
Word Recognition Score	48.38	15.32	46.70***	15.55	49.20	14.76	48.95	14.38
BPI Score	57.80	45.93	55.06***	44.21	59.11***	46.05	68.88	48.07
Share of Female	0.49	0.50	0.50	0.50	0.49	0.50	0.48	0.50
Share with H-S or More	0.80	0.40	0.77***	0.42	0.80***	0.40	0.84	0.36
Share with Some College	0.43	0.50	0.34***	0.48	0.45***	0.50	0.54	0.50
Share with College or More	0.27	0.44	0.19***	0.39	0.28***	0.45	0.36	0.48
Share of Marriedh	0.68	0.47	0.66**	0.47	0.69*	0.46	0.72	0.45
Share of Teenage Mothers	0.13	0.33	0.12	0.32	0.11***	0.32	0.05	0.22
Share of African-Americans	0.28	0.45	0.29*	0.45	0.27	0.44	0.25	0.43
Share of Hispanics	0.19	0.39	0.19	0.39	0.20	0.40	0.21	0.41
No siblings	0.43	0.50	0.45	0.50	0.43***	0.50	0.33	0.47
One Sibling at Birth	0.33	0.47	0.35***	0.48	0.32	0.46	0.33	0.47
Two+ Siblings at Birth	0.24	0.43	0.20***	0.40	0.26***	0.44	0.34	0.47
Observations	11411		5117		3749		2095	

Notes: This table shows the summary statistics of my estimating sample for non cognitive outcomes. They include all the children that have outcomes for the Behavioral Problems Index. State Unemployment is the average monthly unemployment rate faced by each children in her first rolling year after birth. Levels are constructed using the series of monthly unemployment in each state (Low: bellow percentile 33; Mild: between percentiles 33 and 66; High: above percentile 66). Starts show statistical significance for the difference of means between high and mid in column (2) and mid and low in colum (3):

* p<0.10, ** p<0.05, *** p<0.01

To further evaluate the channels that may be driving the results, I used elements of the HOME assessment. Which comprises a series of questions addressed to a child's mother and a direct assessment by an interviewer. The questions are originally nondichotomous, but are recoded to be dichotomous. The dichotomous items are then summed to calculate the HOME score. Similarly, I created measures of parental investment in time and money by using some of those dichotomous items.[8] All questions were weighted equally, and the higher the score, the more stimulant the environment. All children aged below 15 years were eligible, and questionnaires were age-group specific (0-2, 3-5, 6-9, and 10-14).

Table 3.3 3 shows summary statistics of the sample used to evaluate parental investment early in life and includes all the children aged 1 year or less with scores for all the measures of parental investment. The sample size is similar to that presented in 3.1. Time and money investments are presented before standardization. The maximum score for time investment is 4, and the maximum for money investment is 3 (the higher, the better). Individuals born under a low and high unemployment score spend on average 2.46 and 2.45, respectively, in time investment. This finding is not far from the total sample average of 2.41. The score of children born under mid-unemployment rates is 2.31. Regarding monetary investments, children born under low and mid-unemployment rates score 2.69 and 2.68, respectively. These figures are close to the sample average of 2.7. The score of children born under high unemployment is 2.76.

3.3 Empirical Model

The analysis performed in Section 3 is notable but insufficient to draw inferences with respect to the relation between aggregate unemployment rates and child devel-

[8]See Section 3.4.4 for further details on how I constructed these measures.

Table 3.3: Summary Statistics for Parental Investment Sample

	(1)		(2)		(3)		(4)	
	Total		High		Mid		Low	
	mean	sd	mean	sd	mean	sd	mean	sd
State Unemployment	6.85	2.07	8.26***	1.96	6.13***	1.04	4.74	0.93
Time Investment Scores	2.41	1.05	2.45	1.13	2.31*	1.07	2.46	1.03
Money Investment Score	2.70	0.59	2.76	0.52	2.68	0.63	2.69	0.58
Share of Female	0.49	0.50	0.50	0.50	0.49	0.50	0.48	0.50
Share with H-S or More	0.79	0.40	0.76***	0.43	0.80***	0.40	0.84	0.36
Share with Some College	0.41	0.49	0.33***	0.47	0.44***	0.50	0.54	0.50
Share with College or More	0.24	0.43	0.18***	0.38	0.28***	0.45	0.36	0.48
Share of Married	0.68	0.47	0.66**	0.47	0.69*	0.46	0.72	0.45
Share of Teenage Mothers	0.09	0.29	0.10	0.31	0.11***	0.31	0.05	0.22
Share of African-Americans	0.27	0.44	0.29*	0.45	0.27*	0.44	0.24	0.43
Share of Hispanics	0.19	0.40	0.19	0.39	0.19	0.40	0.21	0.41
No siblings	0.42	0.49	0.44	0.50	0.42***	0.49	0.32	0.47
One sibling	0.34	0.47	0.35**	0.48	0.32	0.47	0.34	0.47
Two+ Siblings at Birth	0.25	0.43	0.21***	0.41	0.26***	0.44	0.34	0.47
Observations	11098		5082		3743		2118	

Notes: This table shows the summary statistics of my estimating sample for parental investment outcomes (HOME assessment scores). They include all the children that have outcomes for the my two measures of investment (time and money). State Unemployment is the average monthly unemployment rate faced by each children in her first rolling year after birth. Levels are constructed using the series of monthly unemployment in each state (Low: bellow percentile 33; Mild: between percentiles 33 and 66; High: above percentile 66).

opment outcomes. First, to measure the effect of the business cycle, I must absorb the effect of permanent state characteristics that may be confounding the impact of the unemployment rate. Second, a measurement error attached to age and Flynn effects[9] could also be confounding my results. Furthermore, summary statistics prevent me from investigating the effect of unemployment rates beyond individual characteristics. Finally, the magnitude of the treatment—the unemployment level to which a child is exposed at birth—may be endogenous, biasing the results. To overcome all these concerns, I present an instrumental variable regression model in this section.

My approach of using the state of unemployment at birth instead of other measures for economic conditions presents advantages and disadvantages. First, the theory on fertility considers that aggregate unemployment is less likely to be endogenous to fertility decisions than more individual, private variables may be. I will, however, address these potential concerns for endogeneity. Furthermore, as a highly publicized measure of the business cycle, the unemployment rate should capture aspects beyond the mothers' job and the mothers or households' income losses (Dahl and Lochner, 2012; Agostinelli and Sorrenti, 2018), such as price shifts and a broader idea of economic uncertainty. For example, Brenner (1979)demonstrates, for the mid-twentieth century, that recessions induce increased insecurity and stress. Another caveat related to the data used is that theory relates fertility to credit constraints (Hotz et al., 1997) but NLSY measures of credit availability and asset holdings are, when they exist, not sufficient. However, I do observe demographic characteristics that generally constitute satisfactory predictors of these variables such as race (Jappelli, 1990), education level, and marital status. Furthermore, because NLSY79 waves have been

[9]The Flynn effect is the sustained increase in intelligence test scores measured in many parts of the world over the 20th century.Baker et al. (2015)

conducted biennially since 1994, unemployment rates allow me to work with a larger sample than if I used individual characteristics present in only the survey.

My main specification is the following:

$$y_{ita} = \alpha + \beta U^s_{i0} + f(age_t) + \phi^y_{it} + \varphi^s_{i0} + x'_{i0}\lambda + \varepsilon_{it} \tag{3.1}$$

where y_{ita}, the dependent variable, represents the children i's score in year t and age a, α is a constant and β is the parameter of interest. U^s_{i0} represents the average monthly unemployment rate for the rolling year after birth in the state where the children were born.[10] $f(age)$ represents a cubic function of the age of the children at the time of the test or age fixed effects. I exploit variation across states and within states over time in the unemployment rate: ϕ^y_{it} and φ^s_{i0} are a current year indicator, and a state of birth fixed effect. This specification does not differ much from those used by the strand of the literature that has researcher the impact of unemployment rates at birth on another type of outcomes (see Dehejia and Lleras-Muney, 2004, for an example). x_{i0} is a vector of control variables that are constant for child i (e.g., gender, race) or are measured at birth (e.g., household income, hours worked, mother's age, marital status). I cluster standard errors at the state–month because the is the source of variation identifying the effect.[11]

I include current year fixed effects instead of year of birth fixed effects because it better accounts for having a different number of observations across individuals with the same value for unemployment at birth. However, the specification when exploring relevant mothers' characteristics at birth includes the year of birth fixed effects instead of current year. I also exclude the control variables because I am interested in exploring only the possible selection channels correlated with the unemployment level.

[10] I use other measures as robustness checks in Subsection 3.4.1.

[11] Clustering at the state and family level does not change the results.

State unemployment is, as aforementioned, generally exogenous to individual decisions. However, endogeneity could occur if women decided to leave their jobs because of the prospect of having a child. If the decision of fertility is causing unemployment and this decision is correlated to child development outcomes, an endogeneity problem may occur.[12]

These considerations emerge from Dehejia and Lleras-Muney (2004). They study the relationship between unemployment rates at the time of a baby's conception and health outcomes at birth, parents' characteristics, and prenatal care. They show that children conceived during times of high unemployment have a reduced incidence of low weight. This phenomenon is attributed to two mechanisms: selection into who conceives children under different levels of unemployment and improvements in health-related behavior during recessions. They show their concern about potential reverse causality. According to them, endogeneity is not the primary concern but could emerge if women leave their jobs in anticipation of future pregnancy, affecting unemployment rates. They also claim that unemployment rates might capture the effect of omitted variables. Regarding my study, although I focus on unemployment rates at birth, and not unemployment rates at conception, that women may be leaving their jobs to have children might similarly affect my results.

It could also be that parents consider the ups and downs of the business cycle to decide where and when they have their children. This decision changes the treatment level children are exposed to. There is a potential source of endogeneity if the decision of moving is correlated with the unemployment rate at birth, and the variation across

[12]Although it may seem implausible, remember that the unemployment rate is the quotient between unemployed individuals looking for a job and the sum between these and employed individuals (total labor force). If a woman leaves her job and leaves the labor force, the quotient will increase as a consequence of a fertility decision that may be correlated with my dependent variable.

the states between which agents move is correlated with children outcome. If the state of reception increases the expenditure in early childhood daycare services, for example, relative to that of the state of origin, the actual effect of moving on child development cannot be observed. As a consequence, whatever the estimated signs are, the estimated magnitudes may be biased toward zero.

As a means to address these issues, I present results using the 12-month average monthly state unemployment rate centered 1 year before the presumed month of conception in the state of birth as an instrumental variable. The size of the lag guarantees that I consider a period before conception and, most likely, to the fertility decision.[13] In every case, errors are clustered at the state–month level of variation.

3.4 Results and Discussion

In this section, I present the outcomes of my empirical study. First, I present a general analysis and run robustness checks. Second, I examine the mothers' characteristics to explore who is having children under different levels of unemployment. Third, I study heterogeneous impacts of unemployment on different populations. Finally, I directly explore potential mechanisms.

3.4.1 Baseline Results

Table 3.4 shows baseline results for the aggregate measure of cognitive and noncognitive skills. On the one hand, the first and third columns are the naive ordinary least squares models without and with controls, respectively, and the second and fourth columns are an IV model for cognitive outcomes. All of them are estimated with dum-

[13] As mentioned in the introduction, Buckles et al. (2018) find that conception growth rate Granger causes recessions. Using the aforementioned lag mentioned as an instrument, I am addressing potential concerns arising from these findings.

mies for state of birth, age fixed effects, and indices for the year in which the test was taken. The coefficients' size changes considerably. The estimates on unemployment coefficients start at virtually zero and increase to almost 3ed . An increase of one percentage point in the state unemployment rate at birth will have a positive impact on the test score outcomes of almost 3% of a standard deviation of the combined measure of math and reading skills. Unemployment at birth is the average monthly state unemployment rate during children's first year of life. On the other hand, in columns 5 and 6, noncognitive behavioral outcomes do not turn significant and remain almost zero, despite a change in signs from negative to positive. Remember, the higher the score, the more problems the child has, and the lower the child's noncognitive skills.

In those regressions, many maternal characteristics may be playing a part in determining child development outcomes, affecting the estimations. This phenomenon is particularly true if there is selection regarding who is born at a certain level of unemployment. To account for this, in Table 3.5 I show results controlling for several of those characteristics. , I show the results controlling for several of those characteristics. Column (1) is the same estimation in Column (4) on Table 3.4. Column (2) includes microeconomic controls such as hours worked and household income around the year of birth.[14] Column (3) adds the only completely exogenous control: gender. Column (4) adds mothers' permanent characteristics, and column (5) includes mothers' family (life cycle) characteristics at birth.

All the coefficients have the expected sign on all specifications. Dummies controlling for race have negative signs for Black and Hispanic. The variable corresponding to the Armed Forces Qualification Test (AFQT), a proxy for maternal skills, also has a positive effect. AFQT scores account for much of the variation in test scores

[14]Precisely, the variable captures the hours worked and income perceived throughout the 12 months before the interview that occurred during the year of birth.

Table 3.4: Baseline: OLS vs IV

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Unemployment at birth	0.004	0.030***	0.004	0.025**	-0.002	0.014	0.001	0.004
	(0.003)	(0.011)	(0.003)	(0.012)	(0.005)	(0.018)	(0.006)	(0.023)
birthhrswk1			0.000	0.000			-0.003***	-0.003***
			(0.001)	(0.001)			(0.001)	(0.001)
birthhhincome_dtrnd			0.012	0.013			-0.059***	-0.059***
			(0.011)	(0.011)			(0.018)	(0.018)
AFQT			0.202***	0.202***			-0.083***	-0.083***
			(0.007)	(0.007)			(0.013)	(0.013)
Female			0.049***	0.047***			-0.150***	-0.150***
			(0.010)	(0.010)			(0.019)	(0.019)
Hispanic			-0.030*	-0.030*			-0.081***	-0.081***
			(0.017)	(0.017)			(0.030)	(0.030)
Black			-0.049***	-0.048***			-0.082***	-0.082***
			(0.016)	(0.016)			(0.030)	(0.030)
One Sibling at Birth			-0.076***	-0.077***			0.010	0.010
			(0.013)	(0.013)			(0.023)	(0.023)
Two+ Siblings at Birth			-0.170***	-0.169***			0.032	0.033
			(0.015)	(0.016)			(0.028)	(0.028)
Mother Age at Birth			0.017***	0.017***			-0.003	-0.003
			(0.003)	(0.003)			(0.005)	(0.005)
Married at Birth			0.049***	0.051***			-0.121***	-0.121***
			(0.014)	(0.014)			(0.026)	(0.026)
Observations	32466	31208	22680	22680	34947	33587	24075	24075
R^2	.7295687		.7928315		.2597488		.2593206	
F		356.5184		279.2074		367.8795		288.7279

Notes: This table shows the estimates of my analysis of child cognitive and behavioral development. Columns (1) to (4) report the impact of the average monthly state unemployment for the rolling year after birth on a standardized averaged measure of math and reading PIAT tests. Columns (3) and (4) include an array of control variables. Estimation methods are OLS and IV, as described in each column. The instrumental variable is the average monthly state unemployment rate centered one year before conception. Analogously, (5) to (8) regress a standardized Behavioral Problems Index on the same unemployment rates. Unemployment is measured in percentage points. All models include state of birth fixed effects, current year age fixed effects. Standard errors are clustered at the state-month level. Observations include all the records of children at each period of time who have the corresponding measures of outcome and unemployment. This explain the discrepancies between models.

* p<0.10, ** p<0.05, *** p<0.01

Table 3.5: Baseline: Exploring Controls (Cognitive)

	(1)	(2)	(3)	(4)	(5)
Unemployment at birth	0.030***	0.025*	0.024*	0.024**	0.025**
	(0.011)	(0.014)	(0.014)	(0.012)	(0.012)
Hours Worked Birth (100 hours)		0.009***	0.009***	0.003***	0.000
		(0.001)	(0.001)	(0.001)	(0.001)
HH Income Birth (1000 dollars)		0.102***	0.102***	0.024**	0.013
		(0.021)	(0.021)	(0.012)	(0.011)
Female			0.043***	0.048***	0.047***
			(0.012)	(0.011)	(0.010)
AFQT				0.216***	0.202***
				(0.007)	(0.007)
Hispanic				-0.042**	-0.030*
				(0.018)	(0.017)
Black				-0.086***	-0.048***
				(0.016)	(0.016)
One Sibling at Birth					-0.077***
					(0.013)
Two+ Siblings at Birth					-0.169***
					(0.016)
Mother Age at Birth					0.017***
					(0.003)
Married at Birth					0.051***
					(0.014)
Econ. Ctrls at Birth	no	yes	yes	yes	yes
Race	no	no	yes	yes	yes
AFQT Score	no	no	no	yes	yes
Siblings	no	no	no	yes	yes
Mother's Age at Birth	no	no	no	no	yes
Marrital Status	no	no	no	no	yes
Observations	31208	23305	23305	22685	22680
F	356.5184	283.5447	282.9095	282.8642	279.2074

Notes: This table shows the estimates of my analysis of child cognitive development. Columns report the impact of the average monthly state unemployment for the rolling year after birth on a standardized averaged measure of math and reading PIAT tests. Estimation method is IV. The instrumental variable is the average monthly state unemployment rate centered one year before conception. Unemployment is measured in percentage points. All models include state of birth fixed effects, current year and age fixed effects. Standard errors are clustered at the state-month level. Observations include all the records of children at each period of time who have the corresponding measures of outcome and controls. This explain the discrepancies between models.

* p<0.10, ** p<0.05, *** p<0.01

according to the literature (Todd and Wolpin, 2007) and are a good predictor of, for example, educational ability, employment, wage rates, and involvement in illicit activities (Heckman and Rubinstein, 2001).Mothers' age at birth has an unsurprising positive impact on outcomes. Finally, I control for siblings at birth. The impact of household income and labor supply are absorbed by other control variables in column (5).[15] The effects of these variables on behavioral outcomes are also reasonable, but the estimation of the coefficients on the state unemployment rate is not statistically significant (Table 3.6). Controls are mostly significant and in the expected direction.

In Table 3.5 regardless of the set of controls I include in my estimation, a one percentage point increase in the unemployment rate seems to have a positive effect of approximately 2.5% of a standard deviation on tests scores, holding other variables constant. Although statistically significant, this figure may seem small. However, a back-of-the-envelope calculation may provide additional information regarding the actual economic relevance of this estimation. In the peak of the business cycle that preceded the Great Recession, the federal unemployment rate was 4.4% and, the highest rate registered after its onset was 10%. Taking this model at face value, the difference in test scores between the children born in the peak and the throw is 14 percentage points of a standard deviation. Dahl and Lochner (2012) as reference, a back-of-the-envelope calculation indicates that this variation is the equivalent to an increase of approximately US$2,300 dollars in annual household income. Using the estimations in Agostinelli and Sorrenti (2018), the effect is the equivalent to either an increase of US$3,181 in annual income or a decrease of 233 hours per year in labor supply.

A positive impact of unemployment on cognitive tests may appear counterintu-

[15]Including siblings and other characteristics at the time of the test does not critically change my results.

Table 3.6: Baseline: Exploring Controls (Non Cognitive)

	(1)	(2)	(3)	(4)	(5)
Unemployment at birth	0.014	-0.006	-0.003	0.003	0.004
	(0.018)	(0.023)	(0.023)	(0.023)	(0.023)
Hours Worked Birth (100 hours)		-0.006***	-0.006***	-0.004***	-0.003***
		(0.001)	(0.001)	(0.001)	(0.001)
HH Income Birth (1000 dollars)		-0.092***	-0.093***	-0.067***	-0.059***
		(0.020)	(0.020)	(0.018)	(0.018)
Female			-0.148***	-0.150***	-0.150***
			(0.019)	(0.019)	(0.019)
AFQT				-0.094***	-0.083***
				(0.013)	(0.013)
Hispanic				-0.073**	-0.081***
				(0.030)	(0.030)
Black				-0.032	-0.082***
				(0.028)	(0.030)
One Sibling at Birth					0.010
					(0.023)
Two+ Siblings at Birth					0.033
					(0.028)
Mother Age at Birth					-0.003
					(0.005)
Married at Birth					-0.121***
					(0.026)
Econ. Ctrls at Birth	no	yes	yes	yes	yes
Race	no	no	yes	yes	yes
AFQT Score	no	no	no	yes	yes
Siblings	no	no	no	yes	yes
Mother's Age at Birth	no	no	no	no	yes
Marrital Status	no	no	no	no	yes
Observations	33587	24835	24835	24080	24075
F	367.8795	290.6881	290.3236	292.3101	288.7279

Notes: This table shows the estimates of my analysis of child non cognitive development. Columns report the impact of the average monthly state unemployment for the rolling year after birth on a standardized averaged measure BPI scores. Estimation method is IV. The instrumental variable is the average monthly state unemployment rate centered one year before conception. Unemployment is measured in percentage points. All models include state of birth fixed effects, current year and age fixed effects. Standard errors are clustered at the state-month level. Observations include all the records of children at each period of time who have the corresponding measures of outcome and controls. This explain the discrepancies between models.

* p<0.10, ** p<0.05, *** p<0.01

itive; however, it does not necessarily contradict past evidence or theory. Under high unemployment, the equilibrium amount of time that a mother dedicates to work may change. A quick estimation using NLSY79 data shows that, conditioning on only state and year fixed effects, a woman is three percentage points more likely to be unemployed at birth with an increase of one percentage point in the state unemployment rate. The hours a mother works operate in two ways. First, given a specific wage rate, the reduction in working hours may result in a reduction in total income. Second, a decrease in working hours has a potential substitution effect in the use of time of the parent. A mother may choose to allocate her time to raise her children instead of spending it on leisure or work (Del Boca and Flinn, 2014). In a recent study, Agostinelli and Sorrenti (2018) find that, controlling for household income using an instrumental variables approach, the hours worked by the mother have an adverse and relatively large effect on children's contemporaneous outcome: extra 100 hours per year worked by a mother in the calendar year the test is taken cause a reduction of 6% of a standard deviation on the tests. These effects are potentially exacerbated in the first year of life. For instance, a positive and large link between breastfeeding and child development has been broadly documented (see Taylor and Wadsworth, 1984; Anderson et al., 1999; Quinn et al., 2001; Victora et al., 2015, among many others). In particular, Taylor and Wadsworth (1984) and Quinn et al. (2001) have demonstrated a large and positive effect of breastfeeding on outcomes at the age of 5. Additionally, some studies have demonstrated a negative effect of hours worked on breastfeeding (see Skafida, 2012; Smith et al., 2015, for evidence in Scotland and Ireland respectively). This study shows that the effect of business cycles stretch beyond labor supply and income. Taking it as another aspect of human capital that may be positively affecting test scores, the literature has also found positive connections between unemployment rates, and health and mortality, either through

selection, behavior, or environmental fluctuations (Van den Berg et al., 2006; Dehejia and Lleras-Muney, 2004; Noelke et al., 2019).

Robustness

In this section, I show robustness checks and address minor concerns of selection on unobservables.

One question that may arise immediately after observing my empirical strategy is related to the chosen measure of "unemployment rate at birth." As Table 3.7 shows, my results do not change considerably when I choose the state unemployment rate at the month of birth in the main specification. In this case, unemployment 12 months before conception (21 months before birth) in the state of birth is used as an instrumental variable.

Another concern I address is whether results are being driven by the outcomes at a certain age. The data I am using does not strictly have the structure of a panel, because each unemployment rate at birth is matched to several test scores of the same child across time. Therefore, I consider it notable to assess whether there is some anomaly in sample sizes or estimations; notably, in Table 3.8, there is not. The sample size is similar across all ages, and estimated parameters take very similar values across time too. Results are robust to removing observations of different ages.

Despite the wide range of control variables introduced in Table 3.5 and Table 3.6, and the implementation of the instrumental variable, concerns of selection on unobservables may still arise. I address this potential concern by using two means: family fixed effects and controls for economic conditions at conception.

In Table 3.9, column (2) shows the result of introducing family fixed effects to the standard specification for cognitive outcomes.[16] To avoid perfect multicollinearity

[16]Noncognitive outcomes in column 2 of Table 3.10.

Table 3.7: Robustness: Different Measures

	(1)	(2)
	Year	Month
Unemployment at birth	0.025**	0.017**
	(0.012)	(0.008)
Hours Worked Birth (100 hours)	0.000	0.000
	(0.001)	(0.001)
HH Income Birth (1000 dollars)	0.013	0.013
	(0.011)	(0.011)
Female	0.047***	0.048***
	(0.010)	(0.010)
AFQT	0.202***	0.202***
	(0.007)	(0.007)
Hispanic	-0.030*	-0.030*
	(0.017)	(0.017)
Black	-0.048***	-0.049***
	(0.016)	(0.016)
One Sibling at Birth	-0.077***	-0.077***
	(0.013)	(0.013)
Two+ Siblings at Birth	-0.169***	-0.169***
	(0.016)	(0.016)
Mother Age at Birth	0.017***	0.017***
	(0.003)	(0.003)
Married at birth	0.051***	0.050***
	(0.014)	(0.014)
Observations	22680	22680
F	279.2074	549.6345

Notes: This table shows the estimates of my analysis of child cognitive development. Columns report the impact of the average monthly state unemployment for the rolling year after birth on a standardized averaged measure of math and reading PIAT tests. Estimation method is IV. In column (1), the IV is the average monthly state unemployment rate centered one year before conception. In column (2), the IV is the month state unemployment rate one year before conception.

* p<0.10, ** p<0.05, *** p<0.01

Table 3.8: Robustness: Across Age

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	All Ages	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
Unemployment at birth	0.025**	-0.002	0.007	0.005	0.034*	0.058**	0.022	0.035	-0.000	0.014	0.030
	(0.012)	(0.012)	(0.013)	(0.020)	(0.019)	(0.023)	(0.019)	(0.025)	(0.021)	(0.024)	(0.029)
Hours Worked Birth (100 hours)	0.000	0.001*	-0.002**	0.001	-0.003**	0.003*	-0.003**	0.003**	-0.002	0.002	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
HH Income Birth (1000 dollars)	0.013	0.015*	0.007	-0.013	-0.007	0.008	0.004	0.038*	0.012	0.052**	-0.018
	(0.011)	(0.008)	(0.016)	(0.020)	(0.029)	(0.022)	(0.022)	(0.022)	(0.020)	(0.025)	(0.031)
Female	0.047***	0.050***	0.055***	0.062***	0.081***	0.060***	0.037*	0.031	0.034	0.018	0.025
	(0.010)	(0.009)	(0.013)	(0.017)	(0.019)	(0.020)	(0.020)	(0.022)	(0.021)	(0.023)	(0.031)
AFQT	0.202***	0.086***	0.117***	0.196***	0.192***	0.249***	0.206***	0.255***	0.230***	0.268***	0.228***
	(0.007)	(0.006)	(0.009)	(0.012)	(0.013)	(0.014)	(0.014)	(0.016)	(0.015)	(0.016)	(0.021)
Hispanic	-0.030*	-0.041***	-0.022	-0.015	-0.080**	-0.003	-0.050	0.011	-0.053	0.021	-0.076*
	(0.017)	(0.015)	(0.022)	(0.028)	(0.033)	(0.033)	(0.035)	(0.036)	(0.036)	(0.038)	(0.046)
Black	-0.048***	0.040***	0.059***	-0.009	-0.066**	-0.031	-0.064**	-0.072**	-0.121***	-0.104***	-0.195***
	(0.016)	(0.015)	(0.021)	(0.027)	(0.031)	(0.031)	(0.032)	(0.035)	(0.034)	(0.034)	(0.045)
One Sibling at Birth	-0.077***	-0.043***	-0.058***	-0.045**	-0.123***	-0.081***	-0.112***	-0.080***	-0.111***	-0.053*	-0.109***
	(0.013)	(0.011)	(0.016)	(0.022)	(0.024)	(0.024)	(0.024)	(0.026)	(0.026)	(0.028)	(0.038)
Two+ Siblings at Birth	-0.169***	-0.118***	-0.121***	-0.120***	-0.184***	-0.144***	-0.228***	-0.167***	-0.247***	-0.175***	-0.290***
	(0.016)	(0.014)	(0.019)	(0.025)	(0.028)	(0.030)	(0.030)	(0.033)	(0.032)	(0.036)	(0.045)
Mother Age at Birth	0.017***	0.005**	0.005	0.006	0.019***	0.023***	0.022***	0.024***	0.021***	0.026***	0.026***
	(0.003)	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.008)
Married at Birth	0.051***	0.026**	0.044***	0.009	0.070**	-0.003	0.079***	0.031	0.085***	0.077**	0.096**
	(0.014)	(0.012)	(0.016)	(0.022)	(0.027)	(0.026)	(0.028)	(0.029)	(0.030)	(0.032)	(0.042)
Observations	22680	2358	2517	2382	2507	2377	2491	2240	2377	2171	1230

Notes: This table shows the estimates of my analysis of child cognitive development. Columns report the impact of the average monthly state unemployment for the rolling year after birth on a standardized averaged measure of math and reading PIAT tests. Estimation method is IV. The instrumental variable is the average monthly state unemployment rate centered one year before conception. Unemployment is measured in percentage points as the average monthly unemployment rate in the rolling year after birth. Each column represents the outcomes conditioned on certain age. All models include state of birth fixed effects, current year fixed effects, controls for siblings, race, gender and AFQT scores (in both second and first stage). Standard errors are clustered at the state-month. Observations include all the records of children at each period of time who have the corresponding measures of outcome and controls. This explain the discrepancies between models.

* p<0.10, ** p<0.05, *** p<0.01

with the FE, these regressions do not have AFQT scores, race, or state fixed effects. NLSYChild contains all siblings born to the mothers surveyed in NLSY79; thus, I can perform this regression with some significance, and a few observations per individual. Family fixed effects average out all potential constant unobservable characteristics associated with the family. Intuitively, variation is from differences across siblings. These estimates should be taken with caution because they omit single children in the sample. However, although the estimates lose precision, the coefficients are of

a similar magnitude to those observed with the standard specification (Table 3.5, column [5]).

The results of another attempt to further dissipate doubts about the validity of my results can be observed in column 3.[17] The models of those regressions include a control dummy variable for the level of unemployment around the time of conception. To create these variables, I compute, for each month m from 1976 to 2009, the average of m with three leads and three lags. Next, by state, I compute the percentiles 33 and 66 of these averages and classify them in high unemployment (if above 66 percentile), medium unemployment (if between 33 and 66 percentile,) and low unemployment (if below 33 percentile). Finally, I merge this data with my primary database, using m as the month of conception (the ninth lag with respect to the month of birth).

The logic behind these controls is straightforward. If there is selection on unobservables induced by unemployment rates, then controlling for the unemployment rates around the moment of the fertility decision should account for the effects of selection. In particular, variation is from the unemployment rate at birth within the groups that had similar unemployment levels around the time of conception. The underlying assumption is that individuals conceived under similar economic conditions, after time and state controls are applied, should have similar relevant characteristics. The difference between coefficients is stark: an increase of one percentage point in unemployment has a positive effect of 12% of a standard deviation versus 2% in the standard specification. Again, caution is advised. Much precision is lost under this specification, probably because of greater colinearity between unemployment rates

[17] Noncognitive outcomes in column 3 of Table 3.10.

Table 3.9: Controlling for selection (Cognitive)

	(1)	(2)	(3)
	Baseline	Family FE	Unemp at Conception
Unemployment at birth	0.025**	0.029*	0.210
	(0.012)	(0.016)	(0.200)
Hours Worked Birth (100 hours)	0.000	0.001	0.004***
	(0.001)	(0.001)	(0.001)
HH Income Birth (1000 dollars)	0.013	0.003	0.068***
	(0.011)	(0.015)	(0.016)
Female	0.047***	0.040***	0.037**
	(0.010)	(0.011)	(0.017)
AFQT	0.202***		
	(0.007)		
Hispanic	-0.030*		
	(0.017)		
Black	-0.048***		
	(0.016)		
One Sibling at Birth	-0.077***	-0.091***	-0.120***
	(0.013)	(0.013)	(0.016)
Two+ Siblings at Birth	-0.169***	-0.145***	-0.272***
	(0.016)	(0.023)	(0.022)
Mother Age at Birth	0.017***	-0.160***	0.018***
	(0.003)	(0.010)	(0.005)
Married at Birth	0.051***	0.041*	0.195***
	(0.014)	(0.022)	(0.018)
Mild Unemployment at Concep.			-0.173
			(0.182)
High Unemployment at Concep.			-0.453
			(0.450)
Observations	22680	23040	23300

Notes: This table shows the estimates of my analysis of child cognitive development. Columns report the impact of the average monthly state unemployment for the rolling year after birth on a standardized averaged measure of math and reading PIAT tests. Estimation method is IV. The instrumental variable is the average monthly state unemployment rate centered one year before conception. Column (1) is the baseline specification. Column (2) includes family fixed effects. Column (3) includes controls for unemployment around conception.

* p<0.10, ** p<0.05, *** p<0.01

Table 3.10: Controlling for selection (Non Cognitive)

	(1)	(2)	(3)
	Baseline	Family FE	Unemp at Conception
Unemployment at birth	0.004	0.042*	0.027
	(0.023)	(0.024)	(0.195)
Hours Worked Birth (100 hours)	-0.003***	-0.003**	-0.004***
	(0.001)	(0.001)	(0.002)
HH Income Birth (1000 dollars)	-0.059***	0.051***	-0.073***
	(0.018)	(0.019)	(0.019)
Female	-0.150***	-0.168***	-0.152***
	(0.019)	(0.016)	(0.021)
AFQT	-0.083***		
	(0.013)		
Hispanic	-0.081***		
	(0.030)		
Black	-0.082***		
	(0.030)		
One Sibling at Birth	0.010	-0.010	0.020
	(0.023)	(0.021)	(0.022)
Two+ Siblings at Birth	0.033	-0.045	0.055*
	(0.028)	(0.037)	(0.029)
Mother Age at Birth	-0.003	0.001	-0.003
	(0.005)	(0.016)	(0.005)
Married at Birth	-0.121***	0.058	-0.143***
	(0.026)	(0.037)	(0.023)
Mild Unemployment at Concep.			-0.013
			(0.180)
High Unemployment at Concep.			-0.061
			(0.434)
Observations	24075	24603	24830

Notes: This table shows the estimates of my analysis of child cognitive development. Columns report the impact of the average monthly state unemployment for the rolling year after birth on a standardized averaged measure BPI scores. Estimation method is IV. The IV is the average monthly state unemployment rate centered one year before conception. Unemployment is measured in percentage points as the average monthly unemployment rate in the rolling year after birth. Column (1) is the baseline specification. Column (2) includes family fixed effects. Column (3) includes controls for unemployment around conception.

* p<0.10, ** p<0.05, *** p<0.01

at birth and the control dummies at conception. Further exploration is required to assess the validity of this strategy.[18]

3.4.2 Analysis of Mothers' Characteristics

Who the individuals are that have children under high unemployment is an notable question and of relevance to my study. In particular, whatever difference there is between estimations in Table 3.4 and Table 3.5 may be partially explained by selection and not by different behaviors. The results shown in this section and the following may increase the understanding regarding which of these channels are operating. Because of the characteristics of the database, I focus on the mothers' characteristics. Although not perfect, these should be a satisfactory predictor of the fathers' characteristics too.

The specification regressed is similar to that corresponding to the main outcomes:

$$y_{st} = \alpha + \beta U^0_{st} + \phi^0_{st} + \varphi^0_{st} + \varepsilon_{st} \tag{3.2}$$

where y_{st}, the dependent variable, represents the share of certain mothers' characteristics in state s, for children born in the year t, α is a constant; and β is the parameter of interest. U^0_{st} represents the average of the monthly average unemployment rate faced by the children born in year t in their first year of life in state s. ϕ^0_{st} and φ^0_{st} are a current year indicator and a state of birth fixed effect, respectively. I run an instrumental variables model where the instrument is the average of the 12-month average of monthly state unemployment rate centered one year before conception by

[18]For example, it is unclear how forward-looking fertility decisions are made. Therefore, it is unclear how the correct control bins should be computed. See Buckles et al. (2018) for a discussion.

state and year of birth. Because observations are at the state-year level, errors are clustered at this same level.[19]

In Table 3.11, the effect of unemployment on different characteristics of my sample can be observed. No coefficient is statistically significant. However, it is worthwhile to analyze the estimations to understand selection at birth in the sample (disregarding external validity). Columns one, two, and three examine the impact on birth rates by race. The effect of a percentage point increase in the unemployment rate has a positive effect of a 0.2/100 increase in the birthrate of Blacks and 0.1/100 in Hispanics. In column 4, we find the coefficient corresponding to marital status at birth. An increase of one percentage point in state unemployment rate correlates with a decrease of 0.6/100 in the share of children born to married women. Similar results can be found for the share of children born to teenage mothers (fall of 0.7/100). By contrast, there is an increase in the share of children born to mothers with some college (as opposed to mothers with a high-school degree or less) and high AFQT of 0.2/100 and 0.3/100, respectively. In Table 3.12results are robust to the measure of unemployment. These results are similar in magnitude to those presented by Dehejia and Lleras-Muney (2004) for unemployment at the time of conception. Nonetheless, the sign of some of the coefficients differs. The reason for this phenomenon might be that although that study investigates different cohorts, the databases used in my study, NLSY79 and NLSYChild, are a representative sample of a particular cohort and its children.[20]

[19]Here, as in the remainder of the study, I follow the criteria in Abadie et al. (2017) for error clustering.

[20]Dehejia and Lleras-Muney (2004) also show a specification with state trends. Results do not change when I control for this trend, probably because of the same reason.

Table 3.11: Impact on Mothers' Characteristics at Birth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Black	White	Hispanic	Married	Some College	High AFQT	Teen Mother
Unemployment at birth	0.002	-0.003	0.001	-0.006	0.002	0.003	-0.007
	(0.008)	(0.009)	(0.006)	(0.010)	(0.008)	(0.004)	(0.005)
Constant	0.096	0.945***	-0.040	1.151***	0.985***	-0.075	0.064
	(0.101)	(0.110)	(0.078)	(0.126)	(0.112)	(0.046)	(0.064)
Observations	8413	8413	8413	8343	8413	8413	8413

Notes: This table shows the estimates of my analysis of mothers' characteristics at children birth. Columns report the impact of the average monthly state unemployment for the rolling year after birth averaged by state and year of birth on different mothers' characteristics at birth. Estimation methods is IV. The instrumental variable is the average monthly state unemployment rate centered one year before conception, averaged by state and year of birth. Unemployment is measured in percentage points. All models include state of birth fixed effects, year fixed effects (in both second and first stage). Standard errors are clustered at the state-year level. Observations include all the children born each year who have the corresponding measures of mothers' characteristics at birth and who have all three of the cognitive measures at least once between 5 and 14 years of age. This explain the discrepancies between models.

* p<0.10, ** p<0.05, *** p<0.01

Table 3.12: Impact on Mothers' Characteristics at Birth (Robustness)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Black	White	Hispanic	Married	Some College	High AFQT	Teen Mother
Unemployment at birth	0.003	-0.005	0.002	-0.006	-0.002	0.003	-0.005
	(0.007)	(0.008)	(0.006)	(0.009)	(0.008)	(0.003)	(0.005)
Constant	0.087	0.966***	-0.053	1.137***	1.029***	-0.076*	0.040
	(0.091)	(0.098)	(0.069)	(0.114)	(0.101)	(0.042)	(0.061)
Observations	8466	8466	8466	8396	8466	8466	8466

Notes: This table shows the estimates of my analysis of mothers' characteristics at children birth. Columns report the impact of the average monthly state unemployment for the calendar year of birth averaged by state on different mothers' characteristics at birth. Estimation methods is IV. The instrumental variable is the average monthly state unemployment in the calendar second lag of with respect of the calendar year of birth, averaged by state. Unemployment is measured in percentage points. All models include state of birth fixed effects, year fixed effects (in both second and first stage). Standard errors are clustered at the state-year level. Observations include all the children born each year who have the corresponding measures of mothers' characteristics at birth and who have all three of the cognitive measures at least once between 5 and 14 years of age. This explain the discrepancies between models.

* p<0.10, ** p<0.05, *** p<0.01

3.4.3 Heterogeneity Analysis

In this section, I focus on different subpopulations to analyze potential heterogeneous effects of unemployment rates on children outcomes. This exploration may contribute to an improved comprehension of the mechanisms that lead to the positive outcomes observed in the sample as a whole. I study four sources of heterogeneity: the mother's age at birth of the child, maternal marital status at birth of the child, mother's educational level at birth of the child, and AFQT score at birth of the child as a measure of maternal skills. I compare Non-Black/Non-Hispanic individuals ("Whites" from now on) with Blacks and Hispanics, teenage mothers (aged less than 18 years at childbirth) with adult mothers, married women with unmarried women (e.g., divorced, separated, widowed), *high education* (some college) with *low education* (high-school degree or less), and *low-skilled* (AFQT below the median) with *high-skilled* (AFQT above the median).

Table 3.13 reports coefficients by subpopulations of different sources of heterogeneity on cognitive outcomes[21]. Column 1 presents marital status at childbirth. Although the interaction is not statistically significant, the effect of an increase of one percentage point of unemployment rates on married women is an increase of 2% of a standard deviation in the math–reading measure. The effect on unmarried women is 3.7% of a standard deviation. Conclusions out of this particular result are not obvious. On the one hand, I expect that negative income shocks would more acutely affect single women; on the other hand, single mothers can generally access welfare coverage, in particular, during pregnancy and her child's early childhood. Furthermore, Bernal and Keane (2011) demonstrate that more than 75% of single mothers use informal

[21]21The effects of unemployment on noncognitive outcomes have roughly the same directions, although significance is lost. See Table 3.14

care (e.g., grandparents, siblings). They also show that this phenomenon decreases children's test scores. If parents have time to spend with their children, this adverse effect would be mitigated. Finally, researchers have demonstrated the counter-cyclical characteristic of intimate partners violence (Van der Berg and Tertilt, 2012; Schneider et al., 2016; Bhalotra et al., 2018) and have established a negative link between domestic violence and children's outcomes (Margolin and Gordis, 2000; Wolfe et al., 2003).[22]

The interaction coefficients on mother skills and education levels are also almost zero. The coefficient on the interaction effect between unemployment and being a teenage mother is negative, large, and relatively significant; it is larger in magnitude than the positive stand-alone unemployment effect. Children born to teenage mothers will experience a negative impact of an increase of one percentage point on unemployment rates at birth on their cognitive test scores of 2.4 percentage points of a standard deviation. This phenomenon is also to be expected because it is reasonable to understand mothers' age as a measure of maternal skills. Adolescent motherhood has been linked to fewer maternal skills, more disturbed mother–infant interactions (Benasich and Brooks-Gunn, 1996), and worse socioeconomic outcomes for the children (Furstenberg Jr et al., 1990). The former may lead to worse management of situations during dire economic conditions. Additionally, teenage motherhood was linked to domestic violence (Gibson et al., 2015). In this case, the quality dimension of the hours spent with the child may be taking on a greater burden of the effect.[23]

[22]It would be notable to analyze childcare options adopted for newborns, but NLSYChild does not count on variables about alternative childcare for the first year of life.

[23]This may be explored by evaluating the use of time of the parents with their children. Presumably, spending time playing video games and helping with homework may not have the same consequences on a different set of children's skills.

Table 3.13: Heterogeneous Effects (Cognitive Outcomes)

	(1)	(2)	(3)	(4)
	Married	AFQT	College	Teen
Unemployment at birth	0.037***	0.025*	0.022*	0.024*
	(0.013)	(0.013)	(0.012)	(0.013)
Unemployment at birth × Married at Birth	-0.017			
	(0.010)			
Unemployment at birth × High AFQT		-0.008		
		(0.010)		
Unemployment at birth × Some college at birth or more			0.007***	
			(0.002)	
Unemployment at birth × Teen Mother				-0.048***
				(0.018)
Observations	22680	23300	22680	22680

Notes: This table shows the estimates of my analysis of child cognitive development. Columns report the impact of the average monthly state unemployment for the rolling year after birth on a standardized averaged measure of math and reading PIAT tests. Estimation method is IV. The instrumental variable is the average monthly state unemployment rate centered one year before conception. Unemployment is measured in percentage points. All models include state of birth fixed effects, current year fixed effects, a cubic function of age, controls for siblings, race, gender and AFQT scores (in both second and first stage). Standard errors are clustered at the state-month. Observations include all the records of children at each period of time who have the corresponding measures of outcome and controls. This explain the discrepancies between models.

* p<0.10, ** p<0.05, *** p<0.01

Table 3.14: Heterogeneous Effects (Non Cognitive Outcomes)

	(1)	(2)	(3)	(4)
	Married	AFQT	College	White
Unemployment at birth	-0.004	0.003	0.010	0.002
	(0.025)	(0.025)	(0.023)	(0.023)
Unemployment at birth × Married at Birth	0.012			
	(0.018)			
Unemployment at birth × High AFQT		-0.009		
		(0.018)		
Unemployment at birth × Some college at birth or more			-0.014***	
			(0.004)	
Unemployment at birth × Teen Mother				-0.000
				(0.022)
Records	29565	33587	32392	32392

Notes: This table shows the estimates of my analysis of child cognitive development. Columns report the impact of the average monthly state unemployment for the rolling year after birth on a standardized averaged measure of BPI scores. Estimation method is IV. The instrumental variable is the average monthly state unemployment rate centered one year before conception. Unemployment is measured in percentage points. All models include state of birth fixed effects, current year fixed effects, a cubic function of age, controls for siblings, race, gender and AFQT scores (in both second and first stage). Standard errors are clustered at the state-month. Observations include all the records of children at each period of time who have the corresponding measures of outcome and controls. This explain the discrepancies between models.

* p<0.10, ** p<0.05, *** p<0.01

3.4.4 Parental Investment Analysis

Parental investments determine child development (Cunha and Heckman, 2007; Del Boca and Flinn, 2014). Therefore, the logical next step is for me to explore the parental use of time and money during periods under different levels of unemployment rates. In this section, I offer an empirical exploration of these channels.

As aforementioned, NLSYChild includes variables related to the HOME assessment. This measures the quality of a child's domestic environment in elements related to their cognitive and behavioral development. Several age-specific questions are asked, and each of these questions constitutes 1 point of the assessment total score. Due to the nature of my research, I focus on the questions asked in the first year of life of the children. NLSYChild recodes some of the answers to these questions into binary variables to create indices of cognitive and emotional stimulation 24 The variables are equal to one if they contribute to any type of stimulation and zero if they do not.

To perform my analysis, I use these binary answers and split the list of questions into two categories: time investments and money investments (see Table 3.15 for details on the questions). For each of these categories, the value of the binary variables are added:

$$\text{Total Investment Score}_{itK} = \sum_{k \in K} \xi_k \qquad K \in \{\text{Time Investment}, \quad \text{Good Investment}\} \tag{3.3}$$

where ξ_k is the value that the recoded answer to question k of category K takes. Finally, I standardize the results to obtain a meaningful continuous outcome variable for my empirical analysis.

Following the same arguments exposed for the main results estimation, an IV

Table 3.15: Exploring Channels: Time Investment

Type	Questions	Answers	Recoded
Time	How often does child have a chance to get out of the house?	1 TOO YOUNG 2 ONCE A MONTH OR LESS 3 A FEW TIMES A MONTH 4 ABOUT ONCE A WEEK 5 A FEW TIMES A WEEK	0
		6 4 OR MORE TIMES A WEEK 7 EVERY DAY	1
	How often do you get a chance to read to child?	1 NEVER 2 SEVERAL TIMES A YEAR 3 SEVERAL TIMES A MONTH 4 ONCE A WEEK	0
		5 ABOUT 3 TIMES A WEEK 6 EVERYDAY	1
	How often do you take child to the grocery store?	2 ONCE A WEEK 3 ONCE A MONTH 4 HARDLY EVER, GO ALONE	0
		1 TWICE A WEEK OR MORE	1
	How often does child eat a meal with both you and his/her father/step/father-figure?	1 MORE THAN ONCE A DAY 2 ONCE A DAY	0
		3 SEVERAL TIMES A WEEK 4 ONCE A WEEK 5 ONCE A MONTH OR LESS 6 NEVER 7 No father, step-father, father figure	1
Money	About how many children's books does child have?	1 NONE, TOO YOUNG 2 1 OR 2 BOOKS	0
		3 3 OR 9 BOOKS 4 10 OR MORE BOOKS	1
	About how many, if any, cuddly, soft, or role-playing toys does child have?	0	0
		>=1	1
	About how many, if any, push or pull toys does child have?	0	0
		>=1	1

Notes: This table shows how the non-dichotomous answers were recoded into binary variables to compute the HOME score in NLSYChild, performed by Bureau of Labor Statistics, U.S. Department of Labor (2016b).

model is also used in this section. The specification of the second stage is as follows:

$$HOME_{it} = \alpha + \beta U^s_{it} + \phi^y_{it} + \varphi^s_{i0} + x'\lambda + \varepsilon_{it} \tag{3.4}$$

where $HOME_{it}$ is the standardized score measured in the first year after birth described above for child i, born in year t; as the main specification, α is a constant and β is the parameter of interest. U^s_{i0} represents the average monthly unemployment rate for the rolling year after birth in the state where the children were born. ϕ^y_{it} and φ^s_{it} are a current year indicator and a state of birth fixed effect. x_i0 is a vector of control variables (e.g., gender, race). I cluster standard errors at the state–month level. Following the same logic as in the main specification I use an instrumental variable approach. The IV is the average monthly state unemployment rate centered 1 year before conception.

Results are consistent with the main findings. In Table 3.16, column (1) shows the results for monetary investments. An increase of one percentage point in the average state unemployment rate in the first year of life causes an increase of 0.486 standard deviations of the measure I constructed. This measure includes whether children have books; cuddly, soft, or role-play (dolls) toys; and push-and-pull toys. Column (2) presents the effect of unemployment rates on time investments. An increase of one percentage point in the rates causes a positive variation of 0.709 standard deviations of the measure. As aforementioned, this measure is a standardized sum of indicators on whether a child is taken out of a home by her or his parents, goes grocery shopping with their parents, is read to by the mother, and dines with members of the family. Column (3) presents the results for a combined measure. This combined money–time measure was created similarly to the math–reading measure described in previous sections: the standardized scores were summed and re-standardized. The outcome is

an increase of 0.755 of a standard deviation as a consequence of an increase of one percentage point in the unemployment rate.

Caution is advised in the interpretation of these results. For example, it is not obvious that the number of books provides a clear-cut measure of money investment that can be easily disentangled from time investments. The sample comprises children aged 1 year or less, which implies that if a parent does not read to their child, having more or fewer books may not be significant concerning child development. Furthermore, simply reading more to her children may cause mothers to acquire more books, with everything else constant.

These results suggest that public policy should focus on parental investment during the first years of life to smooth the cyclical character of child development indicated by other sections of this chapter. These outcomes underscore that policy makers concerned with child development should remain alert even under booming economies to prevent inequalities across cohorts.

Table 3.16: Exploring Channels: Parental Investments

	(1)	(2)	(3)
	Money Investments	Time Investments	Combined Investments
Unemployment at birth	0.486	0.709***	0.755**
	(0.374)	(0.253)	(0.347)
Hours Worked Birth (100 hours)	-0.014	-0.006	-0.013
	(0.009)	(0.007)	(0.008)
Household Income Birth (1000 dollars)	0.149**	-0.066	0.038
	(0.060)	(0.084)	(0.071)
Female	-0.140	0.096	-0.029
	(0.137)	(0.116)	(0.124)
AFQT	0.250**	0.110	0.247***
	(0.100)	(0.083)	(0.093)
Hispanic	0.393	0.044	0.288
	(0.240)	(0.186)	(0.217)
Black	-0.429*	-0.260	-0.418*
	(0.258)	(0.197)	(0.236)
One Sibling at Birth	0.171	-0.039	0.106
	(0.194)	(0.161)	(0.176)
Two+ Siblings at Birth	0.011	-0.162	-0.089
	(0.210)	(0.174)	(0.195)
Mother Age at Birth	-0.026	-0.015	-0.007
	(0.040)	(0.030)	(0.037)
Married at Birth	0.132	0.110	0.158
	(0.239)	(0.185)	(0.214)
Observations	391	392	383

Notes: This table shows the estimates for the impact of unemployment rates on combined scores of parental constructed with time and money investment components of the HOME assessment score. Dependent variables are standardized scores on the time and money scores. Independent variables are monthly state unemployment rates for the rolling year after birth. An IV model is used. The instrumental variable is the average monthly state unemployment rate centered one year before conception. Unemployment is measured in percentage points. All models include state of birth fixed effects, current year fixed effects and a cubic function of age (in both second and first stage), controls on number of siblings, mothers ASVAB test scores, gender and race. Standard errors are clustered at the state-month. Observations include all the records of children at age one or less who have the corresponding outcomes, unemployment and controls. This explain the discrepancies between models.

* p<0.10, ** p<0.05, *** p<0.01

Chapter 4

CONCLUSION

In Chapter 2 I discussed the insurance value of fertility choices. I argue that the value of having the freedom of choosing when to have a child is large. Choosing when to have their children allows parents to smooth their utility throughout time. This is both through the children's quality as public goods within the household and their effect on the marginal utility of consumption while they are in the household. The reaction of this value to wage risk can contribute to explain the current negative trends in fertility.

From a policy perspective, my results suggest that granting control to parents over the fertility process can have large welfare improving effects. Wide access to contraceptive methods as well as fertility methods can go a long way to improve individual households' resilience to economic shocks. If the policy objective was to stop fertility decline at a certain level of family planning, policy makers should focus on mitigate the effect of nonseparabilities of consumption, labor and family size. The provision of accessible and high quality daycare, for example, could mitigate the negative effect of child rearing on female labor supply. Furthermore, expanding consumption support programs (food stamps for food insecurity or CHIP for health insurance) would contribute to mitigate the effect of children on the marginal utility of consumption per capita.

Future research in this agenda involves studying the relation the fertility decline in young adults and single mothers. Since the last recession, the decline in American fertility rates has been led by young adult mothers. This decline could be partially explained by access to information and contraceptive methods, but this doesn't seem

to explain the phenomenon in its entirety. Relevant phenomena have coincided with this decline. The first of these is an acceleration in a long-term decline of marriage rates and, most importantly, a delay in the median age at first marriage on the one hand. Interestingly, the correlation across spouses earnings have increased in the last few years (Gorbachev, 2016), potentially decreasing the insurance value of marriage as such. Besides, the reversal of the college gender gap has reached a maximum: women-to-men ratio in college is in historical heights. From a policy perspective, the coverage expansions proposed by the Affordable Care Act (ACA) have improved the access to contraceptive methods and health care insurance to populations that had been previously left out. This is especially true for pregnant women.

Another potential path in this direction is studying how fertility interacts with occupational choice and human capital atrophy process. Different occupations have different characteristics. Jobs can be more or less flexible, allowing men and women to return quickly to the labor force or to stay longer out of the labor force after child birth without losing a position. It could be the case that an occupation allows to work from home for longer, or that it offers more flexibility in terms of shifts. Women seem to be moving towards more high-skill jobs. These jobs have, in general, a higher rate of atrophy or human capital depreciation than low-skill jobs. Furthermore, the level of human capital depreciation is different at different stages of the career. The most sensitive moments for long-term career success appear to be those in which women tend to be biologically more fertile.

In Chapter 3, I studied whether the business cycle induces changes in child development and a cycle in the characteristics of the mothers. Using NLSY79 and NLSY-Child, I find evidence for the first effect. Results show that when unemployment rates at birth are high, cognitive test scores improve. I do not find significant results in the

dimension of selection. Different specifications attempting to account for selection on unobservables seem to discard the existence of such a risk for identification.

An exploration of mechanisms seems to suggest that results are driven by behavioral changes more than by selection into who is born under high unemployment periods, although this cannot be discarded. Regarding heterogeneous effects, adolescent mothers are negatively affected by higher unemployment rates. This is the only statistically significant finding in this sense.

Although policy implications would be strengthened by further refinement of the time usage mechanisms, notable suggestions can be drawn. For example, policies at different points in the cycle should aim at different populations. In particular, high unemployment rates seem to be detrimental for children born to adolescent mothers; thus, public policy should be especially focused on them. Furthermore, policy makers should not neglect parental investment of children born under low unemployment to prevent intercohort inequality.

A natural extension of this chapter agenda would be to verify the robustness of the outcomes in other databases. NLSY is broad in terms of the number of variables, and its longitudinal aspect provides excellent insight into the evolution of children. However, as years pass by, NLSY loses representativity of the current U.S. population and labor force.

Exploring the effects across a county or metropolitan area could broaden the scope of this paper. Because of the characteristics of the study, it would be relevant to assess the effects of gender and occupation-specific unemployment rates to obtain a richer understanding of how aggregate economic conditions interact with demographic and local conditions.

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