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Child Labor, Idiosyncratic Shocks, and Social Policy

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Abstract:
In this paper, we measure the welfare effects of banning child labor in an economy with strong idiosyncratic shocks to employment. We then design two different policies: an unemployment insurance program and a universal basic income system. We show that they can often lead to an endogenous elimination of child labor. We work within a dynamic, general equilibrium model calibrated to South Africa in the 1990s.

Keywords: Child Labor, Idiosyncratic shocks, Unemployment insurance, Universal basic income, Heterogeneous agents, Child labor ban

JEL Classification: E20, D58, J65

Introduction

In the United States, the average duration of unemployment during much of the 1990s was about twelve weeks. Unemployment rates remained in the neighborhood of 6%, the probability to stay employed was close to 1 and the probability to move out of unemployment over a six-week period was one half. Those without job offers were temporarily offered unemployment benefits which represented close to 35% of their previous wage (Pallage & Zimmermann, 2005).

In some countries, like South Africa, being unemployed over the same period was a different experience. On average, it meant a very long period without work – in the order of 2 years according to Kingdon & Knight (2004b). The average unemployment rate ranged from 20% to 40% (Kingdon & Knight, 2004a), depending on the definition, and until 2001 there was no generalized public support for the unemployed. Since credit was hardly available to those without work (FinScope, 2004), there were essentially two ways to self-ensure against employment shocks: one was to accumulate savings, the other was to rely on child labor when adult work could not be found.

We build a dynamic general equilibrium model with heterogeneous agents calibrated to South Africa prior to the introduction of an unemployment insurance agency. We investigate how child labor responds to idiosyncratic employment shocks in this model and whether an appropriately chosen unemployment insurance [UI] would make child labor endogenously vanish. We compare this result to an outright ban on child labor and to other economic instruments such as a universal basic income.

Child labor is not a small phenomenon. The International Labor Organization (ILO) estimates at 215 million the number of children working worldwide (ILO, 2010). Campaigns against child labor have advocated bans (i.e. ILO, Conventions C138, C182), product boycotts or threats to boycotts (US Senator Harkin's bill), or trade sanctions against countries tolerating the practice.[1]

Since the seminal work of Basu & Van (1998), child labor has generated a large body

[1]The effects of boycotts are analyzed in Basu & Zarghamee (2009), those of trade sanctions are addressed in Jafarey & Lahiri (2002). These studies show that both product boycotts and trade sanctions may in fact increase the incidence of child labor for reasonable scenarios.

of theoretical work trying to understand why altruistic parents would choose to send their children to work. Multiple causes have been highlighted going from poverty (Basu, 1999, 2000; Dessy, 2000; Jafarey & Lahiri, 2002; Dessy & Pallage, 2005) to social norms (López-Calva, 2002; Emerson & Souza, 2003) to market failures (Baland & Robinson, 2000; Dessy & Pallage, 2001; Emerson & Knabb, 2007).

In this paper, we argue that child labor may serve as a natural insurance mechanism against adverse employment shocks hitting the family. If such is the case, a ban on child labor may have adverse welfare effects. If bans have been questioned in the literature (Doepke & Zilibotti, 2005, 2009; Dessy & Pallage, 2005) as appropriate means to fight child labor, our model allows us to measure the welfare effects they could have if they ended up in the forced elimination of child labor.

Empirical studies have shown that child labor may indeed act as a buffer against household income shocks in developing countries. For example, Beegle, Dehejia, & Gatti (2006), using household panel data of Tanzania, highlight the fact that transitory income shocks lead to a significantly higher incidence of child labor. Guarcello, Mealli, & Rosati (2010) show that in Guatemala both collective shocks and individual shocks increase the economic activities of children. Using historical data for the United States in the XIXe century, Goldin (1979) shows that the occurrence of adult unemployment raised the probability of their children going to work.

In order to reduce child labor, more and more governments try to implement social programs, like the Bosla familia program in Brazil or the Oportunidades Program in Mexico. But very few theoretical studies in the literature have compared the different instruments that could be implemented to offer better social protection to families and measured their actual effect on child labor.[2]

An interesting exception is Basu (2000) who considers the impact of a minimum wage legislation on child labor. The minimum wage causes adult unemployment to which parents may respond by sending more children to work. Hence, this poverty-alleviation policy may

[2]On the empirical side, there is a growing literature that investigates the impact of social programs and transfers on child labor (see Edmonds (2008) for a survey). In the case of South Africa, in particular, Edmonds (2006) shows a significant effect of the pension allowances on child participation in the labor market.

end up raising the incidence of child labor.

This paper links two strands of literature: the literature on child labor, and the literature that addresses the optimality of unemployment insurance programs, in the wake of Baily (1978), Shavell & Weiss (1979), Hansen & İmrohoroğlu (1992), Andolfatto & Gomme (1996),Wang & Williamson (1996), Hopenhayn & Nicolini (1997) and Pallage & Zimmermann (2001).

The model we work with is a dynamic general equilibrium model with heterogeneous agents à la Hansen & İmrohoroğlu (1992). Adult agents differ in their employment status, that of their child and the savings they have built up. Parents and children are hit by employment shocks. They receive job offers randomly according to some Markovian stochastic process that reflects the labor market dynamics of the economy we want to mimick. Parents value the household consumption and leisure and dislike child labor. If credit markets are incomplete, adult agents may use child labor as a way to smooth consumption. The model also features imperfect monitoring by the government. Hence there may be moral hazard in the sense that some adults refusing job offers may go undetected and manage to collect undue unemployment benefits.

We parametrize the model to an economy whose labor market dynamics mimick those of South Africa in the 1990s. We solve the model numerically and experiment with different social policies, including a universal basic income such as that discussed by van Parijs (2004) and Suplicity (2007).

The rest of the paper is organized as follows. In the next section, we build the model. In Section 2, we describe key characteristics of the South African labor market and parametrize the model to replicate these. In Section 3 and 4, we present the main results and their robustness to a series of experiments. In Section 5, we conclude.

1 The Model

We work in a one-good, dynamic world with discrete time and borrowing constraints. There are two types of agents, adults and children. Each adult has one child. A child in this model lives forever as a child.[3] There is a continuum of infinitely-lived adults of measure one and a similar continuum of children.

At each point in time t, an adult a is characterized by two employment shocks $s_a \in \{0,1\}$ and $s_c \in \{0,1\}$, respectively for himself and his child: s_a (or s_c) takes value 1 if the adult (or the child) has a job offer, it takes value 0 otherwise. Employment opportunities follow a Markov process with probabilities $p_a(s_{at}|s_{a,t-1})$ and $p_c(s_{ct}|s_{c,t-1})$. Employment offers can be accepted or declined. An agent who works is paid his production.

Let y measure an adult agent's productivity. It also represents the wage of an adult worker. A child laborer's productivity is a fraction λ of an adult's, $\lambda \in [0,1]$.

All decisions at the household level are taken by the parent. There is a simple storage technology, but no access to financial markets. Households are de facto borrowing-constrained. Hence, parents choose whether they and their child should accept job offers when they have one, and how much to save from one period to the next. Let m_t represent the stock of savings available at time t. Parents care about the household consumption c_t and about a linear combination of their leisure l_{at} and their child's l_{ct}. These preferences are represented by a variant of a CES utility function:

$$u(c_t, l_{at}, l_{ct}) = \frac{[c_t^{1-\sigma}(\eta l_{at} + (1-\eta) l_{ct})^{\sigma}]^{1-\gamma} - 1}{1-\gamma} \tag{1}$$

In the above utility function, γ measures the degree of risk aversion of the adult agent, σ the elasticity of substitution between consumption and the weighted sum of leisure in the family, and $\eta \in [0,1]$ is the weight an adult puts on his leisure relative to that of the child. A measure of altruism is thus given by $1-\eta$. The utility function can be interpreted as the family's utility.

Labor is indivisible. If he works, an agent spends a fixed proportion h_a or h_c of his time endowment at work.

[3] Since our focus in this paper is on the trade-off within the household between child labor and savings as ways to smooth consumption in the context of adverse idiosyncratic shocks, we have adapted the model of Hansen & İmrohoroğlu (1992) to allow for the possibility to use child labor as a buffer. Our study does not address intergenerational trade-offs that would require a different modelling with overlapping generations. In particular, we are not investigating an old-age insurance motive of child labor (Baland & Robinson, 2000; Bommier & Dubois, 2004).

Parents face the following budget constraint:

$$m_{t+1} + c_t = m_t + y^d_{at} + y^d_{ct}$$

where y^d_{at} and y^d_{ct} represent the time-t disposable income of an adult and a child respectively.

The objective of a parent is to maximize the expected present-value of infinite streams of utility, subject to the above budget constraint:

$$\max \ \mathsf{E} \sum_{t=0}^{\infty} \beta^t u(c_t, l_{at}, l_{ct})$$

with $\beta \in [0, 1)$, the adults' discount factor.

1.1 The economy with unemployment insurance

We consider an unemployment insurance agency whose monitoring of applicants may be imperfect, which could lead to moral hazard. More precisely, while all agents without job offers are eligible to unemployment benefits, a fraction π of agents who refuse offers will be able to fool the unemployment agency and collect undue benefits. Unemployment benefits are a fraction θ of the typical wage. The unemployment insurance is financed with a proportional income tax. The tax rate, τ, is endogenously chosen in such a way that the unemployment insurance agency balances its budget.

Since child labor is mostly an informal sector phenomenon, we assume that children neither pay taxes nor receive unemployment benefits.[4]

Given all the above, an adult agent's disposable income y^d_{at} can be expressed in the following way:

$$y^d_{at} = \begin{cases} (1-\tau)y & \text{if he works} \\ (1-\tau)\theta y & \text{if he collects UI benefits} \\ 0 & \text{otherwise} \end{cases}$$

[4] In some experiments below, we will let unemployed parents also earn an income on the informal labor market. However, in the case of South Africa, which we use for the parametrization, the adult informal labor market has been very limited even in the post Apartheid society (Kingdon & Knight, 2004b; Rodrik, 2008).

wheras for a child, the disposable income would be:

$$y_{ct}^{d} = \begin{cases} \lambda y & \text{if he works} \\ 0 & \text{otherwise} \end{cases}$$

A typical parent's problem is recursive and can thus be written as a Bellman equation (Bellman, 1954), where we drop time subscripts and use prime symbols to denote future states. In the general case, with an unemployment insurance agency, the value function of a parent who has a job offer ($s_a = 1$) together with his child ($s_c = 1$) can be written as follows:

$$V(s_a = 1, s_c = 1, m) =$$

$$\max \left\{ \max_{m'} \left[u((1-\tau)y + \lambda y + m - m', 1 - h_a, 1 - h_c) + \sum_{s_a} \sum_{s_c} p_a(s_a|1) p_c(s_c|1) V(s_a, s_c, m') \right], \quad \text{(both work)} \right.$$

$$\max_{m'} \left[u((1-\tau)y + m - m', 1 - h_a, 1) + \sum_{s_a} \sum_{s_c} p_a(s_a|1) p_c(s_c|1) V(s_a, s_c, m') \right], \quad \text{(only adult works)}$$

$$(1-\pi) \max_{m'} \left[u(\lambda y + m - m', 1, 1 - h_c) + \sum_{s_a} \sum_{s_c} p_a(s_a|1) p_c(s_c|1) V(s_a, s_c, m')] \right]$$

$$+\pi \max_{m'} \left[u((1-\tau)\theta y + \lambda y + m - m', 1, 1 - h_c) + \sum_{s_a} \sum_{s_c} p_a(s_a|1) p_c(s_c|1) V(s_a, s_c, m')] \right], \quad \text{(only child works)}$$

$$(1-\pi) \max_{m'} \left[u(m - m', 1, 1) + \sum_{s_a} \sum_{s_c} p_a(s_a|1) p_c(s_c|1) V(s_a, s_c, m') \right]$$

$$\left. +\pi \max_{m'} \left[u((1-\tau)\theta y + m - m', 1, 1) + \sum_{s_a} \sum_{s_c} p_a(s_a|1) p_c(s_c|1) V(s_a, s_c, m') \right] \quad \text{(none works)} \right\}$$

The three other cases are simpler. For example, the value function of a parent without a job offer ($s_a = 0$), but whose child has one ($s_c = 1$), can be written in the following fashion:

$$V(s_a = 0, s_c = 1, m) =$$

$$\max \left\{ \max_{m'} u(m + (1-\tau)\theta y + \lambda y - m', 1, 1 - h_c) + \sum_{s_a} \sum_{s_c} p_a(s_a|0) p_c(s_c|1) V(s_a, s_c, m'), \quad \text{(child accepts offer)} \right.$$

$$\max_{m'} u(m+(1-\tau)\theta y - m', 1, 1) + \sum_{s_a}\sum_{s_c} p_a(s_a|0)p_c(s_c|1)V(s_a,s_c,m') \quad \text{(child refuses offer)}\Bigg\}$$

When the parent has a job offer ($s_a = 1$), while his child does not ($s_c = 0$), the value function is:

$$V(s_a = 1, s_c = 0, m) =$$

$$\max\Bigg\{\max_{m'} u(m+(1-\tau)y - m', 1-h_a, 1) + \sum_{s_a}\sum_{s_c} p_a(s_a|1)p_c(s_c|0)V(s_a,s_c,m') \quad \text{(adult accepts offer)},$$

$$(1-\pi)u(m-m',1) + \sum_{s_a}\sum_{s_c} p_a(s_a|1)p_c(s_c|0)V(s_a,s_c,m')$$

$$+\pi u((1-\tau)\theta y + m - m', 1, 1) + \sum_{s_a}\sum_{s_c} p_a(s_a|1)p_c(s_c|0)V(s_a,s_c,m') \quad \text{(adult refuses offer)}\Bigg\}$$

Finally, the case where no one has an offer within the household ($s_a = s_c = 0$) can be summarized as:

$$V(s_a = 0, s_c = 0, m) =$$

$$\max_{m'} u(m+(1-\tau)\theta y - m', 1, 1) + \sum_{s_a}\sum_{s_c} p_a(s_a|0)p_c(s_c|0)V(s_a,s_c,m')$$

1.2 The economy with universal basic income

A universal basic income is given to every adult, whether he works or not. In this case, while the child's disposible income remains unchanged, that of the adult becomes:

$$y^d_{at} = \begin{cases} (1-\tau_{ubi})(1+\underline{\omega})y & \text{if he works} \\ (1-\tau_{ubi})\underline{\omega}y & \text{if he does not work, whether by choice or not} \end{cases}$$

where $\underline{\omega}$ is the basic income as a proportion of a worker's wage. It compares directly to the replacement ratio θ in the case of the unemployment insurance program.

As for the unemployment insurance program, we impose that the universal basic income agency balances its budget. The tax τ_{ubi} levied on all income finances the program. Bellman equations can be written in a similar fashion.

1.3 The economy with a ban on child labor

A ban on child labor forces the productivity of the child to be zero. Here, it boils down to imposing $\lambda = 0$. We will measure the welfare effects of this ban. Furthermore, adult disposable income is simply:

$$y_{at}^{d} = \begin{cases} y & \text{if he works} \\ 0 & \text{otherwise} \end{cases}$$

1.4 Solution technique and equilibrium definition

Bellman equations of the type we have in our model do not admit closed-form solutions. We will therefore parametrize the model and revert to numerical solutions. We use standard dynamic programming techniques to extract equilibrium outcomes. The state space is discretized and the Bellman equations are solved numerically for each individual category, given a policy vector.

This is done by iterations on the value function (Stokey & Lucas, 1989) for every parent, applying Banach fixed point theorem. The agents' optimal decisions are then extracted and the corresponding stationary distribution of agents is computed. In each scenario (unemployment insurance, universal basic income or ban), the stationary distribution of agents $f^*(s_a, s_c, m)$ is found by iterations using the optimal decision rules of parents obtained from their respective Bellman equation. The distribution is stationary at iteration j, if we have:

$$f_{j+1}^*(s_a, s_c, m) = f_j^*(s_a, s_c, m) \ \forall s_a, s_c, m$$

Clearly, population accounting implies that f^* also satisfies:

$$\sum_{s_a} \sum_{s_c} \sum_{m} f^*(s_a, s_c, m) = 1$$

If the social program does not balance its budget for the resulting stationary distribution, we adjust the tax rate and start the value function iteration again for the new policy vector. The procedure is stopped when the agency's budget is balanced. We compare steady states of our economy under various policies.

A *steady state equilibrium*, in this economy, is therefore a choice of adult and child leisure, household consumption and savings, for every parent at every state of the world (s_a, s_c, m), a distribution of households f^*, and, when applicable, a policy vector (either $[\tau, \theta]$ or $[\tau_{ubi}, \underline{\omega}]$), such that all parents' decisions maximize their Bellman equation given the policy vector, the distribution of agents is stationary, and the social agency balances its budget.

2 Parametrization

We parametrize the model to South Africa in the 1990s, after the end of Apartheid and prior to the introduction of a generalized public unemployment insurance program.

2.1 Child labor in South Africa

In 1999, Statistics South Africa, together with the International Labor organization (ILO), conducted the first national survey of child labor [the Survey of Activities of Young People (SAYP)].

The aggregate statistics suggest a very large incidence of child labor: According to the SAYP (1999) and CLAP (2003), in 1999, 45% of children were engaged in some form of child labor. These statistics are computed for children 5-17 and for a minimum of one hour of work per week. About 15.5% of children in this age group were working more than twelve hours a week. If we limit ourselves to children 5-14, as is more common in child labor studies, the incidence of child labor is 6.8% for the three-hour minimum, and to 2.5% for twelve hours or more.

Since 1997, child labor in South Africa is prohibited by law (Basic Conditions of Employment Act of 1997). While the ban was obviously not completely effective in 1999, it is likely that child labor observed in the 1999 survey is already tainted by its implementation. In 2000, South Africa ratified both ILO Conventions C138 (Minimum Age for Employment) and C182 (Worst Forms of Child Labor). In this paper, we question the use of a ban. We will investigate alternative ways to fight child labor.

Different social policies have been implemented in South Africa since the end of the

Apartheid, to reduce poverty, like the Old Age Grant (Bertrand, Mullainathan, & Miller, 2003; Edmonds, 2006), the Child Support Grant and the Foster Care Grant – in particular for children in households affected by HIV/AIDS. The Child Support Grant is emphasized in the Child Labour Action Programme (CLAP, 2003). It provides a small conditionnal grant (at R 240 a month in 2009) for children between 6 and 15, in order to reduce poverty and the number of children engaged in work activities. In 2001, an unemployment insurance system was also established (South African Department of Labour, 2001).

2.2 Parametrizing the model

The job market in South Africa, in the 1990s, is characterized by high unemployment, a relatively small informal sector, and high unemployment duration.

We set the length of a period to six weeks, as is typical in models of the kind (Hansen & İmrohoroğlu, 1992; Pallage & Zimmermann, 2001) and set the discount factor β to 0.9944. This implies a 5% annual real interest rate, which is consistent with the real interest rate in South Africa in much of the 1990s, early 2000 (World Bank, 2010).

The South African unemployment rate we consider is 23.3%, while the average duration of unemployment we select is about two years, i.e. 17.33 model periods (Kingdon & Knight, 2004a, 2004b, 2007). In fact, Kingdon & Knight (2004b) computed from the October Household Survey 1997 (OHS 97) that 37% of the unemployed experienced an unemployment duration superior to 3 years, 29% had an unemployment spell between 1 and 3 years. Table 1 provides the relevant statistics.

Table 1: South African adult labor market statistics

Adult unemployment duration (1997)	Unempl rate (narrow def)	Unempl rate (broad def)
2.2 years	23.3% [OHS 1999]	36.2% [OHS 1999]
	28.2% [LFS 2003]	41.8% [LSF 2003]

Source : Kingdon & Knight (2004b), October Household Survey 1999 (OHS 1999), and Labour Force Survey 2003 (LFS 2003).

As can be seen from Table 1, our choice of an unemployment rate of 23.3% for 1999 is in fact quite conservative. The narrow definition excludes the unemployed who wanted to work but did not search actively in the reference period, contrary to the broad definition that includes this group. Interestingly, some empirical work shows that a very small proportion of the unemployed go to the informal sector in South Africa, contrary to developing countries standards (Kingdon & Knight, 2004b; Magruber, 2010). Kingdon & Knight (2004b) also show that this lack of search in South Africa is mainly due to discouragement and constraints driven by poverty rather than due to a weaker desire to get into the labor market, and that both narrow and broad definitions of unemployment are relevant.

We do not have data on "child unemployment" since such statistics are not recorded. We thus consider two possibilities for children's idiosyncratic shocks. In a first series of experiments, we assume that children always have a job opportunity. Since child labor is an informal sector phenomenon, we consider that children's labor market is more flexible (lower unemployment rate and smaller unemployment spells). We will later on report a case in which children face the same labor market risk as their parents (case of symmetric shocks).

Transition probabilities for adult employment shocks are computed using the adult unemployment rate and unemployment duration in the following way. First, the probability to exit unemployment, $p(1|0)$, is given by the inverse of the unemployment duration, i.e. $p(1|0) = 1/17.33 = 0.0577$. To obtain $p(0|1)$, we use Bayes laws and the fact that the unemployment rate, p_u, needs to satisfy the following equation: $p_u = p(0|1)(1-p_u)+(1-p(1|0))p_u$. Table 2 gives the resulting transition probabilities.

Table 2: Transition probabilities

$p(1\|1)$	$p(0\|1)$	$p(1\|0)$	$p(0\|0)$
0.9825	0.0175	0.0577	0.9423

We do not have estimates of the elasticity of substitution σ and risk aversion γ for South Africa. We set these parameters to the closest equivalent in the United States [$\gamma = 2.5$ and $\sigma = 0.67$ as in Hansen & İmrohoroğlu (1992)]. We therefore assume that households in South Africa and the United States, although they face very different labor market risks, have similar preferences. We think this assumption is reasonable, in absence of any indication otherwise.

We normalize adult production y to 1. This will allow us to interpret quantitative results in terms of GDP per capita.

Some parameters remain unknown. We will therefore consider a range of values for the child/adult productivity ratio, λ, and for the weight of adult leisure in the utility function, η.[5]

We focus on child labor that is equivalent to full-time work. We consider that an adult works for 45% of his available time. Hence children when they work spend an equivalent time away from leisure: $h_c = h_a = 0.45$.

3 Results

We want to identify the socially optimal UI policy and compare its effects to a ban on child labor and a universal basic income. We do so in an economy that experiences idiosyncratic shocks similar to those of South Africa. Table 3 summarizes the results under different scenarios.

As can be seen quite rapidly, Table 3 has a lot of important implications. First, it suggests that regardless of the altruism/child productivity parameters, bans on child labor in such environment always do worse in terms of average welfare than the other policies considered. Second, it also suggests that the optimal unemployment insurance policy always dominates the other policies, even under intense moral hazard ($\pi = 1$). Third, it shows that a universal basic income may sometimes be a reasonable alternative to unemployment insurance, especially since it may be easier to manage.[6] Fourth, unemployment insurance and universal basic income policies can endogenously lead to the elimination of child labor if altruism, $1 - \eta$, is at least moderate, and child productivity, λ, is not too large, with respect to adult productivity. Fifth, although results may be quantitatively different depending on

[5] In the case of λ, i.e. the contribution of the child to the household income, unfortunately little data is available on child wages. In South Africa, much of child labor takes place in family businesses (SAYP, 1999), or is illegal. For Botswana, however, Mueller (1984) shows that all children and young adults (aged 7 to 19) account for 42 percent of all income earning time. Levison, Anker, Ashraf, & Barge (1998) estimate that in India's carpet industry, children are 21 percent less productive in hand-knitting than adults. Moehling (2005) shows that in early twentieth century United States, earnings from child labor account for 23% of the child laborer's family income, which translates in our model to a λ-value of 30%. We experiment in the paper with a range of reasonable values.

[6] The cost of managing the program – not incorporated in the model – may indeed make the basic income policy more appealing than the unemployment insurance, for which monitoring applicants is important.

the scenario, the qualitative conclusion that unemployment insurance is socially desirable and better than a child labor ban, is very robust.

Table 4 illustrates the response of steady state child labor and savings to the increase in unemployment insurance compensation in the case of moderate child contribution and moderate altruism ($\lambda = \eta = 0.5$), a case we consider reasonable and conservative. It appears that child labor disappears for replacement rates, θ, well below the optimum. Precautionary savings also drop rapidly, from more than 10 times the average periodic income to zero when θ is optimal. Table 4 also shows that there are important welfare gains associated with the introduction of the optimal unemployment insurance package. The idiosyncratic shocks are so strong that agents need to self insure by accumulating costly buffers or reluctantly resorting to child labor. The unemployment insurance program relieves them from either form of self-insurance.

Although child labor decreases monotonically in this table, there may be several opposite effects at play as we increase θ. First, unemployed adults tend to reduce child labor as the need to self-insure becomes smaller. Second, because being more generous towards the unemployed implies a higher tax rate, some adult workers may resort to child labor to make up for the lost income if their assets are low. Eventually, as generosity becomes very large, it may be that the tax burden induces adults to quit working and substitute child labor for adult labor. In Table 4, the first effect dominates the second and the third does not take place. In some experiments , however, we may lose the monotonicity of the response of child labor to higher social generosity (e.g. Table 6).

Interestingly, moral hazard is not as important in this context as previously reported (Hansen & İmrohoroğlu, 1992; Wang & Williamson, 1996). It takes a success rate of shirkers, π, above 0.5, to observe significant quitting behaviors.[7] This is due to the fact that parents do not value leisure as strongly in this model as in others. They value a weighted average of their leisure and their child's. If we remove altruism and let η go to 1, we find the type of results emphasized in the literature. Altruism is important at turning off moral hazard. Indeed, if $\pi < 1$, parents know that by refusing job offers, they increase the likelyhood that they will have to use child labor to earn a positive income. As long as there is a disutility from

[7]In fact, even for cases in which $\pi = 1$, it takes rather large replacement rates, θ, in this model to induce unsustainable quitting behaviors.

child labor, they are much less likely to refuse offers than in a purely selfish environment. Hence moral hazard matters much less.

In Table 5, similar effects are reported for the universal basic income in the same reasonable scenario. One should note, however, that it takes higher social generosity than with unemployment insurance for child labor to vanish at the steady state. Savings also tend to stay at higher levels. In effect, the net income from UBI is rather low, given the very large tax rates that are required to sustain the program. When $\underline{\omega}$ becomes very large, adult workers decide to quit, the system of universal basic income collapses (tax rate of 100%) and child labor re-emerges massively as it becomes the only way to earn a positive income. Clearly, such scenario is socially very costly. The drop in average utility when $\underline{\omega}$ goes beyond the optimum ($\underline{\omega}^{\star} = 0.70$) is quite dramatic.[8]

It should be noticed that, although suboptimal, the levels of UI generosity θ or UBI $\underline{\omega}$ sufficient to eliminate child labor both procure an average level of welfare that is higher than under a child labor ban. These levels of generosity are likely somewhat higher than those currently in place in South Africa. The Unemployment Insurance Act, introduced in 2001, and amended in 2008 offers a maximum Income Replacement Rate (IRR), of between 38% and 60% for a maximum of 34 weeks.[9]

The limits of social policies to address child labor – Social policies, we have shown, can do much to alleviate the effects of idiosyncratic employment shocks. In many plausible instances, they may provide enough consumption smoothing to those hit by the shocks so that they no longer need to resort to child labor. There are limits to this effect, however. In situations in which parents care significantly more about their own leisure than that of their child (cases of relative selfishness with $\eta \to 1$) or in situations in which children bring home an income almost as large as their parents ($\lambda \to 1$), it is not possible to eliminate child labor with the proper design of an unemployment insurance or a universal basic income. The case

[8]It is interesting to notice that when $\underline{\omega} = 0.5$ in Table 5, the universal basic income acts as would another policy sometimes used to fight child labor: a conditional grant. At this level of generosity, the transfer is sufficient for all parents to abandon child labor.

[9]Pallage, Scruggs, & Zimmermann (2009) show that the mapping between observed unemployment insurance replacement ratios and those in models similar to ours is not straightforward. The socially optimal $\theta^{\star}$ reported in Table 4, for example, suggests an unemployment insurance generosity substantially higher than that in place in South Africa, since the latter has time limits to benefits.

of a large λ was already illustrated in Table 3 (Scenario 5). We show in Table 6 the case of a relatively high η. As can be seen from the table, an increase in UI generosity reduces child labor up to a certain point as less self-insurance is needed. Savings also drop simultaneously. Yet as the tax burden to sustain the unemployment insurance program becomes large, more and more adults choose to refuse offers, and voluntary adult unemployment thus increases, putting even more pressure on those who stay on the job to finance the unemployment insurance program. Quitters sustitute tax-immune child labor to the heavily taxed adult labor. Hence the non-monotonicity of child labor's response to higher replacement ratios, θ. The quitting behavior makes it impossible to sustain an unemployment insurance policy as generous as that in the base scenario (Table 4). At the socially optimal level of generosity ($\theta^{\star} = 0.60$), child labor is not eliminated. Still, the optimal social policy dominates the ban in terms of average welfare.

4 Discussion and other experiments

Pure self-insurance – Does doing nothing also dominate the child labor ban? Although Table 3 suggests that such may be the case, we should be very careful in drawing this conclusion. Absent from the model is education and the effects it should have on future welfare. While education would have the same effect on all policies that eliminate child labor (ban, UI, UBI) and thus would not change the conclusions reached above, it would change the comparison between the social welfare resulting from the ban and that resulting from the status quo. Another model with overlapping generations would thus be required to investigate this particular question.

A policy mix – What if we combine a UI or UBI policy with a child labor ban? Most recent efforts to eliminate child labor typically feature a ban with accompanying policies (see, for instance, ILO Convention 138). A priori, at levels of generosity θ or $\underline{\omega}$ for which child labor endogenously vanishes, the constraint imposed by the ban will not be binding, making the ban a redundant policy. For low levels of generosity in which child labor would be optimally chosen by families, the ban removes one important insurance mechanism against idiosyncratic shocks, with adverse welfare effects. Italicized numbers in Table 7 confirm this intuition for the case of moderate altruism. However, in the case of universal basic income, another effect is at play. Without the ban, adult workers tend to quit in large numbers when benefits $\underline{\omega}$ become too large, which makes the UBI policy unsustainable at the steady state. The ban makes such quitting behavior very costly since one can no longer rely on child labor to bring home a labor income. Hence, the ban may in fact be a desirable policy for large levels of $\underline{\omega}$, as bold numbers in Table 7 suggest. Such policy combination, however remains dominated by the optimal UI package identified in Table 3.

Using the broad definition of unemployment – Kingdon & Knight (2004b) show that the measure of unemployment in South Africa may be substantially higher than the one we use if one accounts for agents who want work but no longer actively search because they have been discouraged by past experiences. Correcting for those, in 1999 would have meant an unemployment rate of 36.2% (see Table 1). We have reparameterized our economy to account for this possibility. Table 8 presents the steady-state results for the base scenario with moderate altruism and moderate child contribution. As can be expected when we increase the amplitude of idiosyncratic shocks adult agents tend to revert more frequently to child labor. Banning the latter in such case is of course all the more costly to families. Although, riskiness has almost doubled compared to that in Table 4, average assets have hardly increased. Parents respond to the increased riskiness by almost doubling the number of child laborers at the steady state.

Symmetric shocks – We have assumed so far that children always find work if they want to. We relax this assumption in an experiment in which children face the same employment risk on the informal labor market as their parents on the formal labor market. Both face an unemployment rate of 23.3% and an average unemployment duration of 2 years. We report the results for the unemployment insurance policy and a possible child labor ban in Table 9. This change in child labor riskiness makes child labor a less efficient insurance mechanism. Hence, when we compare the results to those in Table 4, we see that parents on average rely less on their child's labor at the steady state and slightly increase their asset holdings when they would otherwise have chosen more child labor. The child labor ban is nevertheless a dominated policy.

A parameterization to the United States – In another experiment, we investigate what agents would have done if the risks they faced were similar to those experienced by U.S. workers in the same 1990s. We assume an adult unemployment rate of 6% and an average unemployment spell of 12 weeks, as in Hansen & İmrohoroğlu (1992) and Pallage & Zimmermann (2001). Table 10 contains the results of this experiment. As can be seen from the table, with such levels of risk, child labor would hardly be used as a way to smooth out consumption fluctuations. Asset build-up is moderate when compared to that in Table 4, given the low risk of unemployment and the short unemployment spell. Average welfare is clearly strongly better.

An experiment with home production, i.e. productive adult leisure – Finally, we introduce the possibility that unemployed adults may have access to a home production technology. While the informal sector is not important in South Africa (Magruber, 2010), it can be very significant in some developing countries. We proxy this possibility of earning a non-taxable income while being unemployed by this home production technology. In our experiments, we allow unemployed parents to earn an income representing 10% of the income they would have received as formal sector workers. Their leisure is simultaneously reduced by the same proportion. Table 11 shows that the ranking of policies remains unchanged by this possibility, the optimal unemployment insurance policy dominating both the universal basic income policy and the ban, even under substantial moral hazard. In the self-insurance scenario, child labor has clearly dropped compared to the equivalent number in the first part of Table 3. The home production technology makes families less vulnerable to idiosyncratic shocks. Hence they rely less on child labor. In fact, if we let the income from home production rise above 30%, child labor is no longer used, even in absence of unemployment insurance.

Alternative utility function – Our results are fairly robust to an alternative utility function. We experiment with a linear combination of a CES utility function for the adult and for the child:

$$u(c_t, l_{at}, l_{ct}) = \mu \frac{[(\nu c_t)^{1-\sigma} l_{at}^{\sigma}]^{1-\gamma} - 1}{1-\gamma} + (1-\mu) \frac{[\{(1-\nu)c_t\}^{1-\sigma} l_{ct}^{\sigma}]^{1-\gamma} - 1}{1-\gamma} \tag{2}$$

with ν the share of family consumption devoted to the adult and μ the weight of adult utility in the household, with a similar interpretation as η in the previous formulation. We take the same values for σ and γ. Although results may differ quantitatively, the conclusion that unemployment insurance dominates all other policies, including the ban, is robust to this new utility function for all values of μ and ν. In a scenario very close to the one we consider reasonable with the original utility function (moderate child contribution and moderate altruism) and with children consuming 30% of family consumption, Table 12 suggests a socially optimal unemployment replacement ratio of 0.80, similar to that identified in Table 4. That policy brings an average welfare substantially larger than that under the ban. Child labor endogenously vanishes with the optimal UI.

5 Conclusion

Labor market risks in some countries can be very important and have strong adverse welfare effects. If those subject to employment shocks face borrowing constraints, they will try to self-insure using any possible means. Savings are one way to do this. Sending children to work is another.

In this paper, we show that child labor can endogenously arise as a response to idiosyncratic shocks to adult employment. In this context, a ban on child labor deprives households of an important way to help smooth consumption. Social policies such as an unemployment insurance program that directly addresses the cause of child labor, can induce large welfare gains and remove the need to resort to child labor as a way to help smooth a family's consumption. We show, that in cases of moderate altruism and moderate child laborer's income, the unemployment insurance program and the universal basic income policy can make child labor vanish, and are socially more desirable than a child labor ban.

The paper brings new insight on the link between child labor and social policy and provides a framework to theoretically investigate the response of child labor to idiosyncratic shocks. Our approach puts emphasis on theory and measurement. We quantify the effects shocks may have on child labor, the effects a child labor ban may have on welfare and individual choices, and the generosity of social programs needed to alleviate the effects of the shocks. We can therefore perform a wide variety of experiments and compare the desirability of alternative social responses to child labor. Our results show that social policies should be viewed as credible ways to address child labor.

Other paths could be explored. In particular, easing parents' borrowing constraints by allowing for some micro-credit may be an interesting competitor to the policies we investigate. Accounting for the effect of aggregate shocks could represent another interesting path.

There are no easy remedy to child labor. Except in some cases well highlighted in the literature, bans are typically not the solution. Solutions should address the causes of the phenomenon, which can be difficult to identify. If the causes, as in this paper, are idiosyncratic shocks, a ban alone will act as a rhinoceros trying to pick a poppy. It will not address the shocks. It will only make them more severe for those who experience them. Social policies, in particular an unemployment insurance system, could do substantially better.

References

Andolfatto, D. & Gomme, P. (1996). Unemployment insurance and labor market activity in Canada. *Carnegie-Rochester Conference Series on Public Policy*, *44*, 47–82.

Baily, M. N. (1978). Some aspects of optimal unemployment insurance. *Journal of Public Economics*, *10*, 379–402.

Baland, J.-M. & Robinson, J. A. (2000). Is child labor inefficient?. *Journal of Political Economy*, *108*(4), 663–679.

Basu, K. (1999). Child labor: cause, consequence, and cure, with remarks on international labor standards. *Journal of Economic Literature*, *37*(3), 1083–1119.

Basu, K. (2000). The intriguing relation between adult minimum wage and child labour. *The Economic Journal*, *110*(March), C50–C61.

Basu, K. & Van, P. H. (1998). The economics of child labor. *American Economic Review*, *88*(3), 412–427.

Basu, K. & Zarghamee, H. (2009). Is product boycott a good idea for controlling child labor? a theoretical investigation. *Journal of Development Economics*, *88*(2), 217–220.

Beegle, K., Dehejia, R., & Gatti, R. (2006). Child labor and agricultural shocks. *Journal of Development Economics*, *81*, 80–96.

Bellman, R. (1954). The theory of dynamic programming. *Bulletin of the American Mathematical Society*, *60*, 503–516.

Bertrand, M., Mullainathan, S., & Miller, D. (2003). Public policy and extended families: evidence from pensions in South Africa. *World Bank Economic Review*, *17*(1), 27–50.

Bommier, A. & Dubois, P. (2004). Rotten parents and child labor. *Journal of Political Economy*, *112*(1), 240–248.

CLAP (2003). *The National Child Labour Action Programme for Souh Africa*. StatsSA.

Dessy, S. E. (2000). A defense of compulsory measures against child labor. *Journal of Development Economics*, *62*(1), 261–275.

Dessy, S. E. & Pallage, S. (2001). Child labor and coordination failures. *Journal of Development Economics*, *65*(2), 469–476.

Dessy, S. E. & Pallage, S. (2005). A theory of the worst forms of child labour. *The Economic Journal*, *115*(500), 68–87.

Doepke, M. & Zilibotti, F. (2005). The macroeconomics of child labor regulation. *American Economic Review*, *95*(5), 1492–1524.

Doepke, M. & Zilibotti, F. (2009). International labor standards and the political economy of child-labor regulation. *Journal of the European Economic Association*, *7*(2-3), 508–518.

Edmonds, E. V. (2006). Child labor and schooling responses to anticipated income in South Africa. *Journal of Development Economics*, *81*, 386–414.

Edmonds, E. V. (2008). Child labor. In Schultz, T. P. & Strauss, J. A. (Eds.), *Handbook of Development Economics*, Vol. 4, chap. 57, pp. 3607–3709. Elsevier.

Emerson, P. M. & Knabb, S. D. (2007). Fiscal policy, expectation traps, and child labor. *Economic Inquiry*, *45*(3), 453–469.

Emerson, P. M. & Souza, A. P. (2003). Is there a child labor trap? Intergenerational persistence of child labor in Brazil. *Economic Development and Cultural Change*, *51*(2), 375–98.

FinScope (2004). *Survey Highlights: South Africa*. FinMark Trust.

Goldin, C. (1979). Household and market production of families in a late nineteen-century American city. *Explorations in Economic History*, *16*, 111–131.

Guarcello, L., Mealli, F., & Rosati, F. (2010). Household vulnerability and child labor: the effects of shocks, credit rationing, and insurance. *Journal of Population Economics*, *23*, 169–198.

Hansen, G. D. & İmrohoroğlu, A. (1992). The role of unemployment insurance in an economy with liquidity constraints and moral hazard. *Journal of Political Economy*, *100*(1), 118–142.

Hopenhayn, H. A. & Nicolini, J. (1997). Optimal unemployment insurance. *Journal of Political Economy*, *105*(2), 412–438.

ILO (1973). *C138 Minimum Age Convention.* International Labor Organization, Geneva.

ILO (1999). *C182 Worst Forms of Child Labour Convention.* International Labor Organization, Geneva.

ILO (2010). *Accelerating Action Against Child labour, The Global Report on Child Labour*. International Labor Organization, Geneva.

Jafarey, S. & Lahiri, S. (2002). Will trade sanctions reduce child labour: The role of credit markets. *Journal of Development Economics*, *68*(1), 137–56.

Kingdon, G. G. & Knight, J. (2004a). Race and the incidence of unemployment in South Africa. *Review of Development Economics*, *8*(2), 198–222.

Kingdon, G. G. & Knight, J. (2004b). Unemployment in South Africa: the nature of the beast. *World Development*, *32*(3), 391–408.

Kingdon, G. G. & Knight, J. (2007). Unemployment in South Africa, 1995-2003. *Journal of African Economies*, *16*(5), 813–848.

Levison, D., Anker, R., Ashraf, S., & Barge, S. (1998). Is child labor really necessary in India's carpet industry?. In Anker, R., Barge, S., Rajagopal, S., & Joseph, M. (Eds.), *Economics of Child Labor in Hazardous Industries of India*, pp. 95–133. Hindustan Publishers, New Delhi.

López-Calva, L. F. (2002). A social stigma model of child labor. *Estudios Economicos*, *17*(2), 193–217.

Magruber, J. (2010). Intergenerational networks, unemployment, and persistent inequality in South Africa. *American Economic Journal: Applied Economics*, *2*(1), 62–85.

Moehling, C. M. (2005). 'she has suddenly become powerful': Youth employment and household decision-making in the early Twentieth Century. *Journal of Economic History*, *65*(2), 414–438.

Mueller, E. (1984). Value and allocation of time in rural Bostwana. *Journal of Development Economics*, *15*, 329–360.

Pallage, S., Scruggs, L., & Zimmermann, C. (2009). Unemployment insurance generosity: a trans-Atlantic comparison. *Annals of Economics and Statistics*, *95/96*, 15–24.

Pallage, S. & Zimmermann, C. (2001). Voting on unemployment insurance. *International Economic Review*, *42*(4), 903–924.

Pallage, S. & Zimmermann, C. (2005). Heterogeneous labor markets and the generosity towards the unemployed: an international perspective. *Journal of Comparative Economics*, *33*, 88–106.

Rodrik, D. (2008). Understanding South Africa's economic puzzles. *The Economics of Transition*, *16*(4), 769–797.

Shavell, S. & Weiss, L. (1979). The optimal payment of unemployment insurance benefits over time. *Journal of Political Economy*, *87*, 1347–1362.

South African Department of Labour (2001). *Unemployment Insurance Act.*

Stokey, N. L. & Lucas, R. E. with Prescott, E. C. (1989). *Recursive Methods in Economic Dynamics*. Harvard University Press, Cambridge.

Suplicity, E. (2007). Basic income and employment in Brazil: Comment. *Basic Income Studies*, *2*(1), 1–6.

SAYP (1999). *Survey of Activities of Young People*. StatsSA.

van Parijs, P. (2004). Basic income: a simple and powerful idea for the twenty-first century. *Politics and Society*, *32*(1), 7–39.

Wang, C. & Williamson, S. (1996). Unemployment insurance with moral hazard in a dynamic economy. *Carnegie-Rochester Conference Series on Public Policy*, *44*, 1–41.

World Bank (2010). *World Development Indicators (WDI).* Washington: World Bank.

Table 3: A comparison of policies

Scenario 1: moderate child contribution $\lambda = 0.5$ and moderate altruism $\eta = 0.5$					
	θ or $\underline{\omega}$	Tax rate	Assets	Child labor	Average welfare
Child labor ban	n-a	n-a	20.9671	0	-55.5536
Optimal UI ($\pi \leq 0.5$)	0.80	0.1955	0	0	-46.8337
Optimal UI ($\pi = 1$)	0.50	0.1319	1.0600	0	-48.4269
Optimal UBI	0.70	0.4772	2.2024	0	-49.1948
Pure self-insurance	n-a	n-a	10.8270	0.0577	-54.0330
Scenario 2: moderate child contribution $\lambda = 0.5$ and large altruism $\eta = 0.3$					
	θ or $\underline{\omega}$	Tax rate	Assets	Child labor	Average welfare
Child labor ban	n-a	n-a	22.3079	0	-41.4492
Optimal UI ($\pi \leq 0.5$)	0.90	0.2147	0	0	-32.9512
Optimal UI ($\pi = 1$)	0.70	0.1754	0.0726	0	-33.5319
Optimal UBI	0.70	0.4772	2.8442	0	-35.5155
Pure self-insurance	n-a	n-a	12.2364	0.0518	-40.1023
Scenario 3: moderate child contribution $\lambda = 0.5$ and small altruism $\eta = 0.6$					
	θ or $\underline{\omega}$	Tax rate	Assets	Child labor	Average welfare
Child labor ban	n-a	n-a	20.2685	0	-63.8578
Optimal UI ($\pi \leq 0.5$)	0.80	0.1955	0	0	-54.9743
Optimal UI ($\pi = 1$)	0.40	0.1083	2.1022	0	-57.3479
Optimal UBI	0.30	0.2812	5.4214	0	-59.0868
Pure self-insurance	n-a	n-a	10.4963	0.0942	-61.8096
Scenario 4: small child contribution $\lambda = 0.25$ and moderate altruism $\eta = 0.5$					
	θ or $\underline{\omega}$	Tax rate	Assets	Child labor	Average welfare
Child labor ban	n-a	n-a	20.9671	0	-55.5536
Optimal UI ($\pi \leq 0.5$)	0.80	0.1955	0	0	-46.8337
Optimal UI ($\pi = 1$)	0.50	0.1319	1.0600	0	-48.4269
Optimal UBI	1	0.5659	1.0600	0	-48.4269
Pure self-insurance	n-a	n-a	15.7249	0.0181	-54.9596
Scenario 5: large child contribution $\lambda = 0.8$ and moderate altruism $\eta = 0.5$					
	θ or $\underline{\omega}$	Tax rate	Assets	Child labor	Average welfare
Child labor ban	n-a	n-a	20.9671	0	-55.5536
Optimal UI ($\pi \leq 0.5$)	0.80	0.1955	0.2510	0.3194	-44.3377
Optimal UI ($\pi = 1$)	0.40	0.1083	3.7314	0.2904	-46.3595
Optimal UBI	0.10	0.1153	7.1251	0.2901	-48.3874
Pure self-insurance	n-a	n-a	7.7758	0.2835	-49.1865

Note: In the table, average welfare is computed as the weighted sum of households' value function at the steady state corresponding to the given policy. The optimal UI under given moral hazard π or optimal UBI represent the level of generosity (θ or $\underline{\omega}$) that maximizes average welfare in the scenario considered. The tax rate presented guarantees a balanced budget for the chosen policy. All statistics are aggregated from equilibrium households' decisions.

Table 4: Unemployment insurance and child labor

Scenario 1: moderate child contribution $\lambda = 0.5$ and moderate altruism $\eta = 0.5$						
UI ($\pi \leq 0.5$)	θ	Tax rate	Assets	Vol. unempl.	Child labor	Average welfare
	0	0	10.8270	0	0.0577	-54.0330
	0.10	0.0295	8.5719	0	0.0381	-52.7190
	0.20	0.0573	6.3660	0	0.0277	-51.4907
	0.30	0.0835	4.3673	0	0.0106	-50.3493
	0.40	0.1083	2.3871	0	0	-49.3103
	0.50	0.1319	1.0600	0	0	-48.4269
	0.60	0.1542	0.2784	0	0	-47.7133
	0.70	0.1754	0	0	0	-47.1432
	0.80*	0.1955	0	0	0	-46.8337
	0.90	0.2147	0	0	0	-46.8508
	1	0.2330	0.1115	0	0	-47.0155

Note: In the table, average welfare is computed as the weighted sum of households' value function at the steady state corresponding to the given policy. The tax rate presented guarantees a balanced budget for the chosen policy. The socially optimal replacement ratio is identified with a $\star$. All statistics are aggregated from equilibrium households' decisions.

Table 5: Universal basic income and child labor

Scenario 1: moderate child contribution $\lambda = 0.5$ and moderate altruism $\eta = 0.5$						
UBI	$\underline{\omega}$	Tax rate	Assets	Vol. unempl.	Child labor	Average welfare
	0	0	10.8270	0	0.0577	-54.0330
	0.10	0.1153	8.7799	0	0.0429	-52.8332
	0.20	0.2068	7.0649	0	0.0282	-51.8890
	0.30	0.2812	5.7425	0	0.0186	-51.1273
	0.40	0.3428	4.6447	0	0.0134	-50.5076
	0.50	0.3946	3.6551	0	0	-49.9964
	0.60	0.4389	2.8287	0	0	-49.5544
	0.70*	0.4772	2.2024	0	0	-49.1948
	0.80	1	0.3570	0.7670	0.9832	-118.0049

Note: In the table, average welfare is computed as the weighted sum of households' value function at the steady state corresponding to the given policy. The tax rate presented guarantees a balanced budget for the chosen policy. The socially optimal UBI is identified with a $\star$. All statistics are aggregated from equilibrium households' decisions.

Table 6: Low altruism and unemployment insurance

	Moderate child contribution $\lambda = 0.5$ and low altruism $\eta = 0.65$					
UI ($\pi = 0.5$)	θ	Tax rate	Assets	Vol. unempl.	Child labor	Average welfare
	0	0	10.9188	0	0.1738	-65.2814
	0.10	0.0295	8.6348	0	0.1480	-64.1466
	0.20	0.0573	6.4177	0	0.1313	-63.0908
	0.30	0.0835	4.4051	0	0.1053	-62.1258
	0.40	0.1083	2.4573	0	0.0984	-61.2297
	0.50	0.1319	1.1469	0	0.1113	-60.4428
	0.60*	0.1542	0.3529	0	0.1315	-59.7799
	0.70	0.3460	0.3796	0.2761	0.4909	-73.4098
Child labor ban						
	n-a	n-a	19.9111	0	0	-68.3925

Note: In the table, average welfare is computed as the weighted sum of households' value function at the steady state corresponding to the given policy. The tax rate presented guarantees a balanced budget for the chosen policy. The socially optimal replacement ratio is identified with a *. All statistics are aggregated from equilibrium households' decisions.

Table 7: Combining policies

Scenario 1: moderate altruism $\eta = 0.5$						
Ban with UI ($\pi \leq 0.5$)	θ	Tax rate	Assets	Vol. unempl.	Child labor	Average welfare
	0	*0*	*20.9671*	*0*	*0*	*-55.5536*
	0.10	*0.0295*	*11.8293*	*0*	*0*	*-53.2734*
	0.20	*0.0573*	*7.3935*	*0*	*0*	*-51.6734*
	0.30	*0.0835*	*4.4206*	*0*	*0*	*-50.3754*
	0.40	*0.1083*	*2.3871*	*0*	*0*	*-49.3103*
	0.50	0.1319	1.0600	0	0	-48.4269
	0.60	0.1542	0.2784	0	0	-47.7133
	0.70	0.1754	0	0	0	-47.1432
	0.80*	0.1955	0	0	0	-46.8337
	0.90	0.2147	0	0	0	-46.8508
	1	0.2330	0.1115	0	0	-47.0155
Scenario 1: moderate altruism $\eta = 0.5$						
Ban with UBI	$\underline{\omega}$	Tax rate	Assets	Vol. unempl.	Child labor	Average welfare
	0	*0*	*20.9671*	*0*	*0*	*-55.5536*
	0.10	*0.1153*	*12.3426*	*0*	*0*	*-53.4375*
	0.20	*0.2068*	*8.6690*	*0*	*0*	*-52.1680*
	0.30	*0.2812*	*6.3556*	*0*	*0*	*-51.2461*
	0.40	*0.3428*	*4.7778*	*0*	*0*	*-50.5466*
	0.50	*0.3946*	*3.6551*	*0*	*0*	*-49.9964*
	0.60	0.4389	2.8287	0	0	-49.5544
	0.70	0.4772	2.2024	0	0	-49.1948
	0.80	**0.5105**	**1.7254**	**0**	**0**	**-48.8940**
	0.90	**0.5399**	**1.3532**	**0**	**0**	**-48.6415**
	1*	**0.5659**	**1.0600**	**0**	**0**	**-48.4269**

Note: We combine the ban with an unemployment insurance or a universal basic income. Lines in italic mean the ban is welfare decreasing compared to the alternative scenario without the ban, lines in bold characters mean the ban is welfare improving. It is redundant otherwise. Average welfare is computed as the weighted sum of households' value function at the steady state corresponding to the given policy. The tax rate presented guarantees a balanced budget for the chosen policy. The socially optimal replacement ratio or UBI is identified with a *. All statistics are aggregated from equilibrium households' decisions.

Table 8: Broad definition of unemployment

Scenario 1: moderate child contribution $\lambda = 0.5$ and moderate altruism $\eta = 0.5$						
UI ($\pi \leq 0.5$)	θ	Tax rate	Assets	Vol. unempl.	Child labor	Average welfare
	0	0	11.3896	0	0.1025	-65.2176
	0.10	0.0537	8.8539	0	0.0765	-63.6117
	0.20	0.1019	6.5320	0	0.0507	-62.1709
	0.30	0.1455	4.5688	0	0.0249	-60.8797
	0.40	0.1850	2.7145	0	0	-59.7216
	0.50	0.2210	1.3684	0	0	-58.7117
	0.60	0.2540	0.5239	0	0	-57.9295
	$0.70^{\star}$	0.2843	0.0831	0	0	-57.3474
	0.80	0.3122	0	0	0	-56.9762
	0.90	0.3380	0	0	0	-57.0004
Child labor ban						
	n-a	n-a	16.3581	0	0	-68.1358

Note: In this experiment, adults are faced with substantially larger labor market risk (unemployment rate of 36.2%, but same duration of unemployment). Average welfare is computed as the weighted sum of households' value function at the steady state corresponding to the given policy. The tax rate presented guarantees a balanced budget for the chosen policy. The socially optimal replacement ratio is identified with a *. All statistics are aggregated from equilibrium households' decisions.

Table 9: Symmetric risks

Scenario 1: moderate child contribution $\lambda = 0.5$ and moderate altruism $\eta = 0.5$						
UI ($\pi = 0$)	θ	Tax rate	Assets	Vol. unempl.	Child labor	Average welfare
	0	0	15.2719	0	0.0343	-54.5613
	0.10	0.0295	9.6318	0	0.0254	-52.9314
	0.20	0.0573	6.6380	0	0.0194	-51.5442
	0.30	0.0835	4.3773	0	0.0083	-50.3553
	0.40	0.1083	2.3871	0	0	-49.3103
	0.50	0.1319	1.0600	0	0	-48.4269
	0.60	0.1542	0.2784	0	0	-47.7133
	0.70	0.1754	0	0	0	-47.1432
	$0.80^{\star}$	0.1955	0	0	0	-46.8337
	0.90	0.2147	0	0	0	-46.8508
	1	0.2330	0.1115	0	0	-47.0155
Child labor ban						
	n-a	n-a	20.9671	0	0	-55.5536

Note: In this experiment, children face the same labor market risks as adults (unemployment rate of 23% and duration of unemployment of 2 years. Average welfare is computed as the weighted sum of households' value function at the steady state corresponding to the given policy. The tax rate presented guarantees a balanced budget for the chosen policy. The socially optimal replacement ratio is identified with a *. All statistics are aggregated from equilibrium households' decisions.

Table 10: U.S.-like labor market risks

Scenario 1: moderate child contribution $\lambda = 0.5$ and moderate altruism $\eta = 0.5$						
UI ($\pi \leq 0.5$)	θ	Tax rate	Assets	Vol. unempl.	Child labor	Average welfare
	0	0	2.6244	0	0.0030	-42.5083
	0.10	0.0063	2.1781	0	0.0027	-42.3949
	0.20	0.0126	1.7328	0	0.0014	-42.2936
	0.30	0.0188	1.2356	0	0	-42.1920
	0.40	0.0249	0.8102	0	0	-42.0949
	0.50	0.0309	0.4700	0	0	-42.0072
	0.60	0.0369	0.2192	0	0	-41.9252
	0.70	0.0428	0.0521	0	0	-41.8535
	0.80	0.0486	0	0	0	-41.7919
	0.90*	0.0543	0.0065	0	0	-41.7883
	1	0.0603	0.0349	0	0	-41.8329
Child labor ban						
	n-a	n-a	3.5857	0	0	-42.5219

Note: Labor market dynamics in this experiment replicate the US unemployment rate of 6% and average duration of unemployment of 12 weeks in the 1990s. Average welfare is computed as the weighted sum of households' value function at the steady state corresponding to the given policy. The tax rate presented guarantees a balanced budget for the chosen policy. The socially optimal replacement ratio is identified with a *. All statistics are aggregated from equilibrium households' decisions.

Table 11: An experiment with home production (10% of labor income)

Moderate child contribution $\lambda = 0.5$ and moderate altruism $\eta = 0.5$					
	θ or $\underline{\omega}$	Tax rate	Assets	Child labor	Average welfare
Child labor ban	n-a	n-a	12.7042	0	-52.8077
Optimal UI ($\pi \leq 0.5$)	0.80	0.1955	0	0	-46.1525
Optimal UI ($\pi = 1$)	0.50	0.1319	0.3329	0	-47.0726
Optimal UBI	0.80	0.5105	0.7351	0	-47.4616
Self-insurance	n-a	n-a	10.2044	0.0290	-52.4054

Note: In this experiment, unemployed adults devote 10% of their leisure producing a home good, worth 1/10 of a worker's income. Average welfare is computed as the weighted sum of households' value function at the steady state corresponding to the given policy. The tax rate presented guarantees a balanced budget for the chosen policy. All statistics are aggregated from equilibrium households' decisions.

Table 12: Alternative utility function

moderate child contribution $\lambda = 0.5$, moderate altruism $\mu = 0.5$, share of adult consumption $\nu = 0.7$						
UI ($\pi \leq 0.5$)	θ	Tax rate	Assets	Vol. unempl.	Child labor	Average welfare
	0	0	5.2552	0	0.1501	-143.5477
	0.10	0.0295	3.5249	0	0.1499	-142.0279
	0.20	0.0573	2.4168	0	0.1520	-140.8076
	0.30	0.0835	1.7753	0	0.1180	-139.8131
	0.40	0.1083	1.1612	0	0.0810	-138.8202
	0.50	0.1319	0.6940	0	0.0550	-137.8816
	0.60	0.1542	0.2218	0	0	-136.9962
	0.70	0.1754	0	0	0	-136.1404
	$0.80^{\star}$	0.1955	0	0	0	-135.7396
	0.90	0.2147	0.0047	0	0	-135.8248
Child labor ban						
	n-a	n-a	16.3228	0	0	-154.6725

Note: In this experiment, we use a weighted sum of CES utility functions for the adult and the child within the household [Eq. (2)]. Average welfare is computed as the weighted sum of households' value function at the steady state corresponding to the given policy. The tax rate presented guarantees a balanced budget for the chosen policy. The socially optimal replacement ratio is identified with a $\star$. All statistics are aggregated from equilibrium households' decisions.