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# Child Labor, Idiosyncratic Shocks, and Social Policy

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**Abstract**

In this paper, we provide a dynamic model with heterogeneous agents to study child labor in an economy with idiosyncratic shocks to employment. Households facing adverse shocks may use child labor as a buffer to smooth consumption. We show that the introduction of an unemployment insurance program and/or a universal basic income system help eliminate child labor endogenously in this context. A calibration to South Africa in the 1990s is provided.

**Key words:** Child labor, Idiosyncratic shocks, Unemployment insurance, Universal basic income, Heterogeneous agents, Child labor ban

**JEL classification:** E24, D7, D58, J65.

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# 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 model with heterogeneous agents calibrated to South Africa in the 1990ies 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 [UBI].

Child labor is not a small phenomenon. The International Labor Organization (ILO) estimates at 168 million the number of children working worldwide (ILO, 2013). Campaigns against child labor have advocated bans (i.e. ILO, Conventions C138, C182), product boycotts (US Senator Harkin's bill proposal), 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). Parallel to those theoretical efforts, a macroeconomic literature was initiated that addressed the implications of child labor in dynamic equilibrium models (Moe, 1998; Doepke & Zilibotti, 2005; Pallage & Zimmermann, 2007; Soares, 2010).

In this paper, we argue that child labor may serve as a natural insurance mechanism against adverse employment shocks hitting the family. In this context, a social policy that directly addresses the effects of the shock on the household could have a very important effect on the incidence of child labor. It may very well be that this social policy achieves the same goal as a ban on child labor without the additional constraint that a ban imposes on household choices. This social policy mechanism has not been analyzed in the literature.

The impact of idiosyncratic shocks on child labor, however, has been well demonstrated in the empirical literature: 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. Beegle, Dehejia, & Gatti (2006, 2009) document a significant link between the two in the case of contemporary rural households in Tanzania. See also Udry (2004) for an interesting survey of this evidence. Guarcello, Mealli, & Rosati (2010) show that in Guatemala, the labor participation rate of children from households hit by idiosyncratic shocks is 5 percentage points higher than average. In an empirical study of Nigerian households, Boutin (2011) finds that the use of children's labor as a way of coping with negative shocks is still prevalent while remittances can partly alleviate this effect. Duryea, Lam, & Levison (2007) also provide evidence in the case of Brazil that unemployment shocks significantly raises the probability that a child works. Dammert (2008) estimates that the shift of coca production from Peru to Colombia after Peruvian authorities tried to ban its production had a significant positive impact on children labor force participation in coca producing communities. Similar conclusions are reached by Jensen (2000) for agricultural shocks in Côte d'Ivoire and Kruger (2007) in rural Brazil. Indirect evidence for South Africa is also provided by Edmonds (2006) who shows that child labor sharply declines when members of the household become eligible to the government cash pension. Although such income shock could be anticipated, financial markets in South Africa were so incomplete during the period of the study, that households could not borrow against the future pension income. At a more aggregate level, Dehejia & Gatti (2005) show that in countries where financial markets are underdeveloped, child labor is an important way for families to smooth out income shocks, while Karan Singh (2011) provides evidence that child labor is countercyclical. A large literature has also highlighted a direct negative effect of household income shocks on schooling enrolments of children (Jacoby, 1994; Jacoby & Skoufias, 1997; Grimm, 2008). Furthermore, on the theoretical side, Baland & Robinson (2000), Pörtner (2001) and ?) have shown that children and children's labor can be used as insurance devices against uncertainty in household income variations.

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 theorical studies 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 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 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

[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.

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). Our results suggest that these policies can be effective ways to fight child labor.

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 and provide further paths for future research.

# 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. 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. There is a continuum of infinitely-lived adults of measure one and a similar continuum of children. A child in this model lives forever as a child.[3] The model will

[3]An alternative to this model would one in which adults die randomly and their children simultaneously become adults and inherit their parent's asset. The introduction of this probability of death for adults is neutral to our results since it does not affect optimal decisions of agents. 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 &

highlight the tradeoff between adult and child labor.

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 $p_c(s_{ct}|s_{c,t-1})$ that depend on past realizations of the shock. 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 $\lambda$ 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, $\gamma$ measures the degree of risk aversion of the adult agent, $\sigma$ 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 could also be interpreted as the household'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.

Parents face the following budget constraint:

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

Dubois, 2004).

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.

We will successively introduce in this model different social policies and analyze the induced incentives for the agents. We are particularly interested in the way child labor endogenously responds to these policies. We will measure the welfare effects of each policy and contrast it to those of a child labor ban and to a self-insurance environment.

## 1.1 Introducing an unemployment insurance program

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 $\pi$ of agents who refuse offers will be able to fool the unemployment agency and collect undue benefits. Unemployment benefits are a fraction $\theta$ of the typical wage. The unemployment insurance is financed with a proportional income tax. The tax rate, $\tau$, 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. In some experiments below, we will let unemployed parents also earn an income on the informal labor market (experiment with home production).[4]

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

[4] In the case of South Africa, which we use for the parametrization, however, the adult informal labor market has been very limited even in the post Apartheid society (Kingdon & Knight, 2004b; Rodrik, 2008).

following way:

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

whereas 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:

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

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

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

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

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

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

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

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:

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

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

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

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

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

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

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

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

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

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

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

An interesting alternative to the unemployment insurance program, advocated by several authors for its simplicity to manage (Friedman, 1968; Van Parijs, 2004), is a universal basic income. We introduce such policy in our model in the lines below.

## 1.2 Introducing a universal basic income

A universal basic income (UBI) is given to every adult, whether he works or not. This policy is thus simpler than the unemployment insurance program since the monitoring of labor decisions is not necessary. Moral hazard in the sense described above for the unemployment insurance policy is thus irrelevant. In this case, while the child's disposable income remains unchanged, that of the adult becomes:

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

where $\underline{\omega}$ is the basic income as a proportion of a worker's wage. It compares directly to the replacement ratio $\theta$ 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 $\tau_{ubi}$ levied on all income finances the program. Bellman equations can be written in a similar fashion.

## 1.3 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.

To solve the model, we calibrate it to an economy with large shocks. South Africa provides interesting features we are going to use in our parametrization.

# 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.

The job market in South Africa, in the 1990s, is characterized by high unemployment, a relatively small informal sector, and high unemployment duration. These features summarized in Table 1 are key parameters of our calibration of the labor market dynamics.

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 $\beta$ 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. 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 enter the labor market, and that both narrow and broad definitions of unemployment are relevant. It should be emphasized that the informal labor market in South Africa is very small, contrary to developing countries standards (Kingdon & Knight, 2004b; Magruber, 2010), which makes South Africa a good candidate for this model's calibration.

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.

We do not have estimates of the elasticity of substitution $\sigma$ and risk aversion $\gamma$ for South Africa. We choose to set these parameters to the closest equivalent in the United States

Table 2: Transition probabilities

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

[$\gamma = 2.5$ and $\sigma = 0.67$ as in Hansen & İmrohoroğlu (1992)], which allows some comparison with the literature.

We normalize adult production $y$ to 1. We will thus interpret all quantitative results in terms of production per adult worker.

Some parameters remain unknown. We will therefore consider a range of values for the child/adult productivity ratio, $\lambda$, and for the weight of adult leisure in the utility function, $\eta$. In the case of $\lambda$, i.e. the child wage relative to that of an adult, unfortunately little data is available. The literature nevertheless provides us with some indication of the bracket to consider. In Botswana, 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) estimates 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 $\lambda$-value of 30%. We will consider as our base scenario the case in which parents value their leisure and their child's equally ($\eta = 0.5$) and the case in which children's income is 25% of an adult's, i.e. $\lambda = 0.25$. We experiment in the paper with a range of alternative values.

We focus on child labor that is equivalent to full-time work. We consider that an adult works for 45% of his available time as in Hansen & İmrohoroğlu (1992). Hence children when they work spend an equivalent time away from leisure: $h_c = h_a = 0.45$.

Child labor is endogenously determined in the model. We will try to match it to actual child labor statistics in 1999 South Africa.[5] According to surveys SAYP (1999) and CLAP

[5] Child labor was an important issue for the post-Apartheid South Africa. A series of legislative actions were undertaken starting with the 1997 Basic Conditions of Employment Act, which restricted labor participation for children. The latter was followed by the 2003 National Child Labour Programme of Action, a national plan for the elimination of child labour in South Africa, with IPEC.

(2003), the proportion of children ages 5-14 reported to work more than twelve hours a week is 2.5% in 1999 while that of children working more than three hours is 6.8%. It is difficult to assess whether these numbers truly reflect the actual incidence of child labor since a ban had been introduced two years prior to the first survey. Since reverting to child labor was illegal, we can expect some under-reporting of the hours worked and the incidence itself. See Appendix A.

## 3 Results

In our model, in which agents have borrowing constraints, there are two ways at their disposal to smooth consumption in the face of employment shocks: savings and child labor. Table 3 summarizes the results under different scenarios and values of the free parameters. In addition to the base scenario ($\lambda = 0.25$ and $\eta = 0.5$), we consider larger child contributions ($\lambda \in \{0.5, 0.8\}$) and cases of smaller and larger altruism ($\eta = 0.8$ and 0.3 respectively).

For each scenario in Table 3, we compare several policies and the lack of policy (self-insurance) in terms of average welfare, the proportion of child laborers and the size of accumulated savings. As can be readily seen from the table, households do revert to child labor regardless of the scenario when left to themselves (self-insurance case). We present in the table the socially optimal unemployment insurance policy and its effect on the variables identified above, under various moral hazard levels. We do the same for the optimal universal basic income. The case of a child labor ban is also presented as it is the most basic policy available and as there is an extensive literature discussing its desirability (Basu & Van, 1998; Basu, 1999; Dessy, 2000; Baland & Robinson, 2000; Dessy & Pallage, 2001; Doepke & Zilibotti, 2005, 2009; Dessy & Pallage, 2005).

A ban on child labor in this model is equivalent to imposing that the productivity of the child be zero, i.e. it boils down to setting $\lambda = 0$. As shown in Table 3, the child labor ban will typically be dominated in terms of average welfare by the social policies (UI, UBI), since it deprives parents of one of the means to smooth consumption and doesn't generate any compensation effects by itself.[6]

[6]Table 3 also shows that the ban on child labor is dominated by the self-insurance case. In a different model with explicit education, this latter result might not hold. While education would have the same effect

Table 3 has a lot of other implications. First, it shows that the optimal unemployment insurance policy always welfare dominates the other policies, even under intense moral hazard ($\pi = 1$). Second, it suggests that a universal basic income may sometimes be a reasonable alternative to unemployment insurance, especially since it may be easier to manage.[7] Third, unemployment insurance and universal basic income policies can endogenously lead to the elimination of child labor if altruism is at least moderate ($\eta \leq 0.5$), and child productivity, $\lambda$, is not too large, with respect to adult productivity. Fourth, although results may be quantitatively different depending on the scenario, the qualitative conclusion that unemployment insurance is socially desirable is very robust.

Table 4 illustrates the response of steady state child labor and savings to the increase in unemployment insurance compensation in the base scenario. As can be seen from the table, child labor vanishes for replacement rates, $\theta$, well below the optimum. Precautionary savings also drop rapidly, from more than 10 times the average periodic income to zero when $\theta$ 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 the replacement ratio, $\theta$. 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, under small altruism,

on variables in the model for all policies that effectively eliminate child labor (ban, UI, UBI) and thus would not change the welfare ranking between those policies in these cases, it would likely change the comparison between the social welfare resulting from the ban and that resulting from the self-insurance case.

[7] 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.

first panel).

It should be noticed that, although suboptimal, the level of UI generosity, $\theta$, sufficient to eliminate child labor ($\theta = 0.5$) is not far from that 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.[8]

Interestingly, moral hazard is not as important in the context of this model as previously reported (Hansen & İmrohoroğlu, 1992; Wang & Williamson, 1996; Pallage & Zimmermann, 2001). In Table 4, for a success rate of shirkers, $\pi = 0.5$, it takes replacement rates much higher than reported in the literature to observe quitting behaviors. 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. 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 child labor, they are much less likely to refuse offers than in a purely selfish environment. Hence moral hazard matters much less. If we remove altruism and let $\eta$ go to 1, we find the type of results emphasized in the literature (see, e.g., Table 6, first panel, for $\eta = 0.8$).

In Table 5, we detail the impact of the universal basic income on all variables in the base scenario. One should note that it takes higher social generosity with UBI than with unemployment insurance for child labor to vanish at the steady state. Savings also tend to stay at higher levels than for similar replacement rates under UI in Table 4. The UBI is a costly policy since it does not target unemployed agents only. In effect, the net income from UBI is rather low, given the very large tax rates that are required to sustain the program.

*The limits of social policies to address child labor* – Social policies, we have just 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

[8] **?**) show that the mapping between observed unemployment insurance replacement ratios and those in models similar to ours is not straightforward, however. 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.

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 a rather large fraction of an adult income ($\lambda \to 1$), it is not possible to eliminate child labor with the proper design of an unemployment insurance or a universal basic income. The case of a large $\lambda$ was already illustrated in Table 3 (Scenarios 2 and 3). We show in Table 6 (first panel) the case of a relatively high $\eta$. 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, $\theta$. 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, child labor is not eliminated.

In the next section, we propose a portfolio of other experiments to test the robustness of our results.

# 4 Discussion and other experiments

*1. 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 $\theta$ 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 base scenario. The same is true in the case of universal basic income.

*2. 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 we account 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 reparametrized our economy to account for this possibility. Table 8 presents the corresponding steady-state results for the base scenario. 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.

*3. A parametrization 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 9 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.

*4. 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 10. 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 still a dominated policy.

*5. An experiment with home production, i.e. productive adult leisure* – 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.

*6. Conditional transfers* – A policy that has been tested in several countries to address child labor is a transfer to parents whose children do not work. In Table 12, several transfers $\nu$ are presented for the base scenario. Lower levels of conditional transfers are required to eliminate child labor when compared to both UI (Table 4) and UBI (Table 5). However, the optimal level of transfer is equivalent to the UBI policy, and appears to be welfare-dominated by the unemployment insurance proposal.

*7. 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 $\nu$ the share of family consumption devoted to the adult and $\mu$ the weight of adult utility in the household, with a similar interpretation as $\eta$ in the previous formulation. We take the same values for $\sigma$ and $\gamma$. 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 $\mu$ and $\nu$. In a scenario very close to our base scenario with the original utility function (Table 4) and with children consuming 30% of family consumption, Table 13 suggests a socially optimal replacement ratio of 0.80, similar to that identified in Table 4. Child labor also endogenously vanishes with the optimal UI policy.

# 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. An unemployment insurance program that directly addresses the shocks, or a universal basic income, can induce significant welfare gains and make child labor vanish.

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 could be viewed as credible ways to address child labor in the context of idiosyncratic risks.

Other research 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 study. Accounting for the effect of aggregate shocks could represent another interesting path. Modelling the possibility of human capital accumulation would take us a step further to investigate the welfare comparison between a ban on child labor and a scenario of pure self-insurance.

There is no easy remedy to child labor. 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 social policy such as an unemployment insurance program, could well be the remedy to consider.

# 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.

Beegle, K., Dehejia, R., & Gatti, R. (2009). Why should we care about child labour? The education, labor market, and health consequences of child labor. *Journal of Human Resources*, *44*(4), 871–89.

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.

Boutin, D. (2011). Envoi de fonds et allocation du temps des enfants au Niger : l'effet indirect des chocs négatifs. Working Papers hal-00637607, HAL.

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

Dammert, A. C. (2008). Child labor and schooling response to changes in coca production in rural Peru. *Journal of Development Economics*, *86*(1), 164–180.

Dehejia, R. H. & Gatti, R. (2005). Child labor: the role of financial development and income variability across countries. *Economic Development and Cultural Change*, *53*(4), 913–932.

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.

Duryea, S., Lam, D., & Levison, D. (2007). Effects of economic shocks on children's employment and schooling in Brazil. *Journal of Development Economics*, *84*(1), 188–214.

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. & 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.

Friedman, M. (1968). The case for a negative income tax. In Laird, M. R. (Ed.), *Republican Papers*, pp. 202–220. Anchor, Garden City, NY.

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

Grimm, M. (2008). Food price inflation and schooling. Ibero America Institute for Econ. Research (IAI) Discussion Papers 174, Ibero-America Institute for Economic Research.

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.

Jacoby, H. & Skoufias, E. (1997). Risk, financial markets, and human capital in a developing country. *Review of Economic Studies*, *64*, 311–35.

Jacoby, H. G. (1994). Borrowing constraints and progress through school: evidence from Peru. *The Review of Economics and Statistics*, *76*(1), 151–60.

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

Jensen, R. (2000). Agricultural volatility and investments in children. *American Economic Review*, *90*(2), 399–404.

Karan Singh, B. (2011). Impact of adverse economic shocks on the indian child labour market and the schooling of children of poor households. MPRA Paper 30958, University Library of Munich, Germany.

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.

Kruger, D. I. (2007). Coffee production effects on child labor and schooling in rural Brazil. *Journal of Development Economics*, *82*(2), 448–463.

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.

Moe, K. S. (1998). Fertility, time use, and economic development. *Review of Economic Dynamics*, *1*(3), 699–718.

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. & 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.

Pallage, S. & Zimmermann, C. (2007). Buying out child labor. *Journal of Macroeconomics*, *29*(1), 75–90.

Pörtner, C. C. (2001). Children as insurance. *Journal of Population Economics*, *14*(1), 119–136.

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.

Soares, J. (2010). Welfare impact of a ban on child labor. *Economic Inquiry*, *48*(4), 1048–64.

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.

Udry, C. R. (2004). Child labor. Yale School of Management Working Papers ysm399, Yale School of Management.

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.

# A The South African context

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 significant 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).

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 (of 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).

Table 3: A comparison of policies

| | $\theta$ or $\underline{\omega}$ | Tax rate | Assets | Child labor | Average welfare |
|---|---|---|---|---|---|
| **Scenario 1: base scenario $\lambda = 0.25$ and $\eta = 0.5$** | | | | | |
| Child labor ban | n-a | n-a | 16.3580 | 0 | -59.5382 |
| Optimal UI ($\pi \leq 0.5$) | 0.80 | 0.1955 | 0 | 0 | -46.8174 |
| Optimal UI ($\pi = 1$) | 0.50 | 0.1319 | 1.0600 | 0 | -48.4095 |
| Optimal UBI | 1 | 0.5659 | 1.0600 | 0 | -48.4095 |
| Pure self-insurance | n-a | n-a | 10.1522 | 0.1056 | -53.6656 |
| **Scenario 2: $\lambda = 0.5$ and $\eta = 0.5$** | | | | | |
| | $\theta$ or $\underline{\omega}$ | Tax rate | Assets | Child labor | Average welfare |
| Child labor ban | n-a | n-a | 16.3580 | 0 | -59.5382 |
| Optimal UI ($\pi \leq 0.5$) | 0.40 | 0.1084 | 0 | 0.2330 | -44.4836 |
| Optimal UI ($\pi = 1$) | 0.40 | 0.1084 | 0 | 0.2330 | -44.4836 |
| Optimal UBI | 0.70 | 0.4772 | 0 | 0.2330 | -44.4906 |
| Pure self-insurance | n-a | n-a | 2.6755 | 0.2330 | -46.9766 |
| **Scenario 3: $\lambda = 0.8$ and $\eta = 0.5$** | | | | | |
| | $\theta$ or $\underline{\omega}$ | Tax rate | Assets | Child labor | Average welfare |
| Child labor ban | n-a | n-a | 16.3580 | 0 | -59.5382 |
| Optimal UI ($\pi \leq 0.5$) | 0.20 | 0.0573 | 0.1732 | 0.3474 | -38.1654 |
| Optimal UI ($\pi = 1$) | 0.10 | 0.0295 | 0.1817 | 0.3149 | -38.3386 |
| Optimal UBI | 0.10 | 0.1153 | 0.1803 | 0.3081 | -38.3852 |
| Pure self-insurance | n-a | n-a | 0.1965 | 0.2710 | -38.8264 |
| **Scenario 4: $\lambda = 0.25$ and larger altruism $\eta = 0.3$** | | | | | |
| | $\theta$ or $\underline{\omega}$ | Tax rate | Assets | Child labor | Average welfare |
| Child labor ban | n-a | n-a | 16.4616 | 0 | -46.3302 |
| Optimal UI ($\pi \leq 0.5$) | 0.90 | 0.2147 | 0 | 0 | -32.9350 |
| Optimal UI ($\pi = 1$) | 0.70 | 0.1754 | 0.0726 | 0 | -33.5144 |
| Optimal UBI | 1 | 0.5659 | 1.5332 | 0 | -34.7729 |
| Pure self-insurance | n-a | n-a | 13.2275 | 0.0430 | -41.0914 |
| **Scenario 5: $\lambda = 0.25$ and smaller altruism $\eta = 0.8$** | | | | | |
| | $\theta$ or $\underline{\omega}$ | Tax rate | Assets | Child labor | Average welfare |
| Child labor ban | n-a | n-a | 16.1062 | 0 | -86.3173 |
| Optimal UI ($\pi \leq 0.2$) | 0.50 | 0.1319 | 0 | 0.2330 | -71.0935 |
| Optimal UI ($\pi = 0.5$) | 0.20 | 0.0573 | 1.1291 | 0.2330 | -72.9041 |
| Optimal UI ($\pi = 1$) | 0.10 | 0.0295 | 2.7725 | 0.2330 | -74.0411 |
| Optimal UBI | 0.10 | 0.1153 | 2.9678 | 0.2330 | -74.1546 |
| Pure self-insurance | n-a | n-a | 5.4184 | 0.2354 | -75.4365 |

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 $\pi$ or optimal UBI represent the level of generosity ($\theta$ 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

Base scenario: $\lambda = 0.25$ and $\eta = 0.5$

| UI ($\pi = 0.5$) | $\theta$ | Tax rate | Assets | Vol. unempl. | Child labor | Average welfare |
|---|---|---|---|---|---|---|
| | 0 | 0 | 10.1522 | 0 | 0.1056 | -53.6656 |
| | 0.10 | 0.0295 | 6.9589 | 0 | 0.1028 | -52.2513 |
| | 0.20 | 0.0573 | 4.7387 | 0 | 0.100 | -51.0665 |
| | 0.30 | 0.0835 | 3.2367 | 0 | 0.0983 | -50.0814 |
| | 0.40 | 0.1083 | 2.1373 | 0 | 0.0490 | -49.2173 |
| | 0.50 | 0.1319 | 1.0600 | 0 | 0 | -48.4095 |
| | 0.60 | 0.1542 | 0.2785 | 0 | 0 | -47.6959 |
| | 0.70 | 0.1754 | 0 | 0 | 0 | -47.1265 |
| | 0.80$^\star$ | 0.1955 | 0 | 0 | 0 | -46.8174 |
| | 0.90 | 0.2147 | 0 | 0 | 0 | -46.8333 |
| | 1 | 0.2364 | 0.1654 | 0.0143 | 0 | -47.3313 |

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

Base scenario: $\lambda = 0.25$ and $\eta = 0.5$

| UBI | $\underline{\omega}$ | Tax rate | Assets | Vol. unempl. | Child labor | Average welfare |
|---|---|---|---|---|---|---|
| | 0 | 0 | 10.1522 | 0 | 0.1056 | -53.6656 |
| | 0.10 | 0.1153 | 7.2091 | 0 | 0.1028 | -52.3656 |
| | 0.20 | 0.2068 | 5.3875 | 0 | 0.1008 | -51.4386 |
| | 0.30 | 0.2812 | 4.2061 | 0 | 0.0993 | -51.7445 |
| | 0.40 | 0.3428 | 3.4050 | 0 | 0.0989 | -50.2156 |
| | 0.50 | 0.3946 | 2.8568 | 0 | 0.0975 | -49.7997 |
| | 0.60 | 0.4389 | 2.4135 | 0 | 0.0656 | -49.4349 |
| | 0.70 | 0.4772 | 1.9965 | 0 | 0.0492 | -49.1278 |
| | 0.80 | 0.5105 | 1.6678 | 0 | 0.0325 | -48.8555 |
| | 0.90 | 0.5399 | 1.3533 | 0 | 0 | -48.6241 |
| | 1$^\star$ | 0.5659 | 1.0600 | 0 | 0 | -48.4095 |

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: Small vs large altruism and unemployment insurance

| | | | | | | |
|---|---|---|---|---|---|---|
| | | $\lambda = 0.25$ and small altruism $\eta = 0.8$ | | | | |
| UI ($\pi = 0.5$) | $\theta$ | Tax rate | Assets | Vol. unempl. | Child labor | Average welfare |
| | 0 | 0 | 5.4184 | 0 | 0.2354 | -75.4365 |
| | 0.10 | 0.0295 | 2.7725 | 0 | 0.2330 | -74.0410 |
| | 0.20* | 0.0573 | 1.1291 | 0 | 0.2330 | -72.9041 |
| | 0.30 | 0.1117 | 0.1792 | 0.2110 | 0.4441 | -73.9992 |
| | 0.40 | 1 | 0 | 0.7670 | 1 | -140.8931 |
| Child labor ban | | | | | | |
| | n-a | n-a | 16.1062 | 0 | 0 | -86.3173 |
| | | $\lambda = 0.25$ and large altruism $\eta = 0.3$ | | | | |
| UI ($\pi = 0.5$) | $\theta$ | Tax rate | Assets | Vol. unempl. | Child labor | Average welfare |
| | 0 | 0 | 13.2275 | 0 | 0.0430 | -41.0914 |
| | 0.10 | 0.0295 | 10.6909 | 0 | 0.0387 | -39.0224 |
| | 0.20 | 0.0573 | 7.9100 | 0 | 0.0186 | -37.7594 |
| | 0.30 | 0.0835 | 5.2566 | 0 | 0 | -36.6090 |
| | 0.40 | 0.1083 | 3.0555 | 0 | 0 | -35.6041 |
| | 0.50 | 0.1319 | 1.5332 | 0 | 0 | -34.7729 |
| | 0.60 | 0.1542 | 0.5753 | 0 | 0 | -34.0767 |
| | 0.70 | 0.1754 | 0.0726 | 0 | 0 | -33.5144 |
| | 0.80 | 0.1955 | 0 | 0 | 0 | -33.0828 |
| | 0.90* | 0.2147 | 0 | 0 | 0 | -32.9350 |
| | 1 | 0.2330 | 0.0150 | 0 | 0 | -33.0157 |
| Child labor ban | | | | | | |
| | n-a | n-a | 16.4616 | 0 | 0 | -46.3302 |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | $\eta = 0.5$ | | | |
| Ban with UI ($\pi \leq 0.5$) | $\theta$ | Tax rate | Assets | Vol. unempl. | Child labor | Average welfare |
| | *0* | *0* | *16.3580* | *0* | *0* | *-59.5382* |
| | *0.10* | *0.0295* | *11.8287* | *0* | *0* | *-53.2578* |
| | *0.20* | *0.0573* | *7.3936* | *0* | *0* | *-51.6559* |
| | *0.30* | *0.0835* | *4.4207* | *0* | *0* | *-50.3580* |
| | *0.40* | *0.1083* | *2.3871* | *0* | *0* | *-49.2929* |
| | 0.50 | 0.1319 | 1.0600 | 0 | 0 | -48.4095 |
| | 0.60 | 0.1542 | 0.2785 | 0 | 0 | -47.6959 |
| | 0.70 | 0.1754 | 0 | 0 | 0 | -47.1266 |
| | 0.80⋆ | 0.1955 | 0 | 0 | 0 | -46.8174 |
| | 0.90 | 0.2147 | 0 | 0 | 0 | -46.8333 |
| | | | $\eta = 0.5$ | | | |
| Ban with UBI | $\underline{\omega}$ | Tax rate | Assets | Vol. unempl. | Child labor | Average welfare |
| | *0* | *0* | *16.3580* | *0* | *0* | *-59.5382* |
| | *0.10* | *0.1153* | *12.3422* | *0* | *0* | *-53.4203* |
| | *0.20* | *0.2068* | *8.6690* | *0* | *0* | *-52.1505* |
| | *0.30* | *0.2812* | *6.3557* | *0* | *0* | *-51.2287* |
| | *0.40* | *0.3428* | *4.7779* | *0* | *0* | *-50.5292* |
| | *0.50* | *0.3946* | *3.6552* | *0* | *0* | *-49.9789* |
| | *0.60* | *0.4389* | *2.8287* | *0* | *0* | *-49.5369* |
| | *0.70* | *0.4772* | *2.2024* | *0* | *0* | *-49.1774* |
| | *0.80* | *0.5105* | *1.7254* | *0* | *0* | *-48.8765* |
| | 0.90 | 0.5399 | 1.3533 | 0 | 0 | -48.6241 |
| | 1⋆ | 0.5659 | 1.0600 | 0 | 0 | -48.4095 |

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. 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

| | | | | | | |
|---|---|---|---|---|---|---|
| | Base scenario: $\lambda = 0.25$ and $\eta = 0.5$ | | | | | |
| UI ($\pi \leq 0.5$) | $\theta$ | Tax rate | Assets | Vol. unempl. | Child labor | Average welfare |
| | 0 | 0 | 9.7511 | 0 | 0.1722 | -65.1972 |
| | 0.10 | 0.0537 | 7.0069 | 0 | 0.1604 | -62.8670 |
| | 0.20 | 0.1019 | 4.6926 | 0 | 0.1559 | -62.4318 |
| | 0.30 | 0.1455 | 3.1525 | 0 | 0.1540 | -60.3217 |
| | 0.40 | 0.1850 | 2.1597 | 0 | 0.1043 | -59.4407 |
| | 0.50 | 0.2210 | 1.2971 | 0 | 0.0522 | -58.6384 |
| | 0.60 | 0.2540 | 0.5239 | 0 | 0 | -57.9121 |
| | 0.70 | 0.2843 | 0.0831 | 0 | 0 | -57.3300 |
| | $0.80^{\star}$ | 0.3122 | 0 | 0 | 0 | -56.9594 |
| | 0.90 | 0.3380 | 0 | 0 | 0 | -56.9829 |
| Child labor ban | | | | | | |
| | n-a | n-a | 15.1134 | 0 | 0 | -76.4580 |

Note: In this experiment, adults are faced with substantially larger labor market risk than in the base scenario (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 $\star$. All statistics are aggregated from equilibrium households' decisions.

Table 9: U.S.-like labor market risks

| Base scenario: $\lambda = 0.25$ and $\eta = 0.5$ | | | | | | |
|---|---|---|---|---|---|---|
| UI ($\pi \leq 0.5$) | $\theta$ | Tax rate | Assets | Vol. unempl. | Child labor | Average welfare |
| | 0 | 0 | 2.3648 | 0 | 0.0073 | -38.0015 |
| | 0.10 | 0.0063 | 1.8384 | 0 | 0.0070 | -37.8915 |
| | 0.20 | 0.0126 | 1.4105 | 0 | 0.0068 | -37.7857 |
| | 0.30 | 0.0188 | 1.0619 | 0 | 0.0062 | -37.6865 |
| | 0.40 | 0.0249 | 0.7461 | 0 | 0 | -37.5950 |
| | 0.50 | 0.0309 | 0.4193 | 0 | 0 | -37.5113 |
| | 0.60 | 0.0369 | 0.1892 | 0 | 0 | -37.4288 |
| | 0.70 | 0.0428 | 0.0441 | 0 | 0 | -37.3551 |
| | 0.80 | 0.0486 | 0 | 0 | 0 | -37.2968 |
| | $0.90^{\star}$ | 0.0543 | 0.0062 | 0 | 0 | -37.2937 |
| | 1 | 0.0603 | 0.0338 | 0 | 0 | -37.3108 |
| Child labor ban | | | | | | |
| | n-a | n-a | 3.4441 | 0 | 0 | -38.0104 |

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 $\star$. All statistics are aggregated from equilibrium households' decisions.

Table 10: Symmetric risks

| | | | | | | |
|---|---|---|---|---|---|---|
| | Base scenario: $\lambda = 0.25$ and $\eta = 0.5$ | | | | | |
| UI ($\pi = 0$) | $\theta$ | Tax rate | Assets | Vol. unempl. | Child labor | Average welfare |
| | 0 | 0 | 13.8507 | 0 | 0.0813 | -54.6801 |
| | 0.10 | 0.0295 | 8.5943 | 0 | 0.0734 | -52.5971 |
| | 0.20 | 0.0573 | 5.5352 | 0 | 0.0693 | -51.2767 |
| | 0.30 | 0.0835 | 3.5529 | 0 | 0.0683 | -50.1739 |
| | 0.40 | 0.1083 | 2.1908 | 0 | 0.0368 | -49.2397 |
| | 0.50 | 0.1319 | 1.0600 | 0 | 0 | -48.4095 |
| | 0.60 | 0.1542 | 0.2784 | 0 | 0 | -47.6959 |
| | 0.70 | 0.1754 | 0 | 0 | 0 | -47.1263 |
| | 0.80$^{\star}$ | 0.1955 | 0 | 0 | 0 | -46.8169 |
| | 0.90 | 0.2147 | 0 | 0 | 0 | -46.8333 |
| | 1 | 0.2330 | 0.1115 | 0 | 0 | -46.9981 |
| Child labor ban | | | | | | |
| | n-a | n-a | 16.3579 | 0 | 0 | -59.5399 |

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 $\star$. All statistics are aggregated from equilibrium households' decisions.

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

| | | | | | |
|---|---|---|---|---|---|
| | Base scenario $\lambda = 0.25$ and $\eta = 0.5$ | | | | |
| | $\theta$ 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 | 1 | 0.5659 | 0.3329 | 0 | -47.0726 |
| Self-insurance | n-a | n-a | 8.4161 | 0.0791 | -52.0144 |

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: Conditional transfers and child labor

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Base scenario: $\lambda = 0.25$ and $\eta = 0.5$ | | | | |
| Conditional transfers | $\phi$ | Tax rate | Assets | Vol. unempl. | Child labor | Average welfare |
| | 0 | 0 | 10.1522 | 0 | 0.1056 | -53.6656 |
| | 0.10 | 0.1109 | 10.1894 | 0 | 0.0430 | -52.6779 |
| | 0.20 | 0.2068 | 8.6690 | 0 | 0 | -52.1505 |
| | 0.30 | 0.2812 | 6.3557 | 0 | 0 | -51.2287 |
| | 0.40 | 0.3428 | 4.7779 | 0 | 0 | -50.5292 |
| | 0.50 | 0.3946 | 3.6552 | 0 | 0 | -49.9789 |
| | 0.60 | 0.4389 | 2.8287 | 0 | 0 | -49.5369 |
| | 0.70 | 0.4772 | 2.2024 | 0 | 0 | -49.1774 |
| | 0.80 | 0.5105 | 1.7254 | 0 | 0 | -48.8765 |
| | 0.90 | 0.5399 | 1.3533 | 0 | 0 | -48.6241 |
| | $1^{\star}$ | 0.5659 | 1.0600 | 0 | 0 | -48.4095 |

Note: In the table, transfers $\phi$ are provided to parents whose child does not work. 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 level of transfer $\phi$ is identified with a $^{\star}$. All statistics are aggregated from equilibrium households' decisions.

Table 13: Alternative utility function

| | | | | | | |
|---|---|---|---|---|---|---|
| | | $\lambda = 0.25$, $\mu = 0.5$, share of adult consumption $\nu = 0.7$ | | | | |
| UI ($\pi \leq 0.5$) | $\theta$ | Tax rate | Assets | Vol. unempl. | Child labor | Average welfare |
| | 0 | 0 | 12.6588 | 0 | 0.0415 | -147.7544 |
| | 0.10 | 0.0295 | 9.5681 | 0 | 0.0390 | -145.0410 |
| | 0.20 | 0.0573 | 6.8393 | 0 | 0.0188 | -142.9489 |
| | 0.30 | 0.0835 | 4.2335 | 0 | 0 | -141.0439 |
| | 0.40 | 0.1083 | 2.2466 | 0 | 0 | -139.4149 |
| | 0.50 | 0.1319 | 0.9569 | 0 | 0 | -138.0764 |
| | 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.