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Child Labor: The Role of Income Variability and Credit Constraints Across Countries*

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ABSTRACT

This paper examines the relationship between child labor and access to credit at a cross-country level. Even though this link is theoretically central to child labor, so far there has been little work done to assess its importance empirically. We measure child labor as a country aggregate, and credit constraints are proxied by the extent of financial development. These two variables display a significant negative relationship, which is particularly strong in the sample of low income countries. We show this relationship to be robust to selection on observables (by controlling for a wide range of variables such as GDP per capita, urbanization, initial child labor, schooling, fertility, legal institutions, inequality, and openness), and to selection on unobservables (by allowing for fixed effects). Moreover, we find that, in the absence of developed financial markets, households appear to resort substantially to child labor in order to cope with income variability. This suggests that smoothing of income shocks is one of the channels through which financial development affects child labor and that, as a result, policies aimed at widening households' access to credit could be effective in reducing the extent of child labor.

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1. Introduction

Child labor has been a concern of policy since at least the 19th Century (see Basu (1999), Section 2.2), and the debate on which policies should be employed to reduce it – ranging from legislative bans on child labor, to trade sanctions against countries that use child labor, to schooling subsidies for children – is long-standing. As troubling as child labor is *per se*, it is essential to investigate its economic determinants in order to inform policy choices and identify their welfare implications.

The evidence and existing literature suggest a strong link between child labor and poverty (Krueger (1996)). In 1995 there were an estimated 120 million children engaged in full-time paid work (see ILO (1996)). In the same year, the incidence of child labor was 2.3% among countries in the upper quartile of GDP per capita, and 34% among countries in the lowest quartile of GDP per capita. If this link is causal and there are no market inefficiencies, we would expect promoting general economic development to reduce child labor. However, other mechanisms can also account for the observed relationship between child labor and poverty. In particular, market failures – which are arguably more common where poverty is widespread – or externalities might be the actual cause of child labor. For example, if private returns to education are lower than social returns, child labor can be inefficiently high. In this case, government intervention in the specific market where the inefficiency occurs is to be preferred (Grootaert and Kanbur, (1995)).

The work in this paper goes in this direction. In particular, we explore the nexus between child labor and one possible source of inefficiency – credit constraints. The basic intuition is that child labor creates a trade-off between current and future income. Putting children to work raises current family income, but by interfering with children's human capital development, it reduces future income. In this context, credit constraints can play an important role, by preventing households from optimally trading off current income against future returns. By entering the job market, a child immediately contributes to household income, but, to the extent that current work displaces schooling, this carries a future cost in terms of reduced earnings potential. Access to credit also

allows households to also smooth transitory earnings shocks without recourse to child labor.

Even though access to credit is central to child labor theoretically, there has been little work done to assess its importance empirically (see Brown, Deardorff, and Stern (2001)). In this paper, we pursue a cross-country strategy. We measure child labor as a country aggregate, and credit constraints are proxied by the extent of financial intermediation at the country level. These two variables display a strong negative (unconditional) relationship (see Figure 1). Of course, to determine the strength of the relationship we must control for other potentially important covariates. The existing literature on child labor provides some guidance. Most empirical studies on child labor suggest income is a crucial variable. Likewise, the literature suggests that schooling, fertility patterns, ruralization, and openness might also be important determinants of child labor.

Our results show a strong link between child labor and access to credit even after controlling for a range of other variable and using a range of estimation techniques. We also find that income variability has a sizeable, positive impact on child labor in countries where financial markets are underdeveloped, but this is not the case when financial markets are developed. This suggests that households resort to their children's work to cope with income shocks and that access to credit might effectively cut households' demands on children's time. We then focus on the subset of low-income countries – countries which have both less developed financial markets and a greater prevalence of child labor and, as such, are of greater policy interest. We find that the relationship between financial development and child labor is robustly and significantly negative, and sizeable. Moreover, this association persists after allowing for country fixed effects, suggesting that improvements in financial development are strongly associated with decreases in child labor within countries.

The cross-country strategy we pursue in this paper has a number of strengths. First, there is a substantial amount of variation in the prevalence of child labor across countries and over time. Moreover, much of this variation can be explained by factors (such as laws, institutions and openness) that inherently vary at the country level. Among these, is the extent of access to credit, which is itself influenced by a country's financial

institutions. Of course there is also significant within-country variation that is best understood using microeconometric evidence. However, in the absence of policy experiments, it is notoriously difficult to find satisfactory direct measures of access to credit directly at the disaggregated, household level. Furthermore, microeconometric findings are typically country-specific, while the evidence we present here has the advantage of representing trends that can be generalized to many countries and encompass a relatively long time span (1950 to 1995).

Though our approach has its strengths, we view our paper as being complementary to micro-data empirical work examining the relationship between credit constraints and child labor. Indeed, three such papers have been written subsequent to the present work (Beegle, Dehejia, and Gatti (2002), Edmonds (2002), and Guarcello et al., (2002)).

Our results are important for a number of reasons. First, we establish the empirical relevance of a significant strand of the theoretical literature on child labor by highlighting the significant negative relationship between the development of financial markets and child labor. Second, we show that this relationship holds even after controlling for a wide range of covariates which include income levels (usually identified as the major determinant of child labor) and for country fixed effects. Finally, our results clearly point to a policy mechanism – widening access to credit – that might help to alleviate the problem of child labor and that, to some extent, is independent of raising per capita income and solving the more complex problem of general economic development.

The paper is organized as follows. Section 2 reviews the relevant literature. Section 3 describes the data and presents our results. Section 4 examines the robustness of our results. Section 5 concludes.

2. Review of the Literature

The empirical literature on child labor is vast (see Brown, Deardorff, and Stern (2001)), and the more recent theoretical literature is also substantial (see Basu (1999)). In this section, we highlight the papers that are essential to our empirical strategy.

2.1 The Modeling Framework

Basu (1999) partitions the theoretical literature on child labor into two groups – papers that examine intra-household bargaining (between parents, or parents and children) and those that examine extra-household bargaining (where the household is a single unit and bargains with employers).

In the intra-household bargaining framework, child labor is the outcome of a bargaining process between members of the household, for example parents and children (see Bourguignon and Chiappori (1994) and Moehling (1995)) or the father and the mother (who is assumed to care for the children more than the father, see Galasso (1999)). The weight that each member receives can depend upon his or her contribution to the family's resources. Collectively, child labor may be desirable because it contributes to the family income, and it may be desirable to the child because it increases his or her weight in the family decision function. Within this framework the key variables are those that determine the relative bargaining strength of different members of the household. This could include wealth, the number, age, and gender of children, and earnings (wages) if an individual were to work (regardless of whether this is observed or not).

The extra-household bargaining framework considers each household as a unitary entity (see, amongst others, Becker (1964) and Gupta (1998)). The motivation behind this approach is that children's bargaining power is inherently very limited, so that parents determine to what extent a child works without necessarily considering the child's welfare.[1] The parents and the employer bargain about the child's wage and the fraction of that wage to be paid as food to the child. Within this framework the key variables are those that determine the relative bargaining strength of the household vis à vis the employer. These also include household wealth variables as well as access to credit.

[1] However, if parents are altruistic, they face a meaningful trade-off between the benefit of child labor and its cost. We will discuss this mechanism in detail in Section 2.2.

2.2 The Role of Access to Credit

The role of credit markets in determining the extent of child labor has been addressed by a recent strand of the theoretical literature (Parsons and Goldin (1989), Baland and Robinson (2000), Ranjan (1999, 2001) and Rosati and Tzannatos (2000)). Analytically, this question is closely related to the literature on bequests within altruistic, unitary models of the family à la Becker (1974). That literature has highlighted that the non-negativity constraint in bequests can lead to an inefficient allocation of resources within the family (see for example Becker and Murphy (1988)). In particular, if parents care about their children but bequests are at a corner, child labor is not generally efficient. The basic intuition is that child labor creates a trade-off between current and future income. Putting children to work raises current family income, but by interfering with children's human capital development, it reduces future income. This future income is, of course, realized by the children and not the parents. Thus, if there are positive bequests, parents can compensate themselves for foregone current income by reducing bequests. Conversely, if bequests are at a corner – which is more likely to occur for poorer households – parents will tend to draw on child labor too heavily.

Even if conditions exist for an efficient allocation of child labor from an intergenerational perspective (i.e., bequests are positive), parents might still choose an inefficiently high level of labor for their children if they cannot borrow to smooth their consumption over time, i.e. if the intragenerational allocation of resources is constrained. The following model, adapted from Baland and Robinson (2000), illustrates this point analytically.

Consider a two-period model where the parent and the child live contemporaneously. In each period the parent supplies labor inelastically, earning income A. In period 1, the parent decides how much to save for the following period, s, as well as the extent to which his child will work, $l_c \in [0,1]$. When working in period 1, the child earns l_c, which the parent can appropriate completely. In period 2, the child, now an adult, will supply one unit of labor, which will earn her an income of $h(1-l_c)$, where h is the human capital accumulated in period 1. $h(\cdot)$ is decreasing in l_c and is strictly concave, with $h(0)=1$.

We assume that the parent is altruistic. He cares about his own consumption in periods 1 and 2, c_p^1 and c_p^2 respectively, and, to the extent λ, about the child's utility. Because of altruism, in period 2 the parent might want to leave a bequest b to the child.

For simplicity, parental utility is additively separable and there is no intertemporal discount. The child is selfish and cares only about her own consumption c_c (for further simplicity, the child only consumes in period 2).

The parent's utility function is

$$W_p = u(c_p^1) + u(c_p^2) + \lambda W_c(c_c)$$

where $W_c(c_c)$ is the child's utility function and $u(\cdot)$ and $W_i(\cdot)$ are concave and well-behaved functions.

The parent's budget constraints in periods 1 and 2 are:

$$c_p^1 = A + l_c - s$$

and

$$c_p^2 = A - b + s\,.$$

The child's budget constraint is

$$c_c = h(1 - l_c) + b\,.$$

In order to illustrate how inefficiently high child labor might emerge if individuals cannot borrow, we focus on the case where bequests are positive but $s \geq 0$.[2] The first order conditions are as follows:

(1) with respect to b	$u'(c_p^2) = \lambda W_c^{'}(c_c)$	if $b>0$
(2) with respect to s	$u'(c_p^1) \geq u'(c_p^2)$	if $s \geq 0$
(3) with respect to l_c	$u'(c_p^1) = \lambda W_c^{'}(c_c) h'(1 - l_c)$	

In this setup, the chosen level of child labor is efficient when the marginal return to time spent in school equals its marginal cost (the opportunity cost of child labor). Here the return to education is $h(1 - l_c)$ and the opportunity cost of child labor is l_c. Efficient

[2] For simplicity, we allow only transfers from the parent to the child.

child labor is therefore defined by $h'(1-l_c)=1$. Conversely, child labor is inefficiently high if $h'(1-l_c)>1$. Baland and Robinson (2000) show that if *s=0* (i.e. if the borrowing constraint is actually binding), the parent will choose to make his child work too much. If in period 1 the parent wished he could borrow but cannot do so, his consumption will be lower and its marginal utility higher than optimal, $u'(c_p^1)>u'(c_p^2)$. Substituting for $u'(c_p^2)$ from (1) and $u'(c_p^1)$ from (3), it easily follows that $h'(1-l_c)>1$. Intuitively, if the parent cannot smooth consumption between period 1 and 2 through borrowing, he will use child labor to increase consumption in period 1 at the expense of his child's human capital accumulation.

This model suggests that the availability of credit should be a factor that predicts the incidence of child labor. Moreover, finding evidence of such an effect will imply that the child labor we observe is in fact inefficiently high. In the context of our cross-country work, we will use the degree of development of financial markets in a country as a measure of the credit constraints that individuals face.

2.3 Empirical Work

At the cross-country level, much work has gone into creating a uniform definition of child labor. Two significant efforts in this direction are Ashagrie (1993) and Grootaert and Kanbur (1995). These previous analyses are more concerned with measuring the extent of child labor than with estimating the effect of various country characteristics on the degree of child labor. More recently, there have been a number of studies examining the relationship between child labor and specific factors contributing to child labor. Krueger (1996) establishes a strong negative relationship between the prevalence of child labor and national income, a finding which is confirmed in the present study. Krueger also shows that there is little evidence (at least in the United States) that the support for banning imports made with child labor is linked to the potential benefits to domestic rent seekers (i.e., unskilled labor, who might benefit from such a ban). Cigno, Rosati, and Guarcello (2002) examine the relationship between globalization (trade) and child labor. Rogers and Swinnerton (2001) examine the relationship between income distribution and

child labor, arguing that increasing the equality of income distribution does not necessarily lead to reductions in child labor.

At the level of micro data, there is a range of empirical studies that examine the causes of child labor. In a recent volume, Grootaert and Patrinos (1999) review findings from Côte D'Ivoire, Colombia, Bolivia, and the Philippines. Other authors have examined child labor in Ghana (Canagarajah and Coulombe (1997)) and Vietnam (Edmonds and Pavcnik (2001)). A consistent finding is that child labor is associated with poverty. This, of course, is what we would anticipate, and it underlines the necessity of controlling for income in our empirical analysis. Among other determinants of child labor at the individual level are the child's age and gender, education and employment of the parents, and rural versus urban location. From this list, it is of course difficult at the aggregate level to control for household-specific attributes such as gender composition and age, but we can control for education and the degree of urbanization of a country.

Three recent papers, Beegle, Dehejia, and Gatti (2002), Edmunds (2002), and Guarcello et al. (2002), examine the link between credit constraints and child labor using micro data. All of these works find evidence for the role of credit constraints. As suggested in the introduction, we view the current paper as being complementary to these other papers as we are able to examine between-country variation and to address issues (such as the development of financial markets) that are not easily captured at the disaggregated level but that we can show to be relevant for child labor.

A related set of papers have examined the link between child labor and credit constraints indirectly. The literature on the causes of child labor has noted a link between household assets and child labor (see Grootaert and Patrinos (1999) and Brown, Deardorff, and Stern (2001)). To the extent that assets can serve as collateral for borrowing, this link suggests that access to credit might play a role. Of course, the evidence is indirect, and might also be picking up wealth effects. There are also papers that examine the link between credit and schooling choices. Jacoby and Skoufias (1997) examine the completeness of credit markets in a dataset of six Indian villages. They find that households are not fully able to insure themselves against unanticipated idiosyncratic income shocks and, as a result, reduce schooling. Jacoby (1994), using data from Peru, finds that children in households with lower levels of income and durable goods

(consequently, presumably with a lower access to credit) are more likely to repeat grades at school. Flug, Spilimbergo, and Wachtenheim (1998) examine the effect of financial development on schooling using cross-sectional country data, and find a negative and significant effect. These papers are complementary to the present study, because – as shown by Ravallion and Wodon (2000) for data from Bangladesh – schooling and child labor are not necessarily one-for-one substitutes.

3. Data, Specification, and Results

The availability of child labor data (see below) allows us to build a panel for 172 countries for the years 1950-60, 70, 80, 90, 95. For this dataset we first estimate a parsimonious specification where we control for some basic determinants of child labor. We then add to this specification our variable of interest (a proxy for the availability of credit within a country), and investigate whether access to credit is effective in dampening risk by adding to the specification a measure of income volatility. In the next section, we perform a number of robustness checks, which include estimating our specification without outliers, adding to the regression a number of other variables that, if not accounted for, might generate an omitted variable problem, and allowing for fixed effects.

3.1 Data Description

We measure the extent of child labor (CHILDLAB) as the percentage of the population in the 10-14-age range that is actively engaged in work. These data were compiled by the ILO and are available at ten-year intervals starting from 1950 for 172 countries. "Active population" includes people who worked (for wage or salary, in cash or in kind as well as for family unpaid work) for at least one hour during the reference period (ILO (1996)). The structure of the data does not allow us to infer the intensity of child labor, so that we cannot distinguish between light child work (that some might argue to be beneficial for adolescents) and full-time labor that might seriously conflict with human capital accumulation. Moreover, like most official data on child labor, these

data are likely to suffer from underreporting, as work by children is illegal or restricted by law in most countries and children are often employed in the informal sector. These problems notwithstanding, the ILO data has the advantage of being adjusted on a basis of the internationally accepted definitions, thereby allowing cross-countries comparisons over time (Ashagrie (1993)).

As a proxy for the absence of credit constraints we use the ratio of private credit issued by deposit-money banks to GDP (the variable CREDIT, which we refer to interchangeably as "access to credit" or "financial development"). This variable isolates credit issued to the private sector (as opposed to credit issued to governments and public enterprises) and captures the degree of activity of financial intermediaries that is most relevant to our investigation: the channeling of savings into lending (Beck, Demirguc-Kunt, and Levine (1999)). Indirect evidence suggests that financial development might be a good proxy for the extent of credit constraints faced by households in an economy. For example, using data on nearly 3,000 small- and medium-sized firms and 48 countries from the World Business Environment Survey dataset, Beck et al. (2002) show that financial development is negatively and significantly correlated with the degree of firms' financing constraints (a correlation of -0.20, significant at 1%).[3] As it is likely that small and medium enterprises face financing problems similar to those of households, this evidence lends support to our use of this proxy. Not surprisingly, financial development is also negatively correlated with the spread between lending and deposit rates, which is often interpreted as a measure of the cost of intermediation to households and firms (in our sample, the correlation is –0.24, significant at 5%).

We should point out that financial intermediation has an effect not only on households, but also on the producer side of the economy. As such our access to credit proxy embodies both of these effects, and can be interpreted more broadly as capturing the effect of financial development (see King and Levine (1993) and Rajan and Zingales (1998)). To the extent that improved access to credit might lead to an increased demand for child labor from firms, any negative relationship we uncover should be viewed as a

[3] More precisely, it is correlated with enterprise managers' perceptions about how large an obstacle financing issues are for their business. For more details, see Beck et al. (2002).

lower-bound estimate of the effect of financial development on the household supply of child labor.

Figures 1 to 3 depict the relationship between child labor and credit. Figure 1 displays the unconditional relationship. Figure 2 displays the evolution of credit and child labor. Figure 3 displays the correlation between first differences in child labor and credit; the negative relationship suggests that even within-country credit and child labor are negative related.

To proxy for economic volatility we follow Flug et al. (1999) and construct the standard deviation of annual per capita income growth rates in the previous 5 (and 10) years. We expect that more children enter the labor force when economic volatility is high, all the more so if financial institutions are underdeveloped and credit cannot be used by families to smooth consumption over time. The various specifications account for a number of other controls, including linear and squared log GDP per capita (LRGDPPC and LRGDPPC2), percentage of rural population (RURAL), continent dummies, share of imports (IMP) and exports (EXP) of GDP, fertility (FERTILITY), the ratification of the 1973 Geneva convention on child labor (RATIFY), origin of the legal system (LEGAL ORIGIN), and income inequality (GINI). All of the variables and their sources are described in the Appendix. In Section 4, we discuss in detail the possible bias that excluding each variable might generate in the estimated coefficient on credit. Tables 1 and 2 report averages of and correlations among the variables.

3.2 Basic Specification

The empirical literature on child labor uniformly indicates that income is the single most important household-level predictor of child labor (in general, the children of poor families are more likely to work). It seems reasonable to expect that income is an important determinant of child labor at the aggregate level as well. To control for this effect we include in our specification (the log of) per capita income and allow for linear and quadratic terms (LRGDPPC and LRGDPPC2).

Child labor is highly correlated over time. The correlation between child labor in 1950 and child labor in 1980 is around 0.9. Consequently it is important to control for

initial conditions, and we include the level of child labor in 1950 (CHILD50) in our specification. In some sense, including child labor in 1950 amounts to controlling for a country-specific effect, and purges to some extent the spurious cross-sectional correlation that is often problematic in cross-country regressions. (In Section 4.3 we address this issue more directly, by allowing for fixed effects.) We also include in the equation the percentage of rural population to control for the fact that in developing countries (and also historically in developed countries) child labor is strongly associated with agricultural work. Finally, we allow for a time trend.

The baseline specification is therefore:

Child labor$_{it}$ = f(constant, time trend$_t$, log real GDP per capita$_{it}$, log real GDP per capita$^2_{it}$, percentage of rural population$_{it}$, child labor in 1950$_i$).

We estimate the equation using OLS allowing for clustering at the country level. The results are reported in Table 3, column (1). Both income terms are highly significant, with child labor reaching a minimum at a per capita income of $2,891. As anticipated, initial child labor is highly significant. Rural population turns out to be significant only at the 10 per cent level. Finally, the time trend is negative and significant.

3.3 The Availability of Credit

We now introduce our measure of credit availability into the basic specification. The OLS results for the estimation in the full sample are presented in Table 3, column (2). Credit enters with the expected sign (negative – as the aggregate availability of credit increases, the prevalence of child labor decreases), and is statistically significant, even after controlling for income, initial child labor, rural population, and a time trend.

As a test of robustness we exclude outliers from the regressions. With 474 observations and 135 countries, extreme observations might in principle be quite influential. We employ the Hadi (1992) selection criterion for outliers in multivariate

regressions.[4] Four countries (Myanmar, Hong Kong, Switzerland, and Zaire) are identified as outliers in this context. We rerun the OLS specification without these outliers. For OLS the magnitude of the coefficient of credit increases by 30%, and the significance of the estimate is even stronger.

Our results confirm that the availability of credit – as proxied by financial development – plays a significant role in explaining child labor. However, there are several pathways through which this effect could operate, none of which is explicitly captured by the specifications considered so far. For example, access to credit obviously has an effect economic growth and long-run income, but by controlling for the level of GDP per capita, we are accounting for this effect to some extent. In Table 3, columns (4) to (6), we explore one possible mechanism – smoothing income shocks.

As outlined in Section 2, families might resort to sending their children to work to help cope with negative income shocks. If credit is widely available, households can instead borrow to smooth income variability and might not need to disrupt their children's education (or leisure time). When we introduce our measure of income volatility (SDGROW5, the standard deviation of annual GDP growth in the previous 5 years) into the specification, we see that the estimated coefficient is large and highly significant, suggesting that households indeed use child labor to cope with income volatility.[5] In principle, though, the variability of income should affect child labor mostly in those countries where credit is not accessible. To investigate this possible effect, we split the sample into high and low credit groups, using the mean or credit as the cutoff. In Table 3, column (5), we see that for the low credit group, income variability enters the specification significantly and the magnitude of the coefficient is substantial. Instead, for the high credit group (columns (6)), the effect of income volatility on child labor is small and not significantly different from zero.

The magnitude of the estimated coefficient on credit in the full sample is small, relative for example to the effect of GDP per capita. For the OLS estimates, a one standard deviation increase in access to credit is associated with a decrease of five per

[4] Hadi's (1992) technique is particularly useful to identify outliers in a multivariate regression setting and is based on a procedure that recursively defines distance of an observation from a cluster of observations in the model.

cent of a standard deviation in child labor. In contrast, the magnitude of the effect of GDP per capita is much larger. If a country were to move from the 5th to the 10th percentile of GDP per capita in 1995 (i.e., from $504 to $618), child labor would decrease by 3 percentage points, on a base prevalence of child labor of 39% for that level of income. In contrast, moving between the same percentiles of access to credit would lead only to a 0.1 percentage point decrease in child labor. However, as we will see below, the magnitude of the effect is much larger for the subsample of low-income countries. As well, it is plausibly easier to increase household access to credit than to induce general economic development, so it might be reasonable to consider larger increases in the level of access to credit.[6] For example, a move from the 25th to the 75th percentile of access to credit would bring about a one percentage point, or 7 percent, decrease in child labor.

In columns (7) and (8), we examine our results for the sub-samples of rich and poor countries (where we split the data by mean GDP per capita). This is a natural dimension along which to search for heterogeneity in the effect of credit. We would imagine the effect to be greater for poorer countries, where improvements in access to credit are presumably extending the basic infrastructure of financial markets. Instead the effect of access to credit in richer countries is presumably higher-order and less likely to affect households. This is confirmed by our results in Table 3, columns (7) and (8). The effect of credit is significant in both sub-samples, but is more than four times as large for the sample of poor countries (and one third the magnitude for the rich sample).[7]

Thus, for the countries of greatest policy interest – poorer countries, which have both a lower level of financial development and higher child labor – the magnitude of the effect of credit is five times larger than for the overall sample. A move from the 25th to the 75th percentile of credit is associated with a 5 percentage point decrease in child labor, or a 17 percent reduction in child labor among low-income countries. In our subsequent

[5] Results are virtually the same when instead of SDGROW5 we use SDGROW10, the standard deviation of annual GDP growth in the previous 10 years.

[6] More precisely, though it is also difficult to increase the level of financial development of a country, it is presumably easier to increase household access to credit, which is the underlying variable of interest, for example by targeting credit to poorer households with children.

[7] Splitting the sample by income levels inherently accounts for non-linearities in the relationship between income and child labor. Therefore we control for income linearly in the specifications run on the two sub-samples.

tables and discussion, we focus our attention on the low-income countries, since these are the countries of greatest interest with respect to child labor.

4. Robustness Checks

A significant concern regarding our results in Section 3 is whether the effect of credit availability on child labor reflects an actual link between the two variables or is instead driven by spurious or omitted factors. Because of the interrelatedness of macro-level variables, this is a typical concern with cross country regressions. To be able to rule out these potential problems, we extend the empirical framework in several directions to check for the robustness of our results. First, we consider the robustness of our results to implementing Tobit estimation. Second, we consider additional control variables (hence examine sensitivity to selection on observables). Third, we consider fixed-effects models (hence examine sensitivity to selection on unobservables).

4.1 The Mass Point at Zero Child Labor

One important feature of data on child labor is the presence of a substantial proportion of zeros. Of the 703 data points used in Table 3, column (1), over 20 percent are zero. The OLS assumption of linearity (and implicitly normality for the standard errors) might not be appropriate for this sample. Thus, we reestimate the specifications in Table 3 using a Tobit, which explicitly allows for a mass point in the distribution of the dependent variable.

In Table 4, column (1), we see that the sign and magnitude of the coefficients in basic specification is very similar to Table 3, column (1). Likewise, in column (2), the sign of the credit coefficients is the same as in Table 3, column (2), but the magnitude of the impact is doubled. In column (3), we see again that the coefficient is not at all sensitive to discarding outliers from the sample. In columns (4) to (6) we reexamine the impact of aggregate income volatility on child labor. For the full and low-credit samples the magnitude of the impact is essentially unchanged from Table 3, but for the high-credit countries, income volatility now contributes significantly (though at the 10 percent level)

to child labor. However, the coefficient for the standard deviation of income growth is much larger for low-income countries.

Finally, in columns (7) and (8) we consider the split-sample results. For the low-income countries, the Tobit results are virtually identical to OLS. This is not surprising, since so few of the observations are at the mass point. In contrast, for the high-income sample, the credit effect is much larger in magnitude.

4.2 Additional Controls

We now subject our result to a battery of additional controls. In particular, we focus on our results for the low-income sample, since this is the sample of greatest interest. Our interest is not to interpret the additional coefficients causally, since some of the variables we add are potentially endogenous with respect to child labor. The additional controls are intended instead to confirm that the significance of credit is not simply attributable to omitted variable bias. These estimates are reported in Table 5.

First, in order to control for systematic differences in the child labor intercept, we add continent dummies (Table 5, column (1)). The magnitude of the credit variable decreases only slightly, and remains significant at the 1 percent level. We retain continent dummies in all of our specifications in Table 5.

We then control for primary and secondary (female) school enrollment (Table 5, column (2)). The availability of education gives rise to an important inter-temporal trade-off in the time allocation of children. Time spent in schoolwork may displace time spent in work, but also creates a stream of future returns to education. Of course, schooling is not a full-time activity, so this tradeoff may not be very extreme – schooling and child labor might co-exist at the expense of leisure activities (see Ravallion and Wodon (2000)). For both primary and secondary schooling we find negative, albeit insignificant, effects. The magnitude of the credit effect is unchanged.

We next control for the level of fertility. Fertility is strongly tied to child labor. Larger, poorer families might need to send their children to work to help support the family. On the other hand, couples might want to have more children if they think that the children can bring a net increase in family income and if child labor is a widespread

phenomenon in their community. When fertility is included in the regression, the effect of fertility is positive and highly significant. The magnitude of the coefficient on credit in the OLS decreases somewhat, but remains significant at the 5 percent level. In column (4), when we control for both schooling and fertility, the former is insignificant and the latter significant. The credit coefficient is slightly smaller than column (1), but still significant at the 5 percent level.

A potential source of spurious correlation for the credit estimates are legal institutions, which both influence the development of financial intermediation and the enforcement of child labor laws. We proxy for this effect by including dummy variables that identify the historic origins – British, French, etc. – of the countries' legal systems. None of these dummies is significant, individually or jointly (column (5)). The credit effect is slightly larger, and still significant at the 1 percent level.

In order to control more directly for a country's commitment to fight against child labor, we include in the specification a dummy (RATIFY) indicating whether the country has ratified the 1973 ILO convention against child labor – also known as the Minimum Age Convention – which specifies fifteen years of age as the cutoff age for participating in economic activity.[8] Note that only 93 out of the 207 countries originally in our sample have ratified the convention (the US, for example, is not a signatory to the convention). When RATIFY is included in the regression, the magnitude and significance of the credit variable is virtually unchanged. The RATIFY dummy is insignificant.

We also consider variables measuring the openness of the economy (exports and exports-plus-imports as percentages of GDP). If "all good things go together", the prevalence of child labor might simply reflect openness of the economies, while, at the same time, more open countries might also be those with more developed financial markets. Moreover, recent microeconomic evidence from Vietnam suggests that "greater market integration appears to be associated with less child labor" (Edmonds and Pavcnik (2001)). Interestingly, the coefficients on import and export shares, though negative, are not significant. The credit variable remains significant in both sets of estimates.

The degree of income inequality (as measured by the Gini coefficient) is a potentially important source of spurious correlation in the regression (for example, the

[8] Convention concerning Minimum Age for Admission to Employment no.138, 1973, ILO, Geneva.

correlation table highlights that the Gini coefficient displays a significant unconditional correlation with both child labor and credit). The Gini coefficient enters the regression negatively and significantly. The estimated credit effect is on average larger than in column (1) and significant at the 1 per cent level.

Finally, we consider a full set of controls simultaneously: continent and legal origin dummies, fertility, import and export share, and ratification of the ILO convention. We exclude the schooling variables, since they are insignificant in the presence of a fertility control, and the Gini coefficient, since this is available only for a small set of countries. The credit coefficient remains robust in magnitude and significance.

4.3 Selection on Unobservables

In this section we examine the sensitivity of our estimates to the possibility of selection on unobservables. Because of the panel-data structure of the dataset, we can control for selection on unobservables by including in our linear regression model fixed effects, that allow us to control for time-invariant selection effects (Table 6). The results, of course, remain exposed to time-varying omitted variables.

When introducing country and year fixed-effects, the magnitude of estimated coefficient of credit smaller (column (1)). However, the effect of credit remains significant at the 5 percent level. In contrast, the effect of log GNP per capita is now greatly diminished in magnitude and statistical significance: it is one tenth of the OLS estimate in Table 3, column (7). A shift from the 25^{th} to the 75^{th} percentile of credit would lead to a six percent decrease in child labor, whereas the corresponding shift for GDP per capita would lead only to a two percent decrease in child labor.

When we include additional time varying controls such as fertility, export and export-plus-import share, and individually and simultaneously, the magnitude of the coefficient remains similar to column (1). The fact that the level of statistical significant decreases (to the 10% level) is not, inherently, very surprising, given that we are allowing for country and year fixed effects for a sample of less than 80 countries with at most 5 data points each.

5. Conclusion

In this paper we have investigated the relationship between child labor and access to credit across countries. The theoretical literature has highlighted the importance of this relationship, suggesting that, in presence of credit constraints, (inefficiently high) child labor might arise whenever parents are prevented from trading off resources intertemporally. Our empirical results confirm the existence of a significant association between child labor and the share of private credit issued by banks to GDP, which we interpret as a proxy of access to credit. This relationship is particularly large, robust, and significant in the sample of poor countries, which have both less developed financial markets and greater child labor and, as such, are of greater policy interest. We also provide evidence that strong financial markets dampen the impact of income variability on child labor, which would otherwise be sizeable.

As with most work on cross-country data, caution must be used in interpreting the estimated coefficients causally. There are many potential sources of spurious correlation and selection. We subjected our result to a wide array of robustness checks, including adding a range of controls (linear and squared income, share of rural population, continent dummies, fertility, primary and secondary school enrollment, import and exports shares, and ratification of the 1973 ILO convention on child labor), and considering fixed effects. The relationship remains strong under all of these alternatives.

These results are important for two reasons. First, they lend empirical support to the recent strand of the theoretical literature that highlights the role of credit constraints in determining child labor. Second, they open an important policy window on alleviating the problem of child labor. In this context, increasing household access to credit can be an effective tool in reducing the extent of child labor, and has distinct advantages over other remedies. Compared to legal restrictions and direct bans, it can decrease child labor without lowering household welfare, and it is arguably simpler and can have a more immediate impact than general economic development.

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APPENDIX: Data Description and Sources

CHILDLABOR	Share of the active population between age 10 and 14 over total population between 10 and 14. Active population includes people who, during the reference period, performed "some work" for wage or salary, in cash or in kind. The notion of "some work" is interpreted as work for at least 1 hour during the reference period. Source: ILO.
CREDIT	Private credit by deposit money banks to GDP. Source: Beck, Demirguc-Kunt and Levine (1999).
Ln(GDPPC)	Natural logarithm of real GDP per capita in constant dollars, chain Index, expressed in international prices, base 1985. Source: Summers-Heston, years 1960-1990.
RURAL	Rural population, as % of total population. Source: World Development Indicators, World Bank.
SDGROW5	Standard deviation of per capita GDP growth over the previous 5 years.
SCH_PRIF	Gross primary female school enrollment (%). Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Source: World Development Indicators, World Bank.
SCH_SECF	Gross secondary female school enrollment (%). Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Source: World Development Indicators, World Bank.
FERT	Fertility rate, total births per woman. Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with prevailing age-specific fertility rates. Source: World Development Indicators, World Bank.
EXP	Share of exports on GDP. Source: World Development Indicators, World Bank.

IMP	Share of imports on GDP. Source: World Development Indicators, World Bank.
RATIFY	Dummy variable taking value of 1 if a country has ratified the ILO's Minimum Age convention (Convention no.138, ILO, Geneva, 1973).
LEGAL ORIGIN	Origin of a country's legal system. These dummies classify the legal origin of the Company Law or of Commercial Code of each country. The identified origins are five: (1) English Common Law; (2) French Commercial Code; (3) German Commercial Code; (4) Scandinavian Commercial Code; (5) Socialist/Communist laws. Source: La Porta et al. (1998), extended from "Foreign Laws: Current Sources of Basic Legislation in Jurisdictions of the World" and *CIA World Factbook*.
GINI	Ten-year average of the Gini coefficient over the period (e.g. 1960 is the average of 1951-1960; 1970 is the average of 1961-1970, etc.). Source: Deininger and Squire (1996).

Figure 1: Child Labor and Access to Credit

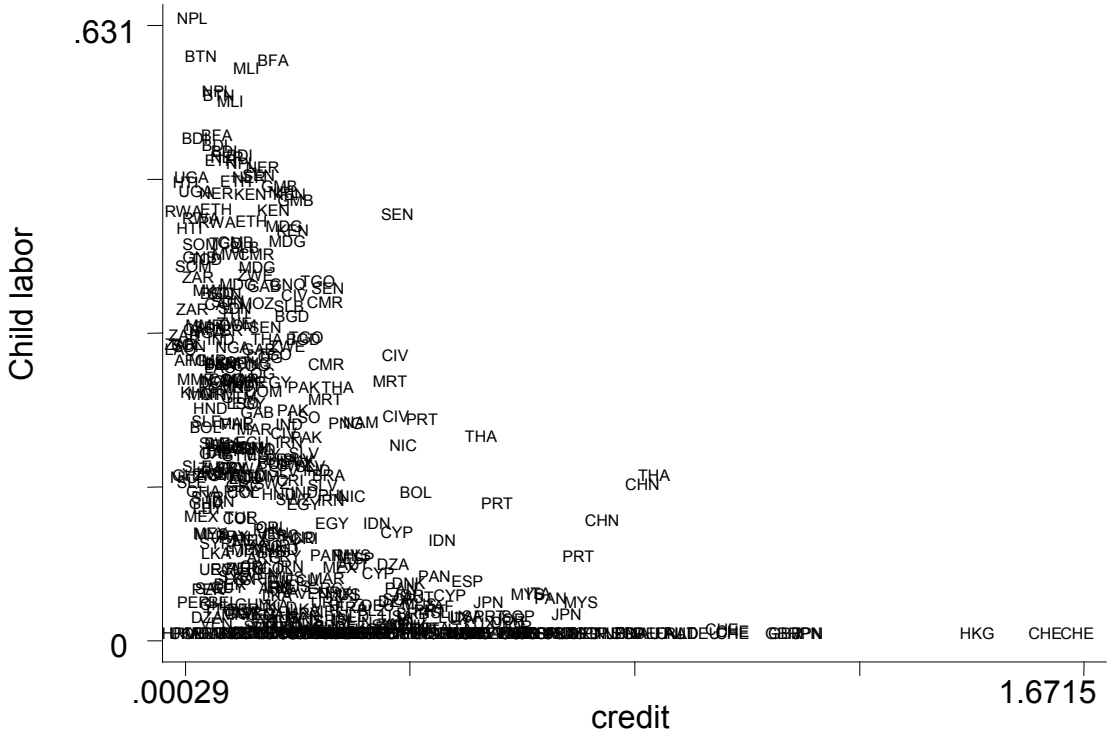

Figure 2: Child labor and access to credit over time

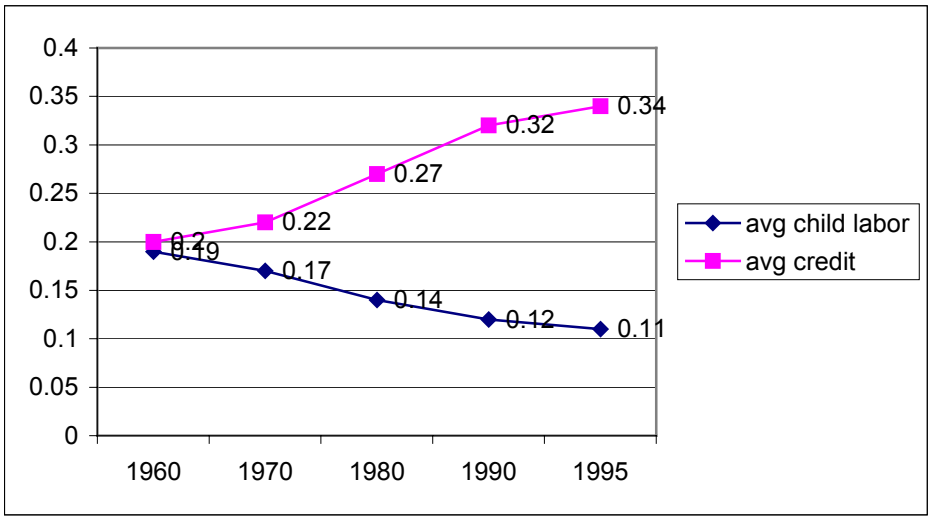

Figure 3: First difference in child labor vs. first difference in credit

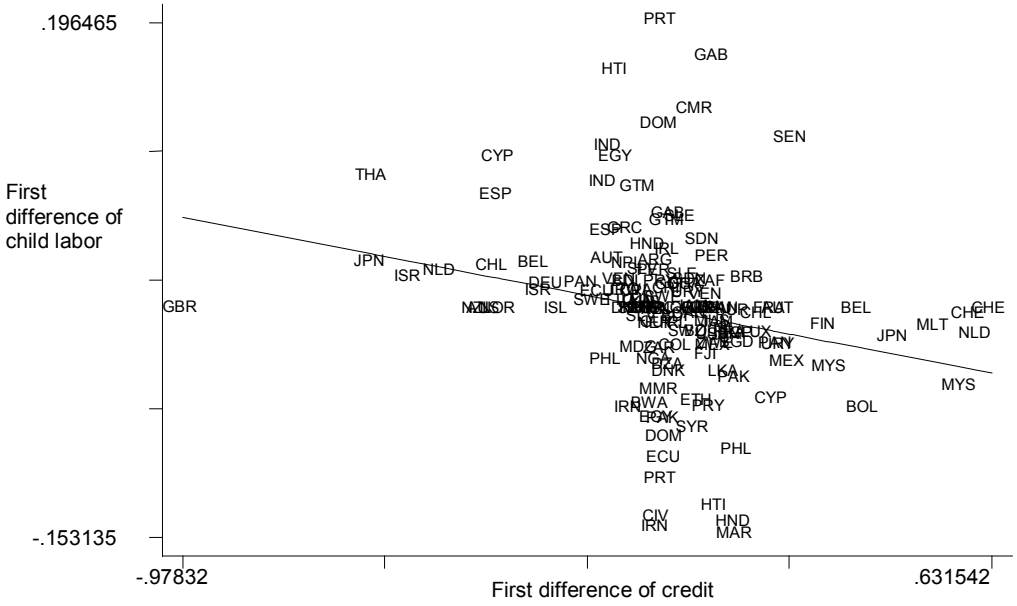

Table 1: Data Description

Variable	Observations	Mean	Std. Dev.	Min.	Max.
Child labor	860	0.15	0.17	0	0.79
Credit	482	0.28	0.25	0.00029	1.67
Standard deviation of income growth	631	0.04	0.04	0.00059	0.79
log real GDP per capita	705	7.76	1.06	5.41	10.58
Percent rural population	857	54.58	24.94	0	98.2
Share of exports of GDP	630	32.6	24.38	1.19	215.38
Share of imports of GDP	634	37.27	24.74	1.9	223.65
Primary female school enrolment	654	81.19	32.84	0.6	170.9
Secondary female school enrolment	639	43.57	35.5	0	151.3
Gini coefficient	302	39.22	10.11	19.5	62.87

Table 2: Correlations Among the Variables

Variable	CHILD LABOR	CREDIT	SDGROW5	LRGDPPC	RURAL	EXP	IMP	SCH_PRIF	SCH_PRIF	GINI	FERTILITY
Child labor	1										
Credit	-0.46	1									
Standard deviation of income growth	0.16	-0.27	1								
log real GDP per capita	-0.81	0.62	-0.23	1							
Percent rural population	0.75	-0.45	0.13	-0.82	1						
Export share of GDP	-0.24	0.14	0.16	0.18	-0.27	1					
Import share of GDP	-0.13	0.07	0.14	0.03	-0.11	0.9	1				
Primary female school enrolment	-0.49	0.23	0.06	0.48	-0.34	0.15	0.08	1			
Secondary female school enrolment	-0.78	0.57	-0.22	0.84	-0.71	0.13	0.01	0.48	1		
Gini coefficient	0.31	-0.33	0.31	-0.38	0.26	0.04	0.11	0.11	-0.46	1	
Fertility	0.81	-0.5396	0.1952	-0.8433	0.6710	-0.1746	-0.0299	-0.5618	-0.8370	0.4523	1.0000

Table 3: Base Specification (dependent variable: child labor)

Variables	Basic	with CREDIT	excluding outliers	Including income variability	low CREDIT	high CREDIT	Low income	High income
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Credit		-0.033**	-0.044***	-0.032*			-0.15***	-0.014
		(0.017)	(0.018)	(0.018)			(0.056)	(0.011)
Standard deviation of growth				0.19***	0.21***	0.016		
				(0.073)	(0.075)	(0.033)		
log real GDP per capita	-0.32***	-0.40***	-0.44***	-0.40***	-0.27***	-0.48***	-0.037***	-0.006
	(0.043)	(0.058)	(0.052)	(0.056)	(0.061)	(0.058)	(0.012)	(0.009)
log real GDP per capita^2	0.019***	0.024***	0.026***	0.024***	0.017***	0.028***		
	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)		
Percent rural population	2.25e-04	3.66e-04*	3.20e-04	3.74e-04*	5.79e-04**	1.88e-04	8.08e-04	1.22e-04
	(1.82e-04)	(2.18e-04)	(2.16e-04)	(2.17e-04)	(2.88e-04)	(2.46e-04)	(5.20e-04)	(1.94e-04)
Child labor in 1950	0.69***	0.63***	0.62***	0.64***	0.72***	0.60***	0.74***	0.43***
	(0.030)	(0.042)	(0.042)	(0.045)	(0.035)	(0.054)	(0.049)	(0.077)
Year trend	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.001***
	(1.86e-04)	(1.82e-04)	(1.78e-04)	(1.96e-04)	(2.04e-04)	(3.05e-04)	(2.94e-04)	(2.43e-04)
N	703	474	469	703	301	303	209	265
R^2	0.93	0.92	0.92	0.92	0.93	0.93	0.88	0.67

Notes: Standard errors in parentheses. Standard errors are corrected for heteroscedasticity and clustering within countries. *,**, and *** represent significance at the 10, 5, and 1 percent levels.

Table 4: Tobit Specification (dependent variable: child labor)

Variables	Basic	with CREDIT	excluding outliers	Including income variability	low CREDIT	high CREDIT	Low income	High income
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Credit		-0.077***	-0.076***	-0.080***			-0.14***	-0.058***
		(0.026)	(0.026)	(0.027)			(0.059)	(0.022)
Standard deviation of growth				0.20***	0.19***	0.069*		
				(0.074)	(0.077)	(0.038)		
log real GDP per capita	-0.17***	-0.21***	-0.24***	-0.20***	-0.20***	-0.29***	-0.036	-0.030
	(0.042)	(0.061)	(0.059)	(0.060)	(0.064)	(0.048)	(0.20)	(0.30)
log real GDP per capita^2	0.008***	0.011***	0.013***	0.011***	0.012***	0.016***		
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)		
Percent rural population	6.42e-05	3.28e-04	3.09e-04	3.15e-04	4.31e-04	1.82e-04	8.74e-04*	2.02e-04
	(2.19e-04)	(2.62e-04)	(2.60e-04)	(2.60e-04)	(2.99e-04)	(3.36e-04)	(5.12e-04)	(2.74e-04)
Child labor in 1950	0.77***	0.69***	0.69***	0.69***	0.75***	0.67***	0.75***	0.54***
	(0.028)	(0.038)	(0.038)	(0.039)	(0.036)	(0.049)	(0.051)	(0.068)
Year trend	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.003***	-0.002***	-0.003***
	(2.14e-04)	(2.25e-04)	(2.23e-04)	(2.28e-04)	(2.17e-04)	(3.65e-04)	(2.99e-04)	(3.60e-04)
N	703	474	469	457	301	303	209	265
Obs. with child labor=0	152	107	104	96	21	92	4	103

Notes: Standard errors in parentheses. Standard errors are corrected for heteroscedasticity and clustering within countries. *,**, and *** represent significance at the 10, 5, and 1 percent levels. Marginal coefficients are reported for Tobit estimates.

Table 5: Robustness Checks (OLS, dependent variable: child labor)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Credit	-0.13***	-0.13**	-0.10**	-0.11**	-0.16***	-0.13**	-0.13**	-0.19***	-0.14***	-0.13**
	(0.056)	(0.058)	(0.051)	(0.050)	(0.055)	(0.059)	(0.060)	(0.048)	(0.057)	(0.056)
log real GDP per capita	-0.022	-0.027*	-0.019	-0.028*	-0.005	-0.020	-0.018	-0.041**	-0.021	-0.002
	(0.016)	(0.016)	(0.015)	(0.016)	(0.015)	(0.017)	(0.016)	(0.020)	(0.016)	(0.014)
Percent rural population	0.001*	8.34e-04	0.001**	9.71e-04*	0.002***	0.001*	0.001**	0.001*	0.001*	0.002***
	(5.65e-04)	(6.08e-04)	(5.30e-04)	(5.40e-04)	(4.87e-04)	(5.82e-04)	(5.75e-04)	(5.25e-04)	(5.58e-04)	(4.88e-04)
Child labor in 1950	0.71***	0.68***	0.67***	0.66***	0.67***	0.71***	0.71***	0.66***	0.71***	0.64***
	(0.049)	(0.059)	(0.046)	(0.054)	(0.052)	(0.051)	(0.052)	(0.057)	(0.051)	(0.049)
Primary female school		-2.31e-04		-1.72e-04						
		(2.65e-04)		(2.64e-04)						
Secondary female school		-2.58e-04		9.84e-05						
		(3.13e-04)		(3.62e-04)						
Fertility			0.011***	0.013**						0.012***
			(0.005)	(0.006)						(0.005)
Export share of GDP						-1.38e-04				-2.52e-04
						(2.61e-04)				(4.14e-04)
Export + Import share of GDP							-1.40e-04			
							(1.71e-04)			
Gini coefficient								-0.002***		
								(8.59e-04)		
Ratified ILO Convention									0.011	0.011
									(0.011)	(0.011)
Region dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Legal origin dummies	no	no	no	no	yes	no	no	no	no	yes
N	209	175	207	174	209	201	201	84	201	199
R^2	0.90	0.91	0.8979	0.91	0.90	0.89	0.89	0.89	0.91	0.90

Notes: Standard errors in parentheses. Standard errors are corrected for heteroscedasticity and clustering within countries. *,**, and *** represent significance at the 10, 5, and 1 percent levels.

Table 6: Fixed-Effects Models

Variable				
	(1)	(2)	(3)	(4)
Credit	-0.067**	-0.067**	-0.059*	-0.057*
	(0.031)	(0.031)	(0.032)	(0.032)
log real GDP per capita	-0.006	-0.006	-0.006	-0.008
	(0.010)	(0.010)	(0.010)	(0.011)
Percent rural population	8.50e-04	8.54e-04		9.51e-04
	(5.66e-04)	(5.74e-04)		(5.87e-04)
Fertility		6.96e-04	9.13e-04	-0.001
		(0.004)	(5.83e-04)	(0.004)
Export share of GDP			-1.97e-04	
			(3.08e-04)	
Export + Import share of GDP				-9.21e-05
				(1.52e-04)
Year dummies	Yes	Yes	Yes	Yes
N	209	207	201	199
R^2	0.98	0.98	0.98	0.97

Notes: Standard errors in parentheses. *,**, and *** represent significance at the 10, 5, and 1 percent levels.