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The Effects of Industrialization on Education and Youth Labor in Indonesia

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Abstract

This study examines the relationship between growth in manufacturing employment and youth outcomes in Indonesia from 1985 to 1995, a time of rapid industrialization. In comparison with cross-national studies, this study has a larger sample size of regions, defines data more consistently, and conducts better checks for causality and specification. We also distinguish between the effects of manufacturing employment in the region and in the household and explore potential causal mechanisms underlying the observed correlations. Overall, manufacturing employment in the region modestly increases enrollment and decreases labor force participation for male and female young teens. At the household level, employment of adult females in manufacturing is associated with lower enrollment and higher labor force participation for young women relative to young men.

KEYWORDS: Education, Industrialization, Child labor, Indonesia

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From Adam Smith (1776) and Marx and Engels (1848) in centuries past to the "Washington Consensus" of the 1980s and 1990s (Williamson 1990), many analysts have made the case that industrialization brings "development." The implicit assumption is that industrialization improves a nation's well-being along a number of dimensions, including educational quality and attainment. At the same time, Smith, Marx, and the originator of the term "Washington Consensus" (Williamson 1999) have warned of the potential downside of industrialization, including increased pollution, growing inequality, and lower social cohesion. Some concerns focus specifically on how industrialization can reduce investments in youth: industrialization may reduce school enrollments by drawing youth into factory work or by increasing the need for youth to help in the home.

The most encouraging evidence of the effect of industrialization on education is that, on average, those nations with high GDP and those that have largely completed the shift from agriculture to industry have healthier and better-educated children. But it is difficult to be sure of the causality in these correlations. For example, nations with above-average increases in GDP per capita from 1960 to 1990 did not enjoy above-average increases in enrollment (Easterly 1999).[1] Similarly, the process of industrialization often, though not always, reduced child health (Steckel and Floud 1997: 425). Many authors have posited that industrialization initially increases child labor, even if later industrialization reduces child employment (e.g., Hindman 2002). Apparently, sometimes industrialization has brought more "dark Satanic mills" than good jobs that increase family incomes.

While cross-national studies are the basis for most social scientists' understanding of how industrialization and development interact, they have a familiar set of problems: sample sizes are modest; variations in data sources and data collection methods across countries can lead to incomparable and unreliable results; results are often sensitive to variations in specifications; and the studies often examine partial correlations of growth and education without examining the causal channels that link them. Given that the cross-sectional evidence suggests industrialization is correlated with enrollment and the cross-national time series evidence does not find a relationship between economic growth and enrollment, it is crucial to perform studies that look at the relationship more closely and with new sources of data. This is the first study to use data from a large nation to examine the relationship between industrialization and education.

We use Indonesian individual-level data for 1985 and 1995 to examine the relationship between industrialization and investments in children, specifically school enrollment. We examine the effects of both district-level and household-level manufacturing employment. In addition to school enrollment, we also

[1] See Bils and Klenow (2000) for a careful examination of the causality underlying the correlation between education and economic growth.

examine labor force participation and household responsibilities for youth. As in other studies of sub-national regions within a country (e.g., Barro and Sala-i-Martin in the United States (1992a) and in Japan (1992b); and Murthi, Guio, and Dreze (1995) in India), this strategy provides a number of advantages. We employ a large sample of individual- and household-level survey data from 274 districts (districts are larger than counties in the United States but smaller than states).

The uniformity of data collection across the surveys, all conducted by Indonesia's Central Bureau of Statistics (BPS), makes it possible to compare data across time and space. In addition, we check that our results are robust to a number of variations in specification. Finally, economic theory suggests that manufacturing growth will affect enrollment because it affects the costs and benefits of education. We examine potential causal channels to identify which, if any, contribute to the overall relationship between manufacturing employment and enrollments that we observe.

Offsetting these strengths are the limitations of examining a single nation over a single decade, issues we return to below. Just as studies of industrialization in Great Britain or the United States are case studies of industrialization in general, this study provides a data-rich case study of the effects of industrialization on Indonesian investments in children's human capital.

We find that at the district level, growth in manufacturing employment is associated with overall higher enrollment and lower labor force participation for young male and female teens. For male youth, this effect was largely associated with rising adult male, as opposed to female, employment in manufacturing. At the household level, however, the employment of adult females in manufacturing is associated with lower enrollments, higher labor force participation, and more household responsibilities for young female teens relative to young male teens. Lower transport costs to school due to better road quality, higher school density, and urbanization, as well as higher household consumption, all appear to explain a portion of the observed benefits of manufacturing.

The Setting

From 1967 to 1997, Indonesia was one of the world's economic success stories, with real per capita GDP growth averaging 4.8 percent per year. The number of people living on 1 dollar a day dropped from 87.2 million in 1970 to 21.9 million in 1995 (World Bank 1999, exchange rates at purchasing power parity). Other indicators of development showed great progress as well: literacy rates rose, immunization rates rose, and infant mortality declined.

We study the period 1985 to 1995, a period of rapid industrialization just preceding the 1997–1998 financial crisis. This rapid growth makes Indonesia a natural case study of the effects of industrialization. Measured in absolute terms,

manufacturing employment more than doubled in this decade. As a percent of the labor force, manufacturing employment rose from 9 to 13 percent. Much of this manufacturing was concentrated near Jakarta, though there was rapid growth in each of the main regions of Indonesia (see Figure 1). The rise of manufacturing employment was part of the broader shift in the Indonesian economy, with agriculture falling from 52 to 41% of the labor force, while construction (growing from 3.7 to 5.1 percent) and services (growing from 19 to 23 percent) joined manufacturing as growth sectors. At the same time, after increasing for a generation, enrollments for teens largely stagnated: remaining constant for males age 13-15 and females age 16-17, rising only modestly for females age 13-15, and falling slightly for males age 16-17.

Schooling in Indonesia is formally free, although families must often pay for uniforms, books, and various fees. While most schools are secular, some private and publicly funded schools have a largely Islamic curriculum. However, the centralization of education funding during this period also has important implications for generalizing these results. During this period, almost all taxes were routed through Jakarta. Thus, prosperous regions did not have the option of collecting high tax revenues and expanding public services. Instead, funding was distributed to provinces and then to districts within provinces based on a complex set of budgetary rules (Gertler and Molyneaux 1994). Nationalized public finance may attenuate the relation between local economic development and enrollment that would show up across nations or in a less centralized nation (which Indonesia is becoming).[2]

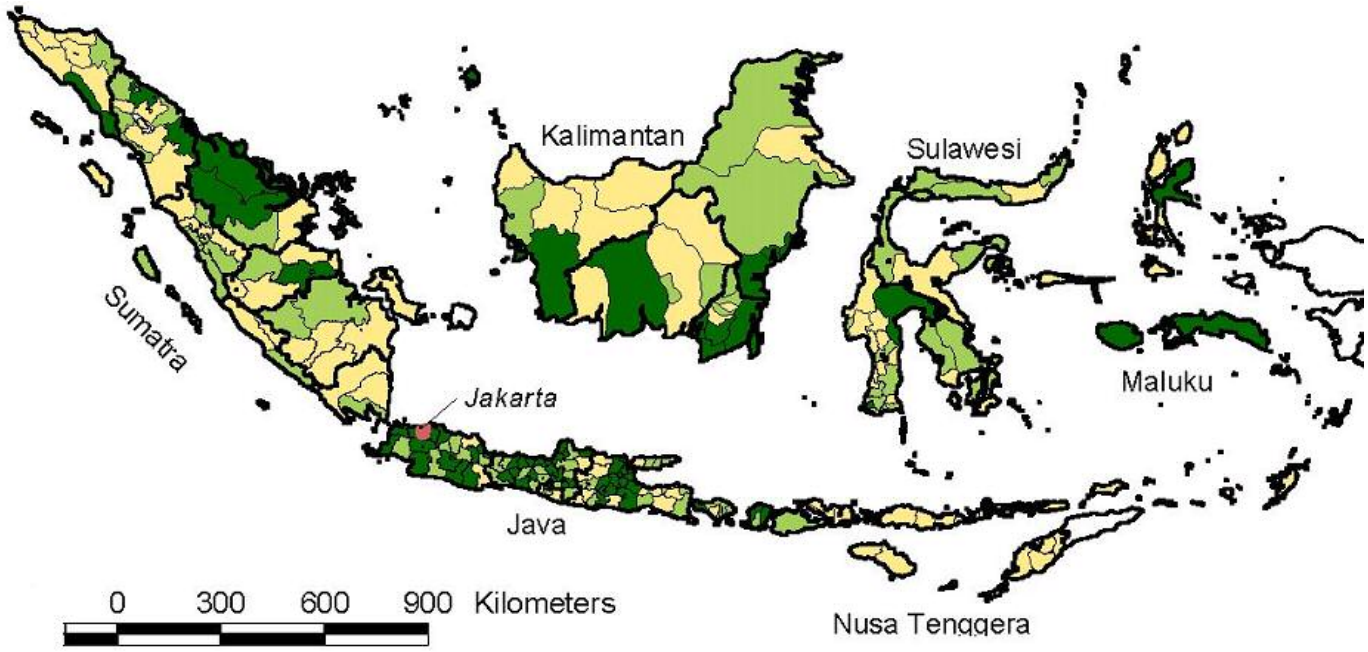
Methods

Our basic methodology is to predict individual-level outcomes using time-varying district characteristics (such as percent manufacturing), year effects, and district fixed effects. Including district fixed effects in a two-period panel is similar to measuring the effects of changes in the percent manufacturing, holding constant all fixed factors in the region. We seek to determine how manufacturing employment in the district and household is related to the youth outcomes of school enrollment, youth employment, and household responsibilities.

A first specification assumes that school enrollment of a child in household i in district d at time t depends on the presence of manufacturing employment in the district ($\%manufacturing_{dt}$), predetermined attributes of the parents (such as parental education, X_{idt}), and a random error (ε). If we assume the model is linear and the important district characteristics are constant over

[2] Industrialization might be particularly harmful to children in a decentralized setting if regions bid for factories, at the expense of investments in children. Figlio and Blonigen find support for such costly bidding in the competition among states in the United States (2000).

Figure 1: Industrial development in Indonesia, 1985-1995[3]



[3] Change in the proportion of manufacturing workers 1985 to 1995 among population aged 16-60 years, district averages, SUPAS. Light gray denotes the bottom third of districts in terms of industrialization, gray denotes the middle third of districts, and dark gray denotes the top third of districts. The white areas on the map – East Timor and Irian Jaya – are excluded from the analysis.

time, we can eliminate all bias from unobserved district characteristics by adding a vector of district fixed effects (***District$_d$***). For example, if good ports, raw materials, or dense schools influence both where factories locate and enrollment decisions, the stable portion of these regional characteristics will be absorbed by the district fixed effects.

$$Enrollment_{idt} = \alpha + \beta_1 \% \; total\ manufacturing_{dt} + \beta_2 \% \; female\ manufacturing_{dt} + \delta X_{idt} + \mathbf{District_d} + \phi \text{Year} + \varepsilon_{idt} \quad (1)$$

Migration may lead to problems in that factories attract a non-random set of migrants. For example, in Indonesia young people and those with above-average education are more likely to migrate to regions with new factories than are others (Miguel, Levine, and Gertler 2002). Thus, we analyze the manufacturing share in the child's birth district. Because our children are all 13 or older, the identity of this district is determined before the 10-year period we study; as such, it is not affected by later changes in manufacturing employment. As discussed further below, we check all results by re-running analyses once with district-level characteristics coded by the current district and including only those youth still living in their district of birth.

It is unclear which family characteristics might be affected by industrialization. We first control for only predetermined characteristics such as parental education and truly random characteristics such as the share of children that are male.[4] In later runs we examine how industrialization correlates with the size and age composition of the household. We then examine how controlling for these richer measures of family structure affects estimation of equation (1).

Reverse causality

Additional problems arise because factories do not locate at random. Appendix Table 1 provides evidence that other variables that may lead to increased enrollment, such as Esther Duflo's measure of school building in the previous generation (2001), road quality and returns to education, do not seem to attract factories. Most potentially important variables are not correlated with manufacturing growth. One exception is the education of adults in 1985, which does correlate with manufacturing growth when added as a quadratic: that is, districts with very high and very low education had a smaller increase in manufacturing employment than did districts with a more typical education level. When we include the average education in the district and its square (for both adults and young adults) as controls in regressions, results are unchanged (results available on request). The total number of junior high schools (private +

[4] Because Indonesia is not a nation with strong son preference, the share of children who are male is random (Kevane and Levine 2002).

government) in a district has no effect on future industrialization. At the same time, the mix of schools between private and public appears to matter a bit, with factories a bit more likely to locate where a higher share of the junior high schools are private. Finally, to address the concern that 1985 manufacturing employment may over-control for important factors that predict the arrival of factories, results were similar to those in Appendix Table 1 when we did not control for baseline manufacturing in the district (not shown).

Potential Causal Channels

We are interested not only in the relationship between manufacturing employment and school enrollment, but also in the potential causal paths linking the two processes. Thus, we consider a variety of additional endogenous factors that may change as a result of district manufacturing growth or household manufacturing employment and whose change may help explain the observed change in enrollment patterns. We choose potential causal channels based on Becker and Tomes' classic economic theory of investments in children (1986). This theory emphasizes the cost of education, the returns to education, and liquidity constraints. As detailed below, these forces suggest a set of potential mediating variables that are affected by industrialization and, in turn, can affect education: household- and district-level consumption, returns to education, school density, urbanization, and road quality. Measurement of these variables is discussed in more detail after the presentation of the results of the basic model.

We first analyze whether manufacturing growth predicts changes in the potential mediating variables. Then, for those potential mediators correlated with manufacturing growth, we add these variables to see if they reduce the estimated effects of manufacturing employment in the district (β). As noted below, some of these forces can also promote industrialization directly, leading to complications addressed below when discussing causality.

Data

We analyze data from a variety of sources collected by Indonesia's Central Bureau of Statistics (BPS). The primary source of data is the Supas Intercensal Population Survey. Additional data are drawn from the Susenas National Socio-Economic Survey, the Podes: Village Potential Statistics, and the Industrial Survey (SI). The datasets are described in the Data Appendix.

Most data are from the Supas household survey and are measured at the individual or household level. Some district-level measures are constructed from the individual-level data using Supas population weights. Other district-level data are constructed by summing across local factories (measured in the industrial survey, SI) or summing across communities (measured in the village survey,

Podes). To create a consistent series of districts, we combine districts that merged or split between 1985 and 1995. Because of limited data validity we drop the (now-former) province of East Timor and the province known during this period as Irian Jaya.

The primary outcome of interest is school enrollment, although we also analyze whether the teenage youth population works and whether the primary activity for females is helping in the home. We focus our analysis on outcomes for teenage youth: young teens age 13–15 and older teens age 16–17. We focus on teenagers because they are more likely than younger children to drop out of school, and we would expect potential employment to be a larger draw for these youth. Because school enrollment rates for children 8–12 are very high (over 96 percent during our sample period) and labor force participation very low, we cannot easily study their variation. As expected in a nation with mandatory and near-universal enrollment, there do not appear to be important effects of manufacturing employment on younger children.[5] Enrollment rates remain modest for teens 16-17 in Indonesia; thus, it is less likely that non-enrollment of this age group represents a social problem or under-investment. As a result, our main focus is on teens 13-15, though initial results are presented for both.

Summary statistics are presented in Tables 1A and 1B. Enrollment rates for female teens did not rise much during this decade and fell slightly for males.[6] This relative stability contrasts with the rapid rise in enrollments during the previous generation. As manufacturing employment grew most rapidly in the decade we study, this time series evidence could suggest that industrialization may not be that helpful. We compare regions with high versus low rates of manufacturing growth, however, rather than simply looking at the nationwide trend. About three-fourths of youth age 13–15 were enrolled and slightly more than half of those age 16–17; both rates were higher for young men than for young women. Young teens' labor force participation was roughly constant over the period.

The main explanatory variable of interest is manufacturing employment measured from the Supas survey. We count someone as a manufacturing worker if he or she works 20 or more hours a week and is an employee or employer in the manufacturing sector.[7] Total and female manufacturing employment is measured at the district level as the share of potential employment among adults age 18–60.

[5] There do not appear to be significant effects of manufacturing employment on children 8-12. If anything, female manufacturing employment in the household and district is correlated with improved enrollments for the youngest children, age 6-7, though the results are not robust to all specifications.

[6] Enrollment is defined as school attendance. Results are robust to alternate definitions of enrollment such as being in school and in the age-appropriate grade.

[7] Thus, we eliminate the self-employed and family workers.

Table 1A: Summary Statistics

District Means and standard deviations -- Weighted

Dependent Variables		**Females**			**Males**		
		1985	1995	Growth	1985	1995	Growth
School enrollment							
Females	age 13-15	70.5%	74.4%	3.9%	76.8%	77.3%	0.6%
		14.7%	12.4%	11.6%	14.0%	12.3%	10.6%
	age 16-17	48.4%	48.5%	0.0%	58.3%	54.1%	-4.3%
		19.1%	18.5%	14.2%	18.8%	17.6%	14.8%
Work more than 20 hrs/week							
Females	age 13-15	10.4%	7.9%	-2.6%	13.3%	12.0%	-1.3%
		6.7%	5.3%	7.0%	8.7%	7.6%	8.3%
	age 16-17	20.0%	19.0%	-1.0%	29.4%	29.9%	0.6%
		12.0%	10.2%	10.8%	15.2%	13.4%	13.4%
Helping at home is primary activity							
Females	age 13-15	8.2%	11.7%	3.6%	0.4%	1.6%	1.2%
		6.4%	7.9%	6.6%	0.8%	1.8%	1.8%
	age 16-17	18.2%	24.4%	6.2%	0.5%	1.8%	1.3%
		12.0%	14.9%	12.4%	1.2%	2.1%	2.3%

District Manufacturing Employment	1985 Sample	1995 Sample	85/95 Pooled Sample
Proportion mfg. workers in district among those 18-60	3.30%	5.34%	4.30%
	3.0%	4.9%	4.2%
Proportion female mfg. workers	1.88%	3.40%	2.62%
	2.4%	3.8%	3.2%
N =	274	274	548

Measures of Manufacturing Growth	
Growth in Mfg (1995 %mfg - 1985 %mfg)	1.96%
	2.6%
Growth in Female Mfg (1995 %mfg - 1985 %mfg)	1.48%
	2.2%
Growth in Mfg ((1995 -1985 mfg workers)/ 1985 potential workers)	3.39%
	4.4%
	N = 274

Table 1B: Summary Statistics

Means and standard deviations

District Characteristics	1985 Sample	1995 Sample	85/95 Pooled Sample
Private jr. high /1000 youth	2.194 0.897	1.996 0.840	2.114 0.891
Govt. jr. high /1000 youth	1.050 0.622	1.206 0.652	1.142 0.652
% of youth in same community as a jr. high	0.486 0.236	0.528 0.210	0.506 0.223
District 20th percentile ln(expenditures/capita)	2.299 0.245	2.409 0.279	2.353 0.267
District median ln(expenditures/capita)	2.644 0.245	2.736 0.312	2.689 0.283
District returns to education (Male)	0.042 0.013	0.040 0.011	0.041 0.012
District returns to education (Female)	0.042 0.013	0.042 0.011	0.042 0.012
Urban	0.273 0.302	0.361 0.304	0.315 0.305
Education of adults (age 25-50)	5.017 1.594	6.730 1.550	5.864 1.790
Education of young adults (age 18-22)	7.007 1.473	8.503 1.343	7.745 1.602
Road Quality	1.240 0.400	1.586 0.323	1.411 0.404
Pct of Manufacturing Employment that is DFI	0.060 0.148	0.084 0.140	0.070 0.145
Pct DFI * Pct Mfg	0.003 0.006	0.006 0.012	0.004 0.009
#districts	274	274	548
Individual/Family Characteristics			
Average Education of Household Heads	4.488 3.641	5.720 3.606	5.161 3.674
Proportion of kids that are male	0.514 0.311	0.511 0.334	0.512 0.324
Age of Head	46.85 10.50	46.05 10.23	46.41 10.36
Number of household members	6.508 2.307	5.807 1.960	6.125 2.153
No male spouse in household	0.110 0.313	0.093 0.290	0.101 0.301
No female spouse in household	0.035 0.184	0.035 0.184	0.035 0.184
Proportion adults in the household	0.432 0.159	0.461 0.164	0.448 0.162
Proportion kids in the household	0.536 0.159	0.507 0.161	0.520 0.160
Proportion of adults that are male	0.479 0.201	0.486 0.192	0.483 0.196
Migrated since birth	0.092 0.289	0.112 0.316	0.103 0.304
Migrated since 5 years ago	0.038 0.192	0.045 0.208	0.042 0.201

Notes: Returns to education are estimated from a consumption expenditures equation, as described in the text. District means are weighted by population. Individual means are weighted by Supas sample weights.

From 1985 to 1995, manufacturing as a share of potential employment increased from 3.3 to 5.3 percent (1.9 to 3.4 percent for women only). Because not all adults work and because we exclude self-employed and family workers, these rates are lower than the manufacturing share of employment that is often published. A household has a manufacturing worker if any adult age 18-60 works in manufacturing; a household has a female manufacturing worker if any adult female works in manufacturing.

Results

Table 2 presents results for enrollments for female and male teens age 13–15 and age 16–17. We present probit estimates of enrollment, reported as marginal effects (how the predicted probability of enrollment changes with a one-unit change of the independent variable). The probit regressions are weighted and the standard errors are adjusted for the clustering of observations at the district-year level. All regressions include district fixed effects.

Youth Age 13 to 15

Enrollment for youth age 13 to 15 rises with the proportion of manufacturing employment in the district (Table 2, column 1 for young women and column 3 for young men). The effect is fairly large (1.64 and 1.59 respectively). To see the magnitude, consider a one standard deviation increase in male manufacturing, which equals about three percentage points of the potential labor force and six percentage point in increase in the actual labor force, almost doubling the mean 1985 levels. Such an increase in manufacturing predicts about 5 percentage points higher enrollment (about one-half of a standard deviation across districts). For males, this positive effect is disproportionately due to a region's male manufacturing employment; the coefficient on female manufacturing employment in the district is two thirds as large as that for total manufacturing employment and negative. (Recall, though, that 1 percentage point more women working raises total manufacturing employment by only half a percentage point of the total potential labor force.)

Consistent with the result that district manufacturing employment is associated with higher enrollments, it is also associated with decreased labor force participation of youth 13-15[8] (-.41 for young women and -.81 for young men). The decrease in male youth employment is primarily associated with increased male manufacturing employment. A three percentage point increase in manufacturing employment predicts 1.2 percentage points fewer young female

[8] We focus on employment of over 20 hours per week; results are similar if we examine youth who had any paid employment.

Table 2: Predicting Enrollment, Working 20+ Hours per Week, and Helping at Home is Main Activity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Enrollment				Working 20+ Hours per Week				Helping at home is main activity	
	Females		Males		Females		Males		Females	
	13-15	16-17	13-15	16-17	13-15	16-17	13-15	16-17	13-15	16-17
Proportion mfg. workers in district among those 18-60	1.635 (0.448)***	0.658 (0.547)[a]	1.588 (0.368)***	0.329 (0.621)	-0.41 (0.201)**	0.13 (0.372)	-0.814 (0.191)***	-0.86 (0.469)*	0.177 (0.208)	-0.367 (0.416)[a]
Proportion female mfg.workers in district	-0.429 (0.550)	0.279 (0.646)[a]	-0.997 (0.457)**	-0.129 (0.702)	0.077 (0.247)	-0.127 (0.447)	0.42 (0.251)*	0.969 (0.562)*	-0.531 (0.248)**	-0.507 (0.471)[a]
Average Education of Household Heads	0.035 (0.001)***	0.049 (0.002)***	0.039 (0.001)***	0.066 (0.001)***	-0.004 (0.001)***	-0.007 (0.001)***	-0.018 (0.001)***	-0.041 (0.001)***	-0.014 (0.000)***	-0.023 (0.001)***
Proportion of kids male	-0.032 (0.010)***	-0.021 (0.015)	0.017 (0.009)*	0.063 (0.015)***	-0.005 (0.005)	0.001 (0.012)	-0.006 (0.006)	-0.044 (0.013)***	0.013 (0.005)***	-0.002 (0.010)
Age 13 (Age 16)	0.207 (0.005)***	0.123 (0.008)***	0.16 (0.004)***	0.103 (0.007)***	-0.074 (0.003)***	-0.042 (0.005)***	-0.095 (0.002)***	-0.079 (0.006)***	-0.064 (0.003)***	-0.063 (0.005)***
Age 14	0.094 (0.005)***		(0.005)***		-0.031 (0.003)***		-0.05 (0.003)***		-0.029 (0.003)***	
Year is 1995	-0.024 (0.006)***	-0.074 (0.009)***	-0.053 (0.006)***	-0.138 (0.008)***	-0.008 (0.003)***	0.007 (0.006)	0.016 (0.003)***	0.057 (0.006)***	0.051 (0.003)***	0.097 (0.006)***
Observations	51991	30988	54631	31811	51587	30932	54534	31811	51991	30988

Notes: Weighted probits reported as marginal effects (dp/dx); district fixed effects included. Standard errors (in parentheses) are robust to heteroskedasticity and to clustering at the district*year level. * significant at 10%; ** significant at 5%; *** significant at 1% [a] jointly significant at 5%

workers and 2.4 percentage points fewer young male workers, with the latter effect smaller when it is female employment that rises.

Matching the declines in market work, there are also small declines in young women claiming their main activity is helping at home, at least when a district's female manufacturing rate rises. (As the question is phrased, respondents can both report their main activity is helping at home and also be attending school.) A two percentage point increase in the female manufacturing share reduces predicted helping at home by a percentage point – a modest but meaningful effect.

Youth Age 16 to 17

By age 16, average enrollment rates are much lower; only 52 percent of those age 16–17 are enrolled versus 75 percent of those age 13–15. Work is also more prevalent: roughly twice the proportion of older teens as younger teens worked more than 20 hours a week. Lower enrollment and higher employment rates for those 16 and over are not generally considered a social problem in Indonesia.

Unlike for those age 13–15, average manufacturing employment in a district is not a statistically significant predictor of enrollment levels for older male youth (Table 2, column 4), but remain positive and jointly statistically significant for female youth (column 2). In contrast, male (but not female) manufacturing employment at the district level predicts slightly lower rates of employment for these older male youth (column 8) but not female youth (column 6).

Reassuringly, female manufacturing growth is not associated with more young women spending time helping at home. On the contrary, a rising share of adults in manufacturing predicts lower rates of young women age 16–17 claiming their primary activity is helping at home (column 10).

Do Potential Causal Channels Contribute to the Observed Relationship Between Manufacturing and Enrollment?

We next consider variables that are candidate channels for the positive relationship between industrialization and enrollment that is observed for young teens. These include district-level consumption, urbanization, various measures of school accessibility, the returns to education, and household level consumption expenditures. To mediate the observed relationship between industrialization and enrollments, two relationships must hold: (1) the mediating variable must vary with industrialization; and (2) enrollments must vary with the variable. We first discuss the various potential mediators that we consider and then present estimates of the relationship between industrialization and the mediators. Then, we re-estimate the relationship between enrollment and manufacturing

employment with the inclusion of those potential mediators that are related to manufacturing growth.

Potential causal channels

We examine several potential causal channels for the relationship between industrialization and education. (At the same time, recall that some of these variables may have an independent effect on industrialization.) We first examine the benefits of schooling, as measured largely by the returns to education. We then turn to the costs of schooling, proxied by access to schools. Finally, we turn to measures of liquidity constraints and parental ability to pay.

Benefits of education

The returns to education may rise or fall as a region industrializes, depending on the type of production. Some labor-intensive assembly plants demand low skills and may also hire under-age workers. Nevertheless, it is unclear if such plants demand lower skills than agriculture. Working in the other direction, industrialization in Indonesia may have led firms to begin producing products that require more medium-skilled workers, in which case physical and human capital are complementary (Feenstra and Hanson 1996). Because only one-third of Indonesians who work receive wages (as opposed to being self-employed, farmers, or informal employees in family and other small businesses), it is not possible to use a wage equation to estimate the returns to education. Instead, we estimate the returns to education in each district based on consumption expenditures of their household. That is, we estimate an equation of the form:

$$ln(consumption_{idt}) = a_d * district_d + b_{1d}\, male\ head's\ education_{idt} * district_d + X_{idt,} \quad (2)$$

where $district_d$ is a dummy equal to one in district d and X_{idt} is a broad set of controls for household characteristics. The vector of coefficients b_{1d} represents the estimated returns to education for men in that district.[9] An analogous equation replacing the education of the male head with the education of the female head provided estimates of women's return to education.[10] For men and women in

[9] As is true in all OLS estimates of the returns to education, the estimated return to education can be biased up if those with the highest levels of education would have done well in the labor market or marriage market even if they had not received more education. To the extent that this bias is constant across Indonesia it will not affect our analyses.

[10] This measure of consumption returns to education differs from the more traditional wage returns. In Indonesia, as in most countries, the family background and academic achievement of spouses tend to be correlated. Like a family income equation, but unlike a wage equation, this method includes the fact that people with higher education tend to marry more prosperous spouses. Thus, this measure captures the entire private return to education (including the benefits

both 1985 and 1995 the mean return across districts was approximately 4 percent per year, with a standard deviation across districts of 1.3 percent in 1985 and 1.1 percent in 1985 (Table 1B).

The presence of modern manufacturing may also affect perceptions of the returns to schooling in ways not captured by standard economic measures (e.g., equation 2). It is possible that industrialization is associated with a shift to a more stereotypically "modern" outlook and that families who live in modern-oriented communities are more likely to perceive education as valuable (Inkeles and Smith, 1974). (See, for example, Akerlof and Kranton (2002) for an economic approach to the social construction of identity.) We do not have direct evidence to test this hypothesis, although it remains an active area for future research.

Cost of education: Access to schools

To the extent that industrialization promotes urbanization or population density more generally, industrialization may indirectly affect enrollment by increasing school accessibility through decreased travel costs or other means (Duflo 2001). For measures of density and school accessibility, we use urbanization, the share of the district's youth living in the same community as a junior high or high school, and the number of private and the number of government junior high schools per 1,000 youth. We also consider road quality because improvements may reduce travel costs. At the same time, it is clear that urbanization and road quality can also promote industrialization, leading to some caution in interpreting these effects.

Liquidity constraints: Regional living standards

Industrialization both employs people directly and increases employment in related business services and among some suppliers too small to be picked up as manufacturing by our definitions. Higher incomes for these employed people can in turn increase employment for those who provide locally made goods and services. To the extent that migration or capital mobility takes time to equilibrate wages in different regions, industrialization in a local labor market will push up average incomes. If Indonesian enrollment is responsive to incomes, then industrialization may increase enrollment by increasing expenditures. As poor people may be particularly likely to face binding liquidity constraints, we consider expenditures at the twentieth percentile in addition to median expenditures as a potential mediator.[11]

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of marrying a higher-earning spouse) that is appropriate when choosing whether to invest in additional education.

[11] District medians and 20th percentiles are calculated from the log expenditure per capita of households. Household expenditure data are available in the 1985 Supas. For 1995, we draw

Family structure

Industrialization may also affect children by altering the structure of families. Family structure, in turn, can affect the costs and benefits of education. For example, families with more children face increasing costs of educating each child. If industrialization affects fertility, then it is possible that changes in family size and composition are important mediating factors of how industrialization affects education.

Which of the potential mediators are related to manufacturing growth?

Tests of whether each candidate mediator varies with industrialization are found in Table 3a. At the district level, growth in the log of median consumption expenditures, growth in the 20th percentile of expenditures (proxying for poverty), urbanization, improved road quality, and increases in the number of private junior high schools per 1,000 youth are all correlated with growing manufacturing employment.[12] Because these are district rather than individual - level regressions, we shift from the two-period pooled regression with district fixed effects to the near-equivalent specification of changes in district manufacturing employment predicting changes in district characteristics. Similarly, we include province rather than district fixed effects. Regressions are weighted by population. The odds of living in the same community as a junior high school, government junior high schools per capita, and returns to education for both men and women are not related to rising manufacturing employment.

Table 3b examines whether growth in a district's manufacturing share is associated with changes in household characteristics among those households with teenage youth. In districts with higher manufacturing growth, households with teenage youth tended to have a rising share of prime-age adults. Districts that increased the share of female manufacturing also had rising household size and declining proportion of the elderly, although the effect of total manufacturing was small and not statistically significant. Because we use district of birth of the

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expenditure data from the Susenas because consumption data were not collected in Supas for that year.

[12] One concern is that number of private junior high schools in a district both predicts factory arrival (Appendix Table A1) and is predicted by factory arrivals (Table 5). Thus, from these correlations it is possible that a fixed factor leads both to private schools and to industrialization or that a region with a high trend in new private junior high construction has been attracting factories both before and since 1985. In fact, these alternative causal paths do not appear important because private junior high school building is negatively autocorrelated. Thus, the causal interpretation we have been using, where factories attract schools, appears most consistent with the data. It should also be noted that while factories appear to attract private schools, factories in Indonesia do not build schools themselves as is the case in some countries.

Table 3A: Does Growth in Manufacturing Employment Predict the Potential Moderators

	Growth in 20th %ile ln(exp/cap)	Growth in median ln(exp/cap)	Growth in road quality	Growth in % near a junior high	Growth in % near a high school	Growth in govt junior highs/1000 youth	Growth in private junior highs/1000 youth	Growth in female returns to education	Growth in male returns to education	Growth in urbanization
Growth in total manufacturing	1.67 (.78)**	1.56 (.768)*	0.926 (.627)[a]	0.464 (0.41)	0.472 (0.47)	-032 (2.25)	11.55 (3.18)***	-0.072 (0.053)	-0.059 (0.05)	1.58 (.821)*
Growth in female manufacturing	0.412 (0.95)	0.75 (0.96)	0.778 (.749)[a]	-0.148 (0.51)	0.09 (0.68)	-2.71 (3.72)	-13.06 (6.35)*	0.073 (0.059)	0.059 (0.061)	0.551 (0.71)
Value of dependent variable in 1985	-0.729 (.037)***	-0.656 (.063)***	-0.346 (.052)***	-0.25 (.068)***	-0.305 (.063)***	-0.564 (.086)***	-0.554 (.061)***	-0.849 (.041)***	-0.859 (.061)***	-0.15 (.022)***
Percent of district urban in 1985	0.335 (.040)***	0.368 (.058)***	-0.028 (0.058)	0.014 (0.049)	0.09 (0.055)	-0.286 (0.19)	0.176 (0.28)	0.008 (.002)***	0.008 (.002)***	
Constant	1.65 (.079)***	1.67 (.159)***	0.60 (.045)***	0.29 (.015)***	0.15 (.007)***	1.37 (.166)***	1.92 (.126)***	0.029 (.002)***	0.028 (.002)***	0.123 (.006)***
Observations	274	274	274	274	274	274	274	274	274	274
R-squared	0.64	0.52	0.57	0.63	0.49	0.37	0.54	0.64	0.62	0.38

Weighted regressions with province fixed effects. Standard errors (in parentheses) are robust to clustering at the province level. Growth in manufacturing is measured as 1995 percent manufacturing -1985 percent manufacturing. Returns to education are estimated from a consumption expenditures equation as described in the text. * significant at 10%; ** significant at 5%; *** significant at 1%, [a] jointly significant at 5%

Table 3B: Does Manufacturing Growth Predict Changes in Household Characteristics at the District Level

Change in:	(1) Household Size	(2) No Male Spouse	(3) No Female Spouse	(4) Proportion Elderly in Household	(5) Proportion Adults in Household	(6) Proportion Kids in Household	(7) Age of Household Head	(8) Proportion of Adults - Male
Growth in total manufacturing	-0.418 (1.60)[a]	0.211 (0.199)	-0.018 (0.103)	0.017 (0.028)	0.030 (0.11)[a]	-0.039 (0.103)	-1.32 (5.449)	0.09 (0.069)
Growth in female manufacturing	2.194 (1.62)[a]	-0.288 (0.25)	-0.009 (0.113)	-0.079 (0.035)**	0.171 (0.124)[a]	-0.062 (0.118)	-2.39 (6.55)	-0.046 (0.083)
Value of dependent variable in 1985	-0.545 (0.059)***	-0.872 (0.060)***	-0.861 (0.040)***	-0.799 (0.044)***	-0.406 (0.060)***	-0.385 (0.058)***	-0.832 (0.063)***	-0.846 (0.055)***
Constant	3.151 (0.409)***	0.070 (0.006)***	0.037 (0.003)***	0.018 (0.001)***	0.193 (0.026)***	0.188 (0.030)***	38.487 (2.880)***	0.412 (0.027)***
Observations	273	273	273	273	273	273	273	273
R-squared	0.53	0.70	0.77	0.53	0.43	0.42	0.67	0.67

Notes: Weighted regressions with province fixed effects. Standard errors (in parentheses) are robust to clustering at the province level. Growth in household characteristics and manufacturing is measured as 1995 value -1985 value. Sample includes only households with youth 13-17. Households are attributed to district of birth of oldest 13-17 year old in household. * significant at 10%; ** significant at 5%; *** significant at 1%, [a] jointly significant at 1%

eldest youth in creating the district averages, these results are driven by changes in household composition, not by selective immigration to factory jobs. Overall, changes in household composition were not strongly related to manufacturing growth.

Do these factors mediate the relationship between manufacturing and enrollment?

Table 4 presents evidence on whether the several potential mediating variables contribute to the observed relationship between manufacturing employment and school enrollments. We are looking for a reduction in the effects of enrollment when controlling for the potential mediating variable. We present only enrollment of those age 13–15, as district manufacturing is not correlated with enrollment for older male youth and only modestly for older female youth.[13]

We present the results adding control variables incrementally. Because the several potential mediating variables are not that highly correlated, results are almost identical if we add the variables in one at a time or in different orders (results not shown). We do not include those variables that were not correlated with manufacturing growth (in Table 3), as these were not candidates to mediate the relationship between manufacturing and enrollment. Columns 1 and 6 of Table 4 repeat the baseline results from Table 2 for young women and for young men.

Cost of schooling: Access to schools

Columns 2 and 7 add urban location to the baseline specification. As expected, enrollment rates are substantially higher in urban areas (for example, 6 percentage points higher for young women, $P< .01$). At the same time, controlling for urban location only reduces the coefficients on the proportion of manufacturing workers in the district among those 18-60 by about 10 percent (falling from 1.64 to 1.5 for young women and from 1.59 to 1.47 for young men; neither decline is statistically significant). Because urban locations can independently attract both schools and factories, this decline is an upper bound on the effects of urban location as a mediating channel.

In columns 3 and 8 we condition on additional measures of access to schools: the number of government and the number of private junior high schools per 1000 youth, and a district's index of road quality (where 1 = dirt and 3 = paved, averaged over all communities in the district). As expected, having more junior high schools and having higher-quality roads predict higher enrollment rates. These results are consistent with the hypothesis that high commuting costs

[13] The relationship between the candidate channels and enrollments for youth age 16-17 are similar to those reported for youth age 13-15.

Table 4: Causal Channels in Predicting Enrollment

	(1)	(2)	(3)	(4)	(5)
	Females (age 13-15)				
Proportion mfg. workers in district among those 18-60	1.635 (0.448)***	1.499 (0.434)***	1.096 (0.456)**	1.051 (0.448)**	1.005 (0.428)**
Proportion female mfg.workers in district	-0.429 (0.550)	-0.402 (0.547)	0.012 (0.555)	-0.011 (0.558)	-0.038 (0.536)
Urban		0.059 (0.010)***	0.062 (0.010)***	0.061 (0.010)***	0.081 (0.009)***
Private Jr High/1000 youth			0.016 (0.006)***	0.016 (0.006)***	0.018 (0.006)***
Govt Jr High/1000 youth			0.037 (0.009)***	0.038 (0.009)***	0.028 (0.008)***
Road Quality			0.069 (0.020)***	0.073 (0.020)***	0.065 (0.020)***
Dist 20th percentile ln(expenditures/cap)				0.032 (0.033)	0.016 (0.032)
Age of Head					0.003 (0.000)***
Square of Age of Head					-0.007 (0.002)***
Number of Household Members					0 (0.002)
No male spouse in household					-0.013 (0.010)
No female spouse in household					-0.071 (0.018)***
Proportion adults in the household					-0.056 (0.033)*
Proportion kids in the household					-0.174 (0.040)***
Proportion of adults male					-0.02 (0.014)
Migrated since birth					-0.074 (0.014)***
Migrated since 5 years ago					-0.35 (0.026)***
Observations	51991	51991	51991	51991	51991

(Table 4 cont.)

	(6)	(7)	(8)	(9)	(10)
	Males (age 13-15)				
Proportion mfg. workers in district among those 18-60	1.588 (0.368)***	1.468 (0.369)***	1.066 (0.380)***	1.13 (0.381)***	1.059 (0.372)***
Proportion female mfg.workers in district	-0.997 (0.457)**	-1.056 (0.463)**	-0.779 (0.453)*	-0.748 (0.461)	-0.642 (0.455)
Urban		0.081 (0.006)***	0.081 (0.006)***	0.081 (0.006)***	0.079 (0.006)***
Private Jr High/1000 youth			0.019 (0.006)***	0.019 (0.006)***	0.019 (0.005)***
Govt Jr High/1000 youth			0.001 (0.008)	0 (0.008)	0.004 (0.008)
Road Quality			0.079 (0.019)***	0.074 (0.019)***	0.069 (0.019)***
Dist 20th percentile ln(expenditures/cap)				-0.044 (0.027)	-0.05 (0.026)*
Age of Head					0.003 (0.000)***
Square of Age of Head					-0.002 (0.001)*
Number of Household Members					0.001 (0.001)
No male spouse in household					0.001 (0.009)
No female spouse in household					-0.047 (0.016)***
Proportion adults in the household					-0.018 (0.030)
Proportion kids in the household					-0.118 (0.031)***
Proportion of adults male					0.005 (0.015)
Migrated since birth					-0.036 (0.013)***
Migrated since 5 years ago					-0.095 (0.024)***
Observations	54631	54631	54631	54631	54631

Notes: Includes district fixed effects as well as the control variables in Table 2: parental education,the proportion of children that are male, and indicator variables for age and year is 1995. Standard errors (in parentheses) are robust to heteroskedasticity and to clustering at the district*year level. Weighted probits reported as marginal effects (dp/dx). * significant at 10%; ** significant at 5%; *** significant at 1%

discourage enrollments. The coefficient on the proportion of manufacturing workers in the district further declines by about a fourth (from 1.5 to 1.1 among young women and from 1.47 to 1.07 among young men). Although economically meaningful, neither decline is statistically significant.

Cost of schooling: Liquidity constraints and ability to pay

One of the more unexpected results is that the living standard of the district does not predict enrollment rates. In columns 4 and 9 we present results for the 20th percentile of consumption in the district, with a very small coefficient that is not statistically significantly different from zero. Results are also small and not significant when we, instead, use the median consumption expenditures in the district. Because consumption expenditures do not predict enrollment, conditioning on such expenditures does not affect the estimated link between manufacturing and enrollment.

We also examined consumption expenditures at the household level (results not shown). This necessitated a switch to the 1995 Susenas (which has no migration history), as the Supas dataset has no consumption measures in 1995. The 1985 Supas is also somewhat limited, as it has only a one-item consumption measure. As expected, household expenditures predict higher enrollment for male and female youth (with an elasticity of about .1, $P < .01$). Conditioning on household consumption expenditures reduces the estimated positive effect of male manufacturing employment in a district by about 10% (although the decline is not statistically significant). At most, consumption expenditures at the household level are only moderately important at explaining the positive relation between manufacturing employment and child enrollment.

Household Composition

In columns 5 and 10 of Table 4 we add an array of household characteristics: age of household head and its square, number of household members, no male spouse in the household, no female spouse in the household, proportion adults in the household, proportion children in the household, proportion of adults who are male, and whether the family has migrated since the child's birth or since 5 years ago. As expected, enrollment is higher in households with both a male and female household head, with a lower share of children, and with longer tenure in the district. At the same time, conditioning on these variables has no meaningful effect on the coefficient on local manufacturing in predicting youth enrollment.

Manufacturing employment in the household

An important question is how much of the effects we estimate operate through manufacturing employment in the household and how much through regional externalities. Thus, we estimate the relationship between manufacturing

employment at the household level and the youth outcomes of enrollment, employment, and household help as the primary activity. The coefficients for manufacturing employment (total and female) in the household may be biased due to selection effects concerning who works in manufacturing. Manufacturing workers appear to be slightly advantaged relative to the general population.[14] The relative effects of household manufacturing employment on outcomes for females versus males, however, should not be affected by selection effects that might disproportionately lead advantaged or disadvantaged adults to work in manufacturing. In Table 5, we present regressions that pool the male and female youth of each age (results are similar when we estimated the equations separately).

Having a manufacturing worker in the household does not predict enrollment in general, but having a female manufacturing worker in the household predicts 3.8 percentage points higher enrollment. This is consistent with both advantaged women working in manufacturing or manufacturing causing increased enrollment -- at least for male youth. To examine the relative effects for females versus males, we include an interaction term between female youth and female manufacturing employment in the household. Having a female manufacturing worker in the household reduces female enrollment relative to males by a very large 10 percentage points. This effect is also large (6 percentage points) for young women 16-17.

We examine two possible explanations for the connection between employment of an adult female in the household and declining relative enrollments for young female teens: higher market work, particularly in manufacturing, and more household responsibility. The effect of female manufacturing employment in the household on employment of young females relative to males is strongly positive. A woman in the household working in manufacturing raises the predicted probability that a female youth works more than 20 hours per week by 11 percentage points, relative to a male youth. This is a very large effect both in absolute terms and relative to the mean employment of girls 13-15: about 10 percent in 1985. The estimated effect of female

[14] For example, in 1995, employees in manufacturing had .75 (for men) to 1 (for women) more year of education than others of their age (though women in manufacturing had less education that those working in other industries). The above-average education makes it plausible that manufacturing employees also have above-average unobserved skills. If so, the regressions may over-state the benefits of manufacturing employment at the household level. We also examine the earnings of manufacturing employees which captures more dimensions of skill than does education alone, but is only applicable to the roughly one-third of the work force that is in the formal sector (and may reflect rent capture in addition to higher human capital). Conditioning on eleven age-education interactions, men and women in manufacturing had higher monthly earnings than those in other industries.

Table 5: The Role of Manufacturing Workers in the Household

(Pooled regressions of male and female youth)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Enrollment		Work		Work in Mfg.		Helping at Home	
	Age 13-15	Age 16-17	Age 13-15	Age 16-17	Age 13-15	Age 16-17	Age 13-15	Age 16-17
Proportion mfg. workers in district among those 18-60	1.004	-0.01	-0.381	0.05	-0.04	0.148	0.116	-0.06
	(0.356)***	(0.485)	(0.153)**	(0.321)	(0.023)*	(0.068)**	(0.086)	(0.135)
Proportion female mfg. workers in district	-0.26	0.633	0.021	-0.142	0.02	-0.134	-0.117	-0.129
	(0.425)	(0.558)	(0.196)	(0.356)	(0.028)	(0.087)	(0.097)	(0.146)
Manufacturing workers present in the household	-0.009	-0.039	0.011	0.046	0.016	0.061	-0.001	-0.004
	(0.008)	(0.013)***	(0.006)	(0.010)***	(0.002)***	(0.006)***	(0.002)	(0.003)
Female manufacturing worker is present in the household	0.038	-0.018	-0.021	-0.025	-0.0003	0.0003	0.0002	0.055
	(0.013)***	(0.020)	(0.008)***	(0.016)	(0.001)	(0.003)	(0.007)	(0.023)**
Female youth	-0.056	-0.108	-0.031	-0.096	0.002	0.007	0.07	0.166
	(0.004)***	(0.008)***	(0.003)***	(0.008)***	(0.001)***	(0.002)***	(0.002)***	(0.004)***
Female Youth * Female Mfg worker in the household	-0.102	-0.062	0.112	0.212	0.011	0.037	0.002	-0.03
	(0.027)***	(0.028)**	(0.021)***	(0.030)***	(0.004)***	(0.009)***	(0.008)	(0.005)***
Observations	106703	62799	106703	62799	80411	53015	106521	62799

Notes: Includes district fixed effects as well as the full set of control variables in Table 4 columns 5 and 10: the number of private and of government junior highs per 1000 youth, road quality, the log of the 20th percentile expenditure per capita, age and squared age of household head, number of household members, parental education, and proportion children in household, proportion adults and proportion children in the household, proportion of children and of adults who are male, and indicator variables for age, urban, migrated since birth, migrated since 5 years ago, no male household head, no female head, and year is 1995. Work is defined as working 20 or more hours per week. Work in manufacturing is defined as working 20 or more hours as an employee in the manufacturing sector. Standard errors (in parentheses) are robust to heteroskedasticity and to clustering at the district*year level. Weighted probits reported as marginal effects (dp/dx) . * significant at 10%; ** significant at 5%; *** significant at 1%

manufacturing employment is similarly large for young women age 16-17 (21 percentage points relative to a baseline employment rate of 20 percent).

Employment of a woman in the household may increase the opportunities for the younger females to work because the adult woman provides links to factory jobs. The correlation between the employment of adult females and of young women could be causal if the working woman provides a role model or job linkages to the young woman. As this estimate is net of the effect on sons' work, it is presumably not largely affected by the family's ability to pay except to the extent poor families protect son's enrollment with female paid work. To examine the role of job access, we examined how much of the excess employment of young women (relative to young men) we see in households with female manufacturing employment was due to the young women working in manufacturing. Essentially all of the increased female youth employment occurs in manufacturing (Table 5, columns 5 and 6).[15]

Finally, we are interested in whether girls' responsibilities at home increase when adult females in the household work in manufacturing. As expected, young women were much more likely (7 percentage points for ages 13-15 and more than twice that for ages 16-17) than young men to say their main activity was helping at home. To our surprise, young women 13-15 were not more likely to give that response if an adult female worked in manufacturing (Table 5, column 7). For the older youth, both young men and young women were more likely to give that response in households with a female manufacturing worker (column 8). We expected this effect to be concentrated among eldest daughters, particularly those with younger siblings at home. While the eldest daughter had higher rates of reporting her primary activity was housekeeping than did young women of the same age who were not the eldest daughter at home, this effect was not higher if an adult woman in her household worked in manufacturing (results available on request).

Summary of results on potential causal channels

In short, the evidence on which causal channels matter is suggestive but inconclusive. That is, adding in measures of the various potential causal channels

[15] Although the interaction of adult female employment's effects on female versus male youth is not affected by selection on advantage or disadvantage, the estimated effect may still not be causal as the coefficient may be affected by the attitudes towards women's work and education within a household or due to factors that affect both the women and youth such as good local job opportunities for women relative to men. We attempt to address the later concern by including a measure of manufacturing employment at the neighborhood level; results are unchanged. Still, some families may have a more positive view of both female employment and education. In other families, female labor may be valued to the exclusion of female education. Because we analyze within a district, our estimates are only affected by culture that affects a household or small area, but not an entire district.

reduces the coefficient on manufacturing in predicting enrollments. Collectively, the measures of the supply and demand for education reduce the estimated effect of manufacturing by just over one-third – driven largely by measures of school access (urban location, road quality, and the number of private schools). Nevertheless, the changes are not estimated with sufficient precision to be statistically significant.

The role of foreign ownership

We were also interested in whether the relationship between school enrollment and manufacturing varies with the ownership of the manufacturing in the area. An important issue in debates concerning globalization is how direct foreign investment (DFI) affects children in poor nations, including concern that young workers may leave school in favor of employment.[16] The period 1985 to 1995 was a period of enormous reduction in trade and investment barriers for Indonesia, leading to a rapid expansion of international trade and foreign investment. Direct foreign investment may demand different skills than domestically owned firms and thus may have distinct effects on the demand for education. In addition, because foreign-owned plants are often visible to citizens, regulators, and the foreign press, they may have above-average incentives to avoid hiring child workers.

The share of manufacturing employees working in plants with substantial direct foreign investment at the district level is added in Table 6. This share is measured using data from the establishment-level Industrial Survey. We condition on both the share of district manufacturing employment that is foreign owned and the interaction of that share with the proportion of manufacturing employment in the district. This interaction measures the share of all adults who work in foreign-owned plants.

The share of district manufacturing employment that is DFI is not statistically significantly related to enrollment of female youth (Table 6, columns 1 and 2). In contrast, for young men (13-15), the share of local manufacturing that is foreign owned predicts above-average rates of enrollment. While the effect size is small, these non-negative results should be moderately reassuring for those concerned that foreign-owned factories draw children away from schooling.

Robustness checks

The tables above deal with concerns about endogenous migration by classifying youth based on the birth district of the youth – that is, where the families were living 13-17 years prior to the survey year. Results are unchanged if we classify

[16] Nike, for example, received substantial censure when it was revealed that some of its factories employed very young workers (Connor 2001).

Table 6: The Role of Direct Foreign Investment

	(1)	(2)	(3)	(4)
	Enrollment			
	Females 13-15		Males 13-15	
Proportion mfg. workers in district among those 18-60	1.472 (0.421)***	0.929 (0.419)**	1.541 (0.362)***	1.042 (0.366)***
Proportion female mfg.workers in district	-0.541 (0.557)	-0.087 (0.533)	-1.094 (0.451)**	-0.71 (0.453)
Pct of Manufacturing Employment that is DFI	0.005 (0.044)	0.022 (0.042)	0.06[a] (0.036)*	0.06[a] (0.032)*
Pct DFI * Proportion Manufacturing	1.048 (0.954)	0.252 (0.874)	0.247[a] (0.717)	0.035[a] (0.746)
Average Education of Household Heads	0.035 (0.001)***	0.042 (0.001)***	0.039 (0.001)***	0.041 (0.001)***
Proportion of kids male	-0.032 (0.010)***	-0.011 (0.012)	0.017 (0.009)*	-0.004 (0.009)
Age 13	0.207 (0.005)***	0.206 (0.005)***	0.16 (0.004)***	0.162 (0.004)***
Age 14	0.094 (0.005)***	0.092 (0.005)***	0.079 (0.005)***	0.08 (0.005)***
Year is 1995	-0.023 (0.006)***	-0.048 (0.010)***	-0.054 (0.006)***	-0.072 (0.009)***
Controls on district and household characteristics as in Table 4, columns 5 and 10	No	Yes	No	Yes
Observations	51991	51991	54631	54631
R-squared	0.17	0.19	0.17	0.18

Notes: Standard errors (in parentheses) are robust to heteroskedasticity and to clustering at the district*year level. Weighted probits reported as marginal effects (dp/dx). Includes district fixed effects. * significant at 10%; ** significant at 5%; *** significant at 1% [a] jointly significant at 5%

youth based on the district of current residence or if we examine only youth that are in the same district.

We were also concerned that the manufacturing share of employment in a district is measured with error. Although sample sizes are large, the percent manufacturing in each district is often small. To address this concern, we instrumented the measure of manufacturing employment share from the Supas survey with a measure of manufacturing employment and a measure of factories per capita from the establishment-level Industrial Survey. These measures of manufacturing employment correlated highly with the Supas measure both in levels and changes. Results were similar when correcting for measurement error in the share of manufacturing employment.

Summary

One of the concerns with industrialization is that youth will be drawn out of school due to lower returns to education, higher need for children to care for younger siblings, and higher demand for youth labor in factories. Yet, in investigating the relationship between manufacturing employment at the district level and youth outcomes, we find a modestly positive correlation. Growth in industrial employment at the district level is positively correlated with higher enrollments and lower youth labor force participation, supporting a more optimistic view.

We investigated several possible causal channels for the observed positive relationship between a region's growing manufacturing employment and enrollments. Districts with more manufacturing growth have more household-level consumption, higher urbanization, higher school density, and better roads. While all are related to enrollment, these factors do not completely mediate the district-level correlation between industrial employment and enrollment changes. The continuing importance of industrialization in a region even after controlling for the several causal channels may be due to measurement error on our measures of the supply of and demand for education. Our results leave open the possibility that manufacturing employment helps shifts perceptions of the benefits of education (this is the "Modernization" hypothesis (Inkeles and Smith, 1974) noted above). While provocative, this possibility remains untested. Also, industrialization remains but one portion of the "modernization" of the Indonesia economy – along with the changes ranging from new tourist motels, McDonald's, and modern media. Additional research should examine these multiple channels; it is possible our measure of industrialization is also picking up some of the effects of modernization in other sectors.

At the household level, having an adult female manufacturing worker in the household is correlated with lower enrollment, higher manufacturing employment, and increased responsibilities in the home for female relative to

male youth. Although some selection may occur based on relative female employment opportunities or on household culture, because these are the relative effect on young women versus young men, these results are robust to selection on overall advantage or disadvantage of the household.

This study covers a single nation during a single decade. Thus, one must be cautious about generalizing. For example, during this period education financing was highly centralized. Thus, industrialization that increased tax revenues in the nation could be spent on education nationally, not necessarily in the industrializing region. In a less centralized regime, industrialization might affect local enrollments much more strongly by increasing public sector revenues. In 2002, Indonesia largely shifted to a decentralized model of public finance, where districts retain most of the tax revenue they collect. It is plausible that this shift in tax policy will strengthen the relation between industrial development and school enrollment. Additionally, Indonesian industrialization has had a distinctive industrial mix; it is plausible that other industrial mixes would affect enrollment differently.

Overall, the relatively benign effects of industrialization on school enrollment are reassuring. What remains to be understood is what drives the relationship—an important area for future research in Indonesia and in other nations. Replication of this study in other countries that have recently experienced rapid industrialization can further shed light on the channels for this relationship. Similarly, it is also important to understand how industrialization affects other outcomes for children and youth, including health, where the benefits of higher incomes may or may not outweigh the costs of potentially higher pollution. These are both areas of ongoing research projects.

Data Appendix: Data Sources

Supas: The Intercensal Population Surveys

The primary sources of data are the 1985 and 1995 Intercensal Population Surveys (Supas), each of which has responses from numerous households. The Supas 1995 contains data on more than 200,000 households that include almost 950,000 people; this represents almost 104,000 youth age 13–17 from 74,000 households. The Supas 1985 includes 124,000 households with almost 600,000 people, including 66,000 youth from 45,500 households. Households are interviewed to obtain information regarding household characteristics and individual characteristics such as work, school attendance and attainment, and migration. The Supas sample was selected to be representative for each of Indonesia's roughly 300 districts. The survey over-samples smaller districts to increase precision.

Susenas: National Socio-Economic Survey

The National Socio-Economic Survey (Susenas) is an annually repeated cross section. It surveyed between 20,000 and 50,000 households per year in the mid-1980s and approximately 200,000 households per year by the mid-1990s. Susenas collects information on the general welfare of each household member in areas such as school enrollment, health, and mortality. Sampling rules follow those of the Supas. We used the Susenas survey to obtain household consumption data and derive district consumption data for 1995.

Podes: Village Potential Statistics

The Village Potential Statistics (Podes) survey provides information about the characteristics of villages or urban neighborhood. Roughly 65,000 village heads complete the survey about their villages. Data on road quality and school density were derived from the 1986 and 1996 Podes surveys. For most measures we average the village-level responses to the district level, typically weighting by population.

The Industrial Survey

The Industrial Survey is an annual census of employers with over 20 employees. Data on factories, employment, and direct foreign investment employment were derived from the 1985 and 1995 Industrial Survey.

Appendix Table A1: Predicting Industrialization

	(1)	(2)
	Manufacturing growth	Female Manufacturing Growth
Proportion manufacturing workers in district	0.222	
	(.058)***	
Proportion female mfg. workers in district		0.05
		(.05)
% Near a Junior High (1985)	-0.015	-0.004
	(.011)	(.009)
Private jr. high /1000 youth	0.003	0.003
	(.0014)**	(.0015)*
Govt jr. high /1000 youth	-0.004	-0.002
	(.002)*	(.003)
Road Quality 1985	0.001	-0.001
	(0.007)	(.007)
Log Median Per Capita Income (1985)	0.007	0.005
	(0.009)	(.009)
Male Returns to Education (1985)	0.023	
	(0.109)	
Female Returns to Education (1985)		-0.005
		(.10)
Education of Adults (age 25-50)	0.018	0.019
	(.008)**	(.007)**
Square of Adult Education	-0.002	-0.002
	(.0008)**	(.0007)***
Education of Young Adults (age 18-22)	-0.002	-0.007
	(.012)	(.009)
Square of Young Adult Education	0.001	0.001
	(0.004)	(.001)
Urban	0.012	0.021
	(.011)	(.0095)**
Sumatera	-0.013	-0.016
	(.005)***	(.004)***
Kalimantan	-0.01	-0.012
	(.007)	(.0065)*
Sulawesi	-0.011	-0.013
	(.0065)*	(.0056)**
Outer islands	-0.009	-0.012
	(.008)	(.0067)*
Constant	-0.043	-0.023
	(.033)	(.031)
Observations	274	274
R-squared	0.3	0.24

Standard errors (in parentheses) are robust to clustering at the province level. Weighted regressions.
* significant at 10%; ** significant at 5%; *** significant at 1%

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