Local Human Capital Formation and Optimal FDI

Muhammad Asali
Adolfo Cristóbal Campoamor

ABSTRACT
This paper lends both theoretical and empirical support to the notion of optimal FDI levels. It does so by uncovering an inverted-U-shaped relationship between FDI and educational effort. The optimality of a particular FDI inflow depends on the educational incentives induced by FDI on the local, heterogeneous population. Those incentives are formed in the face of uncertainty and asymmetric information between the multinational corporation and its potential workers. The revealed concave relationship between FDI and human capital is most evident for tertiary education in less-advanced economies.

Keywords: Asymmetric Information; FDI; Human Capital; Skills; Tournaments.
1. INTRODUCTION

It has been widely reported by the literature on multinational corporations (henceforth MNCs) the role played by the latter in the expansion of formal education in the host countries. As emphasized by Blomström and Kokko (2001), “MNCs provide attractive employment opportunities to highly skilled graduates in natural sciences, engineering and business sciences, which may be an incentive for gifted students to complete tertiary training”\(^3\). According to this idea, in order to access the staff of reputed multinationals, potential workers need to qualify as educated labor force. Therefore, even when not all of them will effectively work for such multinationals, this reality will induce on these workers an effort of human-capital formation with significant spillovers for the rest of their countries.

In principle, it is straightforward that more FDI, meaning better conditions of employability at higher wages, should stimulate human-capital formation to be selected by multinationals. That is, the relation between FDI inflows and educational investment is monotonically increasing when the local population is homogeneous. However, once we introduce some ability-heterogeneity among native workers, such relation becomes non-monotonic: a very large MNC staff implies a high likelihood to be employed for the high-ability natives, which will tend to reduce their effort then; and the lower effort exerted by the most capable will be accompanied (as a reaction) by more laziness by all others. Therefore, under certain conditions we suggest that the above-mentioned relation between FDI per capita and schooling in recipient countries shows approximately an inverted-U shape\(^4\).

There is in principle no reason why the MNCs will tend to maximize the aggregate efficiency units of the local human capital, because there are many other strategic priorities for them. Therefore, it may be in the interest of the local government to use some instruments in order to internalize the external effects, which will spill over most of the productive sectors. Furthermore, human-capital accumulation is not the only priority to be considered by the host-country government. Productive linkages with local sectors, multiple forms of technology transfer, or just the value added generated by FDI may be even more significant (e.g. Markusen and Venables (1999)). Nevertheless,

\(^3\) Abundant empirical studies also suggest that multinational corporations tend to raise the demand for education in developing countries, as their plants are often more skilled-labor-intensive than the rest of the economy (see, for instance, Feenstra and Hanson (1997)).

\(^4\) Unlike Hoffmann (2003), who used a general-equilibrium model to explore the mechanics of the complementarity (and two-way causality) between human-capital accumulation and FDI, we considered a partial-equilibrium framework.
we tried to emphasize the potential non-monotonicity of the previous relation, together with some causal explanations for such phenomenon, whose relevance will be confirmed in the empirical sections of our paper.

Indeed, our empirical estimates confirm the significance of both a positive, linear impact of FDI on tertiary schooling, and of a negative impact of \( \text{FDI}^2 \), both in developed and developing countries. To the best of our knowledge, this is the first paper to incorporate a non-linear effect of FDI in the analysis of human-capital accumulation. Zhuang (2008) used a difference-in-differences approach in which the reverse-causality problem was addressed using dummies of policy changes as independent variables, instead of FDI measured in dollars. On the other hand, Checchi et al. (2007) used explicitly an FDI variable as a regressor, but only captured its positive linear effect on human-capital formation.

The rest of the paper is organized as follows: section 2 describes an illustrative model; sections 3 and 4 present the data and the estimation procedure; section 5 contains the results and section 6 an appendix listing the countries in our sample.

2. AN ILLUSTRATIVE MODEL

In our model there must be a chance for all potential workers (skilled and unskilled) to be eligible for a job in MNCs. Otherwise the gains would be circumscribed to the high-skilled workers. Therefore, some noise in the educational and/or the political system of the host country must play a role, by preventing the MNCs from using a fully-informed recruiting policy. That same noise is also responsible for some uncertainty on the part of the applicants, who will select their optimal education effort as a function of the probability to be selected by the MNCs.

2.1. Education as an instrument to be hired by multinationals

Our theoretical framework is a variation of Lazear and Rosen (1981)’s model of tournaments. In this particular setting there are \( l \) local workers competing for \( h \) jobs offered by the MNCs. The total size of the population (\( l \)) is divided into a proportion \( \frac{1}{2} \) of high-ability types (let us call them type-2) and a proportion \( \frac{1}{2} \) of low-ability types (type-1). The former types own \( \theta \) efficiency units of labor (\( \theta > 1 \)), whereas the latter own just one efficiency unit. However, the type of each individual is not observable to the employer. He needs to use a selection process in order to choose the (presumably) best employees for the MNC, though such selection depends on an imperfect test.
We assume that, in this model, more formal education improves the chance to be selected by the MNC, that is, it plays the role of a signaling device. However, schooling also helps the MNC to improve the quality of its pool of employees, since the most capable individuals will be more educated. Given that the most capable workers are also more productive, this implies that schooling will channel disproportionally the skilled workers to the MNC, raising the aggregate productivity (and value added) of the economy. From that point of view, it can be said that schooling also has an aggregate productivity effect.

Let the personal outcome of any individual $i$ in the test depend on his own training effort ($e_i$) and an element of randomness ($\eta_i$), where the random variable $\eta_i$ follows an uniform distribution over the interval $[-a,a]$, $a>0$ for all $i$. More specifically, let us denote by $g_i$ the test score of individual $i$ and assume that

$$g_i = e_i + \eta_i$$

That randomness ($\eta_i$) obscures the true type of the individual to the eyes of the employer, given that a good (or a bad) result in the test could be obtained (under different circumstances) by any of the two types. We can interpret the variance of $\eta_i$ as an inverse measure of the quality of the educational system in the host country. The magnitude of such variance is measured by the parameter $a$.

Despite the imperfections in the test, the multinational firm decides to recruit the best $h$ scores, where $h$ stands for the size of the local staff in the multinational corporation. That variable ($h$) will also determine the relative incentives of both types to get educated and, subsequently, the ex-post quality of the hired staff.

The way to be selected in the test is beating at least $l-h$ competitors, where $l$ is the total number of candidates involved in the selection process. That is, all workers will be interested in applying for a job in the multinationals, given that the MNC offers a higher wage than the one available locally ($w_F - w_H=\Delta w>0$, where $F$ and $H$ stand for foreign and home, respectively).

First of all, it is intuitive that – given identical preferences (in the form of disutility) with respect to effort – the high-ability types will tend to exhibit a higher incentive to acquire education, since they will enjoy from the same wage gap, but applied to a higher number of efficiency units of labor. We will show this fact by obtaining the probability that any worker (of type $i$) gets a higher score than any other worker (of type $j$; $i,j \in \{1,2\}$), as follows:
where we have considered an uniform, independent probability distribution for the random variables $\eta_i$ and $\eta_j$, and assumed that $a$ is big enough to ensure that probabilities are always positive and lower than one. Let us denote by $\gamma$ the parameter measuring the intensity of the effort disutility by both types of individuals. Now we are ready to present the maximization problem faced by the workers of both types:

$$Welfare_i = \text{Max}_e \{ p_i (e_i, e_2) \Delta w - \frac{1}{2} \gamma e_i^2 \}$$

$$Welfare_j = \text{Max}_e \{ p_j (e_1, e_2) \Delta w - \frac{1}{2} \gamma e_j^2 \}$$

where

$$p_2 = \frac{1}{4} + \frac{1}{2} \left( \frac{1}{2} + \frac{e_2 - e_1}{8a} \right) = \frac{1}{2} + \frac{e_2 - e_1}{8a}$$

$$p_1 = 1 - p_2 = \frac{1}{2} - \frac{e_2 - e_1}{8a}$$

We have denoted by $p_i$ the probability that an agent shows a higher score than another one, conditional on the type $(i=1,2)$ of the former. In (3) we are incorporating the fact that, in order to be hired by a multinational, any candidate must defeat other $(l-h)$ potential workers. Let us denote by $z=e_2-e_1$ the difference between the education efforts of both types, so that $p_2 = p_1 + \frac{z}{4a}$. Then, by plugging the equations in (4) into the maximands given by (3) and taking the corresponding first-order conditions, we come up with the following reaction functions:

$$e_2 = (l-h) \frac{\Delta w}{8ya} \left[ \frac{1}{2} + \frac{z}{8a} \right]^{l-h-1}$$

$$e_1 = (l-h) \frac{\Delta w}{8ya} \left[ \frac{1}{2} - \frac{z}{8a} \right]^{l-h-1}$$

If we now subtract both terms in (5), we can characterize the distance between the optimal efforts made by both types as follows:

$$z = (l-h) \frac{\Delta w}{8ya} \left[ \left( \frac{1}{2} + \frac{z}{8a} \right)^{l-h-1} - \left( \frac{1}{2} - \frac{z}{8a} \right)^{l-h-1} \right]$$

Furthermore, we can close the system by imposing a consistency requirement, which guarantees that the workers' expectations are rational: the effective size of the MNC
staff must be equal to the sum of the probabilities to be hired.\textsuperscript{5} Such requirement can be expressed as follows:

\[
h = \frac{l}{2} \left[ p_{l-h}^l + p_{z-h}^z \right] = \frac{l}{2} \left[ \left( \frac{1}{2} + \frac{z}{8a} \right)^{l-h} + \left( \frac{1}{2} - \frac{z}{8a} \right)^{l-h} \right]
\]  \hspace{1cm} (7)

Therefore, our whole economic system can be characterized by the equations (6) and (7) in the two endogenous variables $h$ and $z$.

If we examine carefully both equations above, it is straightforward that both expressions will hold if $h$ is close enough to $l$ ($h \to l$), and if $z$ is close enough to zero ($z \to 0^+$).\textsuperscript{6} However, we believe that nothing substantial hinges on that proximity to the ‘corner solutions’, since we will be still able to plot the shape of the (admittedly small) individual efforts with respect to the FDI inflow.

Our exercise will consist in taking comparative statics (on the effort levels) with respect to the wage gap; obtaining (and plotting) the labor income generated by FDI\textsuperscript{7} that corresponds to such values of the gap; and also plotting the relationship between FDI and the aggregate training effort of the local population. We consider two possible objective functions (or criteria) to be maximized by the government in the host country: either the labor income generated by FDI, or the aggregate educational effort also induced by FDI. In the latter case, since our proposed objective will be promoting FDI up to the point where aggregate educational effort is maximized, we will derive some conclusions concerning the available policy instruments for the government.

In other words, the wage gap is exogenous for us, whereas FDI (understood here as the local labor income generated by the MNC) and the effort levels are our endogenous variables.

\textbf{2.2. Calibration and diagrammatic results}

Since the system of non-linear equations expressed by (6) and (7) has no analytical solution, we need to solve it numerically for some plausible values of the parameters. In particular, we have followed Ghosh and Whalley (2007) ‘s parameterization with respect to the units-term in the disutility of effort function ($\gamma=1$). Goldin and Katz (1999) suggest an average return to each year of college in the USA of 0.13, which

\textsuperscript{5} In other words, condition (7) means that the MNC can exactly fulfill its promise to hire the best $h$ scores.

\textsuperscript{6} Those two conditions are also a guarantee that the maximization problems specified in (3) are concave.

\textsuperscript{7} We assume that the potential profits generated by the MNC will be repatriated to the home country. Therefore, the host country will be interested exclusively in the labor income stemming from FDI.
amounts to a lower bound for \( \theta = 1.52 \). We will discuss later the implications of changing our parameter \( a \), which for the moment will take a value \( a = 830 \), while \( l = 1.7 \).

A useful definition will be for us

\[
HC = \frac{l}{2} \left[ \left( \frac{1}{2} + \frac{z}{8a} \right)^{l-h} \theta + \left( \frac{1}{2} - \frac{z}{8a} \right)^{l-h} \right]
\]  

That is, the variable \( HC \) captures the aggregate units of effective labor used in the MNC. Moreover, we have normalized (without loss of generality) the domestic wage \( w_H \) to zero. Therefore, the labor income distributed by the MNC among the domestic workers (that is, the value added that remains in the host country) is

\[
FDI \equiv HC (\Delta w)
\]  

Since we are interested in the empirical implications of our numerical results, we have included in every horizontal axis of Figure 1 the variable FDI, as defined in equation (9). We can clearly observe (in the last panel) that \( FDI \) and \( \Delta w \) are positively correlated, which conforms well with Feenstra and Hanson (1997) ’s findings with Mexican data.

[Figure 1 here]

2.3. Interpretation of the figures

Higher wage gaps and FDI inflows are likely to induce additional training on the part of both high-ability and low-ability workers. However, the incentives are in principle stronger for the most capable people, given their extra units of effective labor, which translates into higher wages per hour worked. That is the reason why, as FDI starts to reach very significant values, the aggregate effective units of labor grow substantially and skilled workers increase their training effort at a faster rate.

But that situation will only last up to a certain point. When both FDI and the wage gap are quite high and MNCs hire a significant fraction of the population, skilled types will start to feel that the relative gains from additional effort are lower than their disutility. When they eventually decide to relax, everybody will also decide to do so, as we can observe in the panel that shows the aggregate effort levels. Under such circumstances, it makes sense for the government in the host country to wonder: “Should we really promote FDI so much, when that is (locally) reducing the educational achievement of
our workers, and the MNCs will end up releasing many uneducated, unskilled employees for the rest of the economy?"

In other words, in terms of Figure 1 the government may wonder whether $FDI=50$ is better for the local economy than $FDI=100$, although in the latter case the wage gap is still higher (see the lower panel on the right).

What could the government do to enhance the exertion of educational effort, while allowing for more FDI? Interestingly, a good answer would be increasing the levels of corruption in the administration/educational system. If we raised the value of $a$ from 830 to 835, lowering therefore the precision of the tests in the host country, then type-2’s would have to work harder to differentiate themselves, which would also push type-1’s,…as we can observe in figure 2. However, this process could not persist forever, since eventually an extremely corrupted system would completely abort any effort by both types. Finally, we would obtain again an optimal level of FDI in terms of educational effort; though such effort would be higher this time (compare the second panels on figures 1 and 2).

[Figure 2 here]

Just to conclude with the section, let us emphasize the following idea: if the single priority of the government were maximizing a weighted average of the local welfare levels in (3), then there would be no upper bound for the local FDI target.

Nevertheless, if the government anticipated future layoffs by the multinational and appreciated the adaptability and redeployment capacity of the workers, probably they could limit FDI to enhance the aggregate educational effort.

An instrument that seems to reconcile both criteria is a high corruption level in the educational sector, although that is particularly likely to be damaging in other respects.
3. DATA

We combine data from different sources to carry out our analyses. These are based on data from the World Bank’s World Development Indicators for data on mortality, land area, population density, and rural population; the Barro-Lee educational attainment data for data on the percentage of the population above the age of 15 who have no schooling, enrolled in secondary education, completed secondary education, enrolled in tertiary education, completed tertiary education, the average years of schooling, and the region of the country (Barro and Lee, 2010); and the United Nations Conference on Trade and Development for data on GDP per capita, and FDI stocks and flows per capita and as a percentage of GDP.

The data cover 146 countries, in five-year intervals from 1980 to 2010. Based on Barro-Lee country classification there are 24 countries classified as “advanced economies”; these include, Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States. The remaining 122 countries come from “Other Regions” which cover East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, and Sub-Saharan Africa.

Table 1 reports summary statistics of our main variables of interest, over the whole sample period, overall and by region.

[Table 1 here]

There are 160 country-year observations in the advanced economies sample, and 631 country-year observations in other regions. The average years of schooling in the pooled sample is 7, whereas it is 9.6 in advanced economies and 6.3 in the rest of the world. Figures are calculated for all countries and for the whole period 1980-2010.

46.9 percent of the population in advanced economies are enrolled in secondary education, while this figure is 34.3 percent for the less advanced economies. Striking differences between the advanced economies versus the rest are found in mortality rate under the age of 5, this is 10.6 versus 73 percent; in the portion of the population living

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in rural areas, 26% versus 52%; and in the portion of the population with no schooling: 4.8% in advanced economies versus 25.4% in the remaining countries. At all schooling levels, the performance and enrollment in advanced economies is much higher than that in the less advanced economies, sometimes more than double the measures. Although the stock of FDI per capita in other regions is only 14% of that in advanced economies, it constitutes about 29% of the GDP in both regions.

### 4. ESTIMATION and RESULTS

One of the main testable hypotheses suggested by our theoretical analysis is that the increase in foreign direct investment in a country induces an increase in the human capital of the country, exemplified by higher participation rates in higher education, but at a decreasing rate. Although the model describes a relationship at the micro-level (individuals with multinational corporations), treating each agent as representative of its type bears essentially the same outcomes at the aggregate level. Therefore, we test our hypothesis using the existing aggregate country-level data, acknowledging the potential superiority of (not readily available) micro-data.

To test this hypothesis we estimate the following equation:

\[
HC_{it} = \beta_1 FDI_{it} + \beta_2 FDI^2_{it} + \gamma X_{it} + \delta_i + \phi_t + \epsilon_{it}
\]  

(10)

where \( HC_{it} \), standing for human capital, is either the average years of schooling, the enrollment rate in secondary education, the enrollment rate in tertiary education, or the completion rate of tertiary education in country \( i \) at time \( t \). \( FDI_{it} \) represents the stock of FDI as a percentage of the GDP in country \( i \) at time \( t \).

Other control variables are included in the vector \( X_{it} \) for country \( i \) at time \( t \): the log of GDP per capita, the mortality rate under the age of 5 (per 1000), the no-schooling rate, and the portion of the population living in rural areas. While these variables control for differences in resources and the allocation of these, mortality rate is included in the regression because it conveys some information about poverty (as mortality rate is higher in poorer countries), but also this may affect educational choices: educational attainment is an investment decision, the return of which depends on the life-span [see Egger et al. (2005), Checchi, De Simone, and Faini (2007)].
4.1. Identification

The main variables of interest are FDI and $\text{FDI}^2$, representing the percentage of FDI stock from the GDP of the country, and its square.

The coefficients of interest, $\beta_1$ and $\beta_2$, would not be consistently estimated by OLS if there is an omitted variable that is not included in the model and is correlated with FDI. The omitted variable would be the overall innate ability or motivation in the country, which may be correlated with FDI and the educational attainment. The country and time fixed effects cannot resolve the endogeneity problem, inasmuch as ability may be country-specific and may change over time.\(^{10}\)

To address this concern we estimate the following model

\begin{equation}
HC_i = \beta_{1i} fdi_{it} + \beta_{2i} fdi_{it}^2 + \gamma X_{it} + \delta_i + \phi_i + v_{it} \quad (11)
\end{equation}

\begin{equation}
FDI_{it} = \lambda_1 pFDI_{it} + \lambda_2 pFDI_{it}^2 + X_{it} \lambda_3 + \delta_i + \phi_i + u_{it} \quad (12)
\end{equation}

\begin{equation}
FDI_{it}^2 = \mu_1 pFDI_{it} + \mu_2 pFDI_{it}^2 + X_{it} \mu_3 + \delta_i + \phi_i + w_{it} \quad (13)
\end{equation}

\begin{equation}
FDI_{it} = \theta_{1i} Density_{it} + X_{it} \theta_2 + \delta_i + \phi_i + u_{it} \quad (14)
\end{equation}

using two-stage least squares (2SLS), where equation 11 is the second stage and equations 12-14 constitute the first stage. We run (14) by OLS and get the predicted values of FDI (call these $pFDI$). This is the first step in the first stage of 2SLS. In the second step of the first stage we regress FDI and squared-FDI on the predicted values from the first step (equations 12 and 13). The respective predicted values from these two regressions (named $fdi$ and $fdi^2$) are used in the second stage of the 2SLS, equation (11).\(^{11}\) We use robust standard errors in all regressions, due to the panel aspect of the data—different countries at different periods.

As equation (14) makes it clear, the instrument we use for the FDI variable is based on the population density in each country.\(^{12}\) FDI is positively correlated with the population density, as the increased specialization brought about by population density has a positive effect on productivity which attracts foreign (and domestic) investments.

\(^{10}\) Other potential problems resulting in endogenous FDI and biasing OLS estimates include measurement error in FDI (which tends to attenuate the OLS estimates towards zero), and simultaneous equations framework due to the potential reverse causality between FDI and human capital (Hoffmann 2003).

\(^{11}\) Simply substituting the predicted value of FDI from equation 14, $pFDI$, and its square into equation 11 seems intuitive, however it is a wrong procedure, referred to as the “forbidden regression” in the econometric literature. See Wooldridge (2002) for more details.

\(^{12}\) We also examined other potential instruments like arable land (as a percent of land area), yielding very similar results.
Becker, Glaeser and Murphy 1999; Glaeaser 1999). On the other hand, beyond observable variables in the model, and beyond the channel of FDI, years of education are arguably not caused by population density.

4.2. First Stage

The first-stage regressions for the above specification are shown in Table 2. Because the baseline functional form includes nonlinear terms of the endogenous regressor, namely FDI and squared-FDI, the first stage is carried out in two steps. In the first step we regress FDI against the instrument population density, along with the remaining control variables from the baseline model. Estimation results of this step are found in panel A of the table.

[Table 2 here]

We then calculate the predicted values of FDI from the first step (call it pFDI), and run the two separate first-stage regressions of FDI against pFDI and its square, and of FDI-squared against pFDI and its square, along with all the remaining control variables. These are shown in panel B of the table.

Population density (measured in people per square km of land area) is indeed a good predictor of the magnitude of the stock of foreign direct investment expressed as a portion of GDP. In the first step, the coefficient for the population density is 0.052 and is statistically significant at the 5% level. This means that increasing the population density by 100 persons per square km, holding constant all other variables like mortality rate and illiteracy rate, increases the FDI stock in the country by 5% of the GDP.

The table also includes robust $F$-tests for the joint significance of the linear and quadratic terms of the first-step predicted FDI, along with the respective $p$-values. As is clear from the table, these terms are highly significant, supporting the relevance and strength of our instrument.

4.3. Results

Table 3 shows the main results of our analyses for all human capital variables considered (average schooling, secondary enrollment, tertiary enrollment, and tertiary completion). Along with the 2SLS estimates, the table also reports the simple OLS estimates as a benchmark.
In the first panel we report results for the pooled sample, in the second for advanced economies, and in the last for other regions. For ease of exposition, we report only the coefficients of interest in this study, namely those of FDI and $\text{FDI}^2$.

It is apparent from the table that OLS estimates are biased downward. Observing countries from “other regions,” the correction through 2SLS increased the coefficient of FDI by about 0.01 in years of schooling, 0.07 in tertiary enrollment, and 0.05 in tertiary completion rate.

It is also evident from the table that the effects of FDI on educational attainment are precisely estimated only for the less advanced economies. Also, these are most felt and substantive at the highest level of education, as is clear from results in panels C and D. Considering the case of tertiary enrollment, for a typical country in the less advanced economies, with an average FDI of 29.2%, a one percent increase in the stock of FDI will increase the enrollment in tertiary education by 0.088 (0.0915 - 2x0.0551/1000x29.2).

The most important aspect conveyed by the table is that the education-FDI relationship is best described by a concave (inverted-U shape) function, as implied by our theoretical model. The inverted-U shape relationship between FDI inward stock and education suggests that there exists a potential “optimal” level of FDI.

Results are mostly borne by and significant for the less-advanced economies as well as for the pooled sample. Also, the relationship between FDI and education is significant only for the higher levels of education, suggesting that FDI is likely to be concentrated in human-capital intensive industries.

13 Asali and Cristobal (2011) used WDI cross-sectional data, for the year 2005; they likewise found evidence supporting a concave relationship between FDI and tertiary education enrollment.
5. CONCLUDING REMARKS

The relationship between FDI and human capital is best described by an inverted-U shape function. This relationship is clearer in less-advanced economies and in the case of tertiary education, which may reveal that FDI tends to be skill-biased and raise inequality in most LDCs. There is also a clustering of many countries around a lower-than-optimal level of FDI. We conjecture that some of these countries may be affected by a low-human-capital trap, as suggested by some of our simulations. Proving the effective existence (or inexistence) of those traps is an interesting venue for future research.

6. APPENDIX

Countries included in our samples are:

<table>
<thead>
<tr>
<th>Advanced Economies</th>
<th>Other Regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia, Austria, Belgium, Canada, Denmark,</td>
<td>Afghanistan, Albania, Algeria, Argentina, Armenia, Bahrain, Bangladesh,</td>
</tr>
<tr>
<td>Finland, France, Germany, Greece, Iceland,</td>
<td>Barbados, Belize, Benin, Botswana, Brazil, Brunei Darussalam, Bulgaria,</td>
</tr>
<tr>
<td>Ireland, Italy, Japan, Luxembourg, Netherlands,</td>
<td>Burundi, Cambodia, Cameroon, Central African Republic, Chile, China, Colombia,</td>
</tr>
<tr>
<td>New Zealand, Norway, Portugal, Spain, Sweden,</td>
<td>Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Ecuador, El Salvador,</td>
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<tr>
<td>Switzerland, Turkey, United Kingdom, and the</td>
<td>Estonia, Fiji, Gabon, Ghana, Guatemala, Guyana, Haiti, Honduras, Hungary,</td>
</tr>
<tr>
<td>United States.</td>
<td>India, Indonesia, Iraq, Israel, Jamaica, Jordan, Kazakhstan, Kenya, Kuwait,</td>
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<td></td>
<td>Latvia, Lesotho, Liberia, Lithuania, Malawi, Malaysia, Maldives, Mali, Malta,</td>
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<td></td>
<td>Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Myanmar, Namibia,</td>
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<td></td>
<td>Nepal, Nicaragua, Niger, Pakistan, Panama, Papua New Guinea, Paraguay, Peru,</td>
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<td></td>
<td>Philippines, Poland, Qatar, Romania, Russian Federation, Rwanda, Saudi Arabia,</td>
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<td>Senegal, Serbia, Sierra Leone, Singapore, Slovenia, South Africa, Sri Lanka,</td>
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<td></td>
<td>Sudan, Swaziland, Syrian Arab Republic, Tajikistan, Thailand, Togo, Tonga,</td>
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<td></td>
<td>Trinidad and Tobago, Tunisia, Uganda, Ukraine, United Arab Emirates, Uruguay,</td>
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<tr>
<td></td>
<td>Zambia, Zimbabwe.</td>
</tr>
</tbody>
</table>
7. REFERENCES


Figures:

Figure 1 (a=830)

Figure 2 (a=835)
Tables:

### Table 1—Summary Statistics of the Main Variables, by Region

<table>
<thead>
<tr>
<th>Variable</th>
<th>All</th>
<th>Advanced Economies</th>
<th>Other Regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDI Stock (% of GDP)</td>
<td>Mean: 29.0, Std. Dev.: 74.95</td>
<td>Mean: 28.1, Std. Dev.: 34.47</td>
<td>Mean: 29.2, Std. Dev.: 82.12</td>
</tr>
<tr>
<td>FDI Stock (Per Capita)</td>
<td>Mean: 3108.0, Std. Dev.: 11328.7</td>
<td>Mean: 9778.7, Std. Dev.: 21858.6</td>
<td>Mean: 1416.5, Std. Dev.: 5116.6</td>
</tr>
<tr>
<td>Years of Schooling</td>
<td>Mean: 7.0, Std. Dev.: 2.89</td>
<td>Mean: 9.6, Std. Dev.: 1.85</td>
<td>Mean: 6.3, Std. Dev.: 2.71</td>
</tr>
<tr>
<td>Percent Secondary Education</td>
<td>Mean: 36.9, Std. Dev.: 20.00</td>
<td>Mean: 46.9, Std. Dev.: 13.50</td>
<td>Mean: 34.3, Std. Dev.: 20.58</td>
</tr>
<tr>
<td>Percent Completed Tertiary</td>
<td>Mean: 5.4, Std. Dev.: 5.33</td>
<td>Mean: 10.8, Std. Dev.: 5.81</td>
<td>Mean: 4.0, Std. Dev.: 4.21</td>
</tr>
<tr>
<td>GDP (Per Capita, 2005USD)</td>
<td>Mean: 10210, Std. Dev.: 14353.6</td>
<td>Mean: 30859.1, Std. Dev.: 12893.2</td>
<td>Mean: 4973.9, Std. Dev.: 8980.46</td>
</tr>
<tr>
<td>Mortality Rate (under age 5, per 1000)</td>
<td>Mean: 60.4, Std. Dev.: 64.38</td>
<td>Mean: 10.6, Std. Dev.: 15.20</td>
<td>Mean: 73.0, Std. Dev.: 65.95</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>Mean: 791</td>
<td>Mean: 160</td>
<td>Mean: 631</td>
</tr>
</tbody>
</table>

**Notes:** Authors’ calculations from the working data, based on The World Bank data, the UN data, and the Barro-Lee data, for the years 1980–2010; see text for details. “Advanced Economies” include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States. “Other Regions” include East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, and Sub-Saharan Africa.
Table 2—First Stage Regressions

<table>
<thead>
<tr>
<th>Dependent Variable:</th>
<th>$FDI$</th>
<th>$FDI^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A. First Step</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population Density</td>
<td>0.052***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0142)</td>
<td></td>
</tr>
<tr>
<td>$F$-statistic</td>
<td>10.63</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.6847</td>
<td></td>
</tr>
<tr>
<td>Adj-$R^2$</td>
<td>0.6203</td>
<td></td>
</tr>
<tr>
<td><strong>Panel B. Second Step</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$pFDI$</td>
<td>-0.538</td>
<td>-1.669**</td>
</tr>
<tr>
<td></td>
<td>(.3433)</td>
<td>(0.8580)</td>
</tr>
<tr>
<td>$pFDI^2$</td>
<td>0.006***</td>
<td>0.009**</td>
</tr>
<tr>
<td></td>
<td>(0.0015)</td>
<td>(0.0039)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.8981</td>
<td>0.7257</td>
</tr>
<tr>
<td>Adj-$R^2$</td>
<td>0.8771</td>
<td>0.6692</td>
</tr>
<tr>
<td>Partial $R^2$</td>
<td>0.6833</td>
<td>0.5489</td>
</tr>
<tr>
<td>Robust $F$</td>
<td>17.043</td>
<td>3.012</td>
</tr>
<tr>
<td>$P_F$</td>
<td>0.0000</td>
<td>0.0499</td>
</tr>
<tr>
<td>Observations</td>
<td>791</td>
<td>791</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors are in parentheses. “$pFDI$” is the predicted FDI from the first step. Other control variables included in all regressions are: the log of GDP per capita, mortality rate (under 5, per 1000), percentage of rural population, illiteracy rate, year fixed effects, and country fixed effects. Period covered is 1980-2010.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level
## Table 3—Main Results

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Advanced Economies</th>
<th>Other Regions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>2SLS</td>
<td>OLS</td>
</tr>
<tr>
<td><strong>A. Years of Schooling</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI</td>
<td>0.0008 (0.0008)</td>
<td>0.0099*** (0.0026)</td>
<td>0.0012 (0.0010)</td>
</tr>
<tr>
<td>FDI² (*1000)</td>
<td>-0.0007 (0.0046)</td>
<td>0.0067*** (0.0022)</td>
<td>-0.0099* (0.0055)</td>
</tr>
<tr>
<td><strong>B. Percentage Enrolled in Secondary Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI</td>
<td>0.0048 (0.0117)</td>
<td>0.0061 (0.0343)</td>
<td>0.0056 (0.0126)</td>
</tr>
<tr>
<td>FDI² (*1000)</td>
<td>-0.0035 (0.0062)</td>
<td>-0.0088 (0.0233)</td>
<td>0.2593 (0.0066)</td>
</tr>
<tr>
<td><strong>C. Percentage Enrolled in Tertiary Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI</td>
<td>0.0094 (0.0062)</td>
<td>0.0542*** (0.0169)</td>
<td>0.0167*** (0.0052)</td>
</tr>
<tr>
<td>FDI² (*1000)</td>
<td>-0.0056 (0.0037)</td>
<td>-0.0304*** (0.0117)</td>
<td>0.0571 (0.0033)</td>
</tr>
<tr>
<td><strong>D. Percentage Completed Tertiary Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI</td>
<td>0.0037 (0.0036)</td>
<td>0.0376*** (0.0111)</td>
<td>0.0083*** (0.0029)</td>
</tr>
<tr>
<td>FDI² (*1000)</td>
<td>-0.0023 (0.0021)</td>
<td>-0.0222*** (0.0080)</td>
<td>0.1669 (0.0017)</td>
</tr>
</tbody>
</table>

**Notes:**
- The dependent variable is average years of schooling in panel A, percentage in secondary education in panel B, percentage in tertiary education in C, and percentage completed tertiary education in D.
- “Advanced Economies” include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States. “Other Regions” include East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, and Sub-Saharan Africa.
- Under 2SLS reported are the instrumental variables estimates, using the population density as an instrument for FDI. Other control variables included in all regressions are: the log of GDP per capita, mortality rate (under 5, per 1000), percentage of rural population, illiteracy rate, year fixed effects, and country fixed effects. Period covered is 1980-2010. Robust standard errors are in parentheses.
- ***** Significant at the 1 percent level**
- **** Significant at the 5 percent level
- * Significant at the 10 percent level