Entrepreneurship Selection and Performance: A Meta-Analysis of the Impact of Education in Developing Economies

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This meta-analytical review of empirical studies of the impact of schooling on entrepreneurship selection and performance in developing economies looks at variations in impact across specific characteristics of the studies. A marginal year of schooling in developing economies raises enterprise income by an average of 5.5 percent, which is close to the average return in industrial countries. The return varies, however, by gender, rural or urban residence, and the share of agriculture in the economy. Furthermore, more educated workers typically end up in wage employment and prefer nonfarm entrepreneurship to farming. The education effect that separates workers into self-employment and wage employment is stronger for women, possibly stronger in urban areas, and also stronger in the least developed economies, where agriculture is more dominant and literacy rates are lower.

The theory of human capital posits that one of the main drivers of investment in schooling is the notion that schooling produces skills that raise worker productivity and income. Education, therefore, is thought to be beneficial for economic growth. The development literature thus includes numerous studies that attempt to quantify the rate of return to education. Psacharopoulos (1994) has brought together the evidence from 140 studies from around the world in a way that allows both international comparisons and trend analyses. However, almost without exception, returns to schooling refer to the returns employees generate from their years at school (Bennell 1996). By contrast, the literature on measurement of the rate of return to schooling in entrepreneurship or its most common empirical equivalent, self-employment, is actually still poorly defined,

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both for industrial countries (van der Sluis and others 2003) and for developing economies, the subject of this study.[1]

The objective here is to assess whether and to what extent schooling affects entrepreneurship entry and performance in developing economies.[2] The analysis brings together more than 80 studies that measure these effects. A careful reading of the studies reveals that a simple summary is problematic because definitions of variables, empirical models, and data sources differ so much. Thus meta-analytical techniques based on factors that characterize each study are used to investigate the education effects. A meta-analytical approach yields a quantitative assessment of the literature that complements the more standard literature survey, which highlights particular high-quality pieces of research. A meta-analytical review forces precise comparisons of the research practices and methodologies applied in the studies and provides a quantitative explanation of the variation among the many research outcomes.[3] Such analysis permits a deeper understanding of the gaps and opportunities in this rather poorly developed area of entrepreneurship research. The results are compared to both the better developed studies on employee returns to schooling and to the just as poorly developed studies on entrepreneurs in developed economies.

By assembling the evidence from entrepreneurship studies, this study also contributes a piece to the puzzle of the relationship between education and economic growth. The evidence summarized by Psacharopoulos (1994) pertains mostly to one type of microeconomic study—that of wage employment—which tends to yield more positive results than macroeconomic research into the returns to education (Bosworth and Collins 2003). This article summarizes microeconomic studies pertaining to entrepreneurship and asks what factors cause variation among these studies.

This topic is clearly of great relevance. Researchers and practitioners alike are fully aware of the contributions of entrepreneurs to the economy. Entrepreneurs generate a substantial part of national income and employment in most countries. Small enterprises form a large, flexible buffer between salaried employment and incorporated businesses. Moreover, entrepreneurship may generate benefits for society through the development and maintenance of human and social capital that occur when entrepreneurial activity takes place.

1. In a parallel paper, van der Sluis and others (2003) examine the same set of relationships in industrial countries. The analysis of industrial country studies with an analysis of the developing economy studies is not easily fused, however, because the general level of schooling is lower and a substantial portion of the labor force works on the farm.

2. For more general surveys on entrepreneurship, see Mead and Liedholm (1998), King and McGrath (1999), and Kiggundu (2002). For a survey on the separate literature on the impact of education on farm production, see Jamison and Lau (1982) and Lockheed and others (1987). This literature is also summarized in a meta-analysis by Phillips (1994). This article does not cover the role of education in agricultural activities.

3. Space constraints preclude describing individual studies in detail, which would itself be a useful contribution.

In developing economies, the size and economic importance of the entrepreneurial sector have long been underestimated. In line with Lewis (1954) and Ranis and Fei (1964), studies of economic development have emphasized agriculture and industry. The work by Harris and Todaro (1969) illustrates that workers shifting from agriculture to industry may face a period of unemployment or may be forced to provide for themselves through a low-productivity household enterprise. A 1972 International Labour Organization (ILO 1972) report extended that notion and labeled such enterprises the "informal sector." The concept has proved to be one of the more influential ideas in development economics for right or wrong reasons (see, for example, House 1984; Mead and Morrison 1996; Peattie 1987). As defined, the informal sector covered all economic activity that was hidden from official oversight and that tended not to be very productive. Soon, the perception ruled that the informal sector consisted mainly of small enterprises, unable to make any significant contribution to national economic growth and undesirable for anyone striving to make a decent living. Although many small enterprises appear unproductive, in the late 1980s large-scale household surveys began to uncover much hidden entrepreneurial activity.[4] It was found that small enterprises make useful contributions to household income, and that some blossom into large operations.

With household entrepreneurship found to be so extensive, researchers began to ask what determines the income from household enterprises: for instance, what does schooling contribute? If employment in the formal sector is so much more desirable, why do people want to start a household enterprise? There are good theoretical reasons to presume that education is a determinant of entrepreneurship selection and entrepreneurial success (discussed later) in developing economies. If education in fact improves entrepreneurial performance and results in more entrepreneurs, that would justify appropriate investments in education. This article assesses whether and to what extent schooling affects entrepreneurship selection and performance and evaluates the state of the art of research of this kind.

The article first summarizes the economic theory on the relationship of entrepreneurship entry, performance, and educational attainment. It then describes the data gathering and the characteristics of the database, as well as current research into the relationship between schooling and entrepreneurship entry and performance. Next, it details the construction of subsamples for the meta-analysis used to explain cross-study differences in the relationship between schooling and entrepreneurship (entry and performance). The results from the meta-analysis on performance are then compared with the findings for

4. In contrast, studies of entrepreneurship relied on surveys sampled from lists of registered (and therefore larger scale) enterprises and therefore presented a biased view of entrepreneurship: only successful entrepreneurs would grow and eventually register. For an example in Côte d'Ivoire, see Vijverberg (1992); for an example across Botswana, Kenya, Malawi, Swaziland, and Zimbabwe, see Mead (1994) and Mead and Liedholm (1998).

developed economies, and the relationships between schooling and entrepreneurship selection are examined.

I. Economic Theory of Entrepreneurship Selection and Performance

The theoretical literature proposes several determinants of entrepreneurship selection and performance. Among them are attitude to risk, access to capital, labor market experience, economic conditions, family background, psychological traits, income diversification, access to credit, and education. This section briefly reviews the theoretical arguments on the relationship between schooling and entrepreneurship.

Education as a Determinant of Entrepreneurship Selection and Performance

The level of education might influence the propensity to become self-employed through several channels (Le 1999). Education enhances managerial ability, which increases the probability of entrepreneurship (Calvo and Wellisz 1980; Lucas 1978). Working in the opposite direction, higher levels of education might generate better options (more lucrative paid wage employment under better working conditions) and thus decrease the likelihood of entrepreneurship. It remains unclear what the predicted effect of these offsetting forces might be.

Education may also influence entrepreneurship performance in several ways. According to the Mincerian specification of the determinants of individual earnings, the main factors affecting earnings are schooling and experience. This specification and the implied positive returns to schooling have found empirical support in the wage sector. This reasoning would seem to apply in other occupational sectors as well, such as entrepreneurship, but little systematic work has been done on the subject.

Schooling is acknowledged both for its productive effect on the quality or quantity of labor supplied, as assumed by Mincer, and for its value as a signal of productive ability in labor markets without complete information (Riley 2002; Spence 1973). For entrepreneurs, the education signal may be helpful in dealing with clients, suppliers, bankers, and so on, and thus raise productivity.

Integrated Models of Choice and Performance

Another type of model simultaneously explains the occupational choice and performance of labor market participants. In these structural models the division between entrepreneurs and wage labor turns on the distribution of individual characteristics among the utility-maximizing population. In Lucas (1978) and van Praag and Cramer (2001) this characteristic is individual entrepreneurial ability as determined by, for instance, education. In such models education generates higher levels of expected entrepreneurial ability, which cause higher levels of expected entrepreneurial performance (in terms of profit and firm size). This higher level of expected performance, and thus of income and nonmonetary returns, increases the expected utility attached to entrepreneurship and thereby favors this occupational choice. Similarly, Vijverberg (1986, 1993) models occupational choice as a time allocation problem in which people choose from different income-generating activities (see also Roy 1951). Education has different effects on productivity for different activities, and people with different education backgrounds may have varying preferences for those activities. Thus, education affects sorting outcomes, but the net direction of the impact is an empirical matter.

Education may affect sorting outcomes in several other ways. First, it interacts with the seasonality of on-farm work. During the slack agricultural season, many farm workers seek off-farm employment, but the scarcity of jobs (due partially to the lack of tolerance of nonfarm business ventures for seasonal fluctuations) forces farm workers to enter some sort of nonfarm self-employment activity (Haggblade and others 1989; Lanjouw and Lanjouw 2001). Manual jobs that lend themselves to short-term self-employment require less education, because more educated workers establish themselves in more full-time activities. Second, households seek to diversify their income. They may operate a nonfarm enterprise to offset uncertainty in farming outcomes, and the education level of household members may determine who does what kind of work (see De Janvry and Sadoulet 2000; Haggblade and others 2002; Lanjouw and Lanjouw 2001; Reardon and others 2000). Third, education is associated with greater household wealth. Because credit markets function poorly, nonfarm enterprises depend on farm income to finance their operations and investment (Lanjouw and Lanjouw 2001; Reardon and others 2000). The start-up of entrepreneurial activity is often financed with family assets rather than with loans, and loans themselves are easier to get if the household has some wealth to offer as security (Paulson and Townsend 2001). In all this, education helps people perceive economic opportunities (Schultz 1980).

Thus there are many economic reasons to explain how education affects entrepreneurship choice and entrepreneurial performance. The word *choice* is used loosely here. There are also push factors that take people from agriculture into nonfarm self-employment: failed harvest, population pressure, rationed wage jobs. But this is not a random evolution of the rural economy either, because it could easily be argued that education guides this sorting process as well. As Le (1999, p. 386) notes, educational attainment is "one of the major theoretical determinants."

II. Construction of the Database

In building a database for meta-analysis, the first concern is coverage: how representative of the literature are the collected documents (Nijkamp and Poot 2002)? The aim of this study is complete coverage of empirical studies that estimate a quantified relationship between entrepreneurship (entry or performance) and education. Because the relevant literature is widely scattered, several restrictions are imposed: To be included in the database, the studies must be written in English, be written for an academic audience, pertain to developing economies or economies in transition, and have been published after 1980 and before June 2003, the date by which construction of the database was completed.[5]

The data search included journal articles, book chapters, books, and working papers, a wide net to cast. Working papers and other unpublished papers are included because that was the only way of incorporating the most recent research output, and it enlarges the sample.[6] The first avenue of search was the Internet. Web of Science was the primary source for published journal articles. The primary search engines for working papers were the Social Science Research Network, Working Papers in Economics, and the working paper series of well-known research institutes such as the National Bureau of Economic Research, the World Bank, the World Institute for Development Economics Research, the Institute for the Study of Labor, and the Centre for the Study of African Economies at Oxford University. The second avenue of search for both published and unpublished documents was a scan through the references of each sampled paper. The Web of Science, which has a citations search function, was also used to find all other articles (in the journals covered) that refer to the studies already captured in the sample.

This search resulted in the collection of 84 studies, each with at least one valid observation on the quantified relationship between schooling and entrepreneurship entry or selection (a transition to entrepreneurship) or on the quantified relationship between schooling and performance (earnings, duration). The studies are listed in the second part of the reference list. Altogether, the 84 studies yielded 203 observations, 161 of them from published sources. Among the 203 observations, 129 (64 percent) examine performance, 19 (9 percent) investigate entry into entrepreneurship, and 55 (27 percent) specify the dependent variable as "being self-employed." This last category is a stock (rather than flow) variable that is a hybrid of entry (everyone who is self-employed has entered this occupational status) and performance (it generates an overrepresentation of survivors). These stock studies are therefore kept in a separate category.

III. Description of Studies in the Database

This description of the studies in the database considers such facets as the definition of the primary variables of interest (entrepreneurial outcomes and education), the type of data used, and the analytical techniques employed.

5. The 1980 cutoff is imposed for practical reasons of access, but it is virtually innocuous because this literature really got going only in the mid-1980s.

6. Older working papers are particularly difficult to find. Consequently, the database contains only one working paper from before 1995. To prevent double counting and to preserve the independence of observations, checks were conducted to determine whether working papers later appeared as publications (sometimes with a different title or authorship).

A subsequent section focuses more explicitly on the evidence of the relationship between entrepreneurial outcomes and education.

Measurement of Entrepreneurship, Enterprise Performance, and Education

One of the challenges in performing the meta-analysis is that researchers on entrepreneurship defined key variables of interest to this study (entrepreneurship, enterprise performance, and education) in different ways. Such variation in definitions demands great care in the design of the conceptual framework that synthesizes the available evidence in this field of research.

Although empirical definitions of entrepreneurship are fairly comparable to each other (and much more prosaic than those used in theories that refer to the innovative free mind of the resourceful spiritual entrepreneur), with most researchers defining entrepreneurs as self-employed, how to model the entrepreneurship choice is more problematic. Should the characteristics of the entrepreneur be contrasted against those of everyone else, employees, or (self-employed) farmers? Is entrepreneurship a binary choice, or should the entrepreneur be viewed as someone who chooses from many alternatives?

Table 1 illustrates the wide variety of choices that researchers have made. Most studies look at nonfarm entrepreneurship as a binary option, although another large group of studies models it as a multinomial choice. But this is only part of the complexity. A binomial model contrasts self-employment against a single alternative, but the 38 binomial studies used 6 different alternatives (see table 1). The multinomial models are spread out over seven alternatives while omitting the two most frequently used options of the binomial models. In addition there is an important discrepancy in the choice of the unit of analysis: some studies look at the choice of individuals, others

TABLE 1. Key Variables: Entry/Stock: Type of Comparisons Made

Comparison of Nonfarm Entrepreneurship with:	Logit/Probit	Multinomial Logit	Maximum Likelihood	Total
Any other form of employment	11		2	13
Other employment + nonemployed	11		1	12
Wage workers + nonemployed		2		2
Wage employment	7	32	3	42
Farming	2	9		11
Nonemployed	2	14	1	17
Unemployed		2		2
No entry	5			5
Migrant work		1		1
Contract/piecerate work		2		2
Total	38	62[a]	7	107

[a]This total reflects the number of log-odds combinations derived from the 26 studies using a multinomial model.

Source: Authors' analysis based on literature search described in the text.

at that of households. Needless to say, there is little homogeneity among the studies.

Similarly, the literature has not yet converged on standard definitions of performance (see table 2) and educational (table 3) achievement. Of the 129 observations on performance, 70 (54 percent) focus on self-employment earnings defined in various ways, 16 percent on inputs (typically employment) as a measure of size or growth, and 15 percent on duration or survival.[7]

The largest number of studies model education as a straightforward linear variable reflecting years of schooling. Some studies embellish the relationship using squared years or spline functions that allow a different slope at different schooling levels. Many other studies use dummy variables indicating level of schooling rather than years needed to attain the various levels. Of these, a few studies distinguish lower from upper elementary schooling and lower from upper secondary schooling.[8] A small number of studies distinguish training and apprenticeships as less formal ways of investing in skills. Through all of this it is important to keep in mind that schooling systems in developing countries are highly heterogeneous (Kurian 1988). In some developing

TABLE 2. Key Variables: Performance: Variation across Studies

Variable	Linear	Logarithmic	Total
Earnings, income, profit			
Hourly	1	34	35
Monthly	6	19	25
Annual	3	3	8[a]
Unspecified	1	1	2
Inputs/size			21
Technical efficiency index	9	1	10
Duration/survival			19
Other			9
Total	20	58	129

[a]Two studies examined annual performance measures but not in a linear or logarithmic manner.

Source: Authors' analysis based on literature search described in the text.

7. Ten studies first derive a technical efficiency index from a production frontier analysis and then examine this index as an indicator of entrepreneurial success. Eight studies analyze other performance measures, such as self-employment income as a share of total household income, a private benefit–cost ratio, the growth rate of profits or a business diversification index.

8. The motivation is threefold. One might speculate that there is a threshold effect of education, such that benefits are gained only when cognitive skills reach a minimum level that is achieved after, say, three years of schooling, as appears to be the case in agriculture (Phillips 1994). Furthermore, given the low rates of schooling, especially among the older generation in many parts of the world, it makes sense to distinguish among these levels of schooling. In addition, unlike in some industrial countries, in developing countries secondary schooling is often broken into two levels (Kurian 1988).

TABLE 3. Key Variables: Education: Variation across Studies

Variable	Entry	Stock	Performance	Total
Years of schooling				
Entered linearly	9	20	43	72
Entered in quadratic form		9	15	24
Entered in spline form			9	9
Dummy variables				
Lower elementary	1	7	7	15
Upper elementary	1	7	7	15
Elementary	1	19	18	38
Lower secondary	7	9	11	27
Upper secondary	7	9	11	27
Secondary	2	15	29	46
Postsecondary	3	15	19	37
College graduate		9	9	18
Postgraduate		3	2	5
Master's degree			3	3
PhD degree			2	2
Other human capital variables				
Dummy variable: literate		6	4	10
Training	1	1	20	22
Apprenticeship	1	8	6	15

Source: Authors' analysis based on literature search described in the text.

economies, cognitive skills by grade level are at a par with those in industrial countries; in others basic reading, writing, and arithmetic skills are still weak at the end of elementary school (Lee and Barro 2001, p. 485). Lack of uniformity in measures of schooling may generate additional problems for a quantified meta-analysis of the relationship between schooling and entrepreneurship, with the variation in the quality of education leading to a spread in measured effects.[9]

An additional complexity arises from the use of different estimation strategies. The meta-analysis distinguishes structural studies from reduced-form studies of the same relationship. Several researchers have acknowledged that self-employment is an endogenous choice, dependent on the expected performance of the enterprise or on the utility from income expected to be gained from the enterprise. Failing to account for such selectivity effects may well bias estimates of return to education. Studies labeled "structural" for the meta-analysis attempt to incorporate at least some kind of a deliberate occupational

9. Not reported in table 3 are three studies that count the number of people in the household in each of several education categories, one study that refers to a British type O-level and A-level education, and five studies that did not include any education variable but used information on training or apprenticeships.

choice of labor force participants.[10] Twenty-four of the 129 performance observations (14 percent) are structural. Almost none of the stock and entry studies are structural. However, none of the studies attempts to address the endogeneity of the schooling decision of individuals. This is striking, because doing so is becoming common practice in studies that measure the effect of education on wage employees (see Ashenfelter and others 1999).

The Studies and Their Data Samples

Entrepreneurship research is well known for its multidisciplinary character. Control variables may differ by discipline, which could influence the estimated impact of education. The database includes studies from five academic fields: general economics (13.7 percent), labor economics and education (9.3 percent), development economics (57.8 percent), small business and entrepreneurship (12.4 percent), and management and sociology (6.8 percent). Detailed tabulations indicate that studies of structural performance are overrepresented in general economics and development economics journals, whereas stock studies are overrepresented in labor and development economics journals. Reduced-form performance models appear more frequently in the small business and entrepreneurship journals and in working papers. Studies of entrepreneurship entry are primarily found in the management and sociology category.

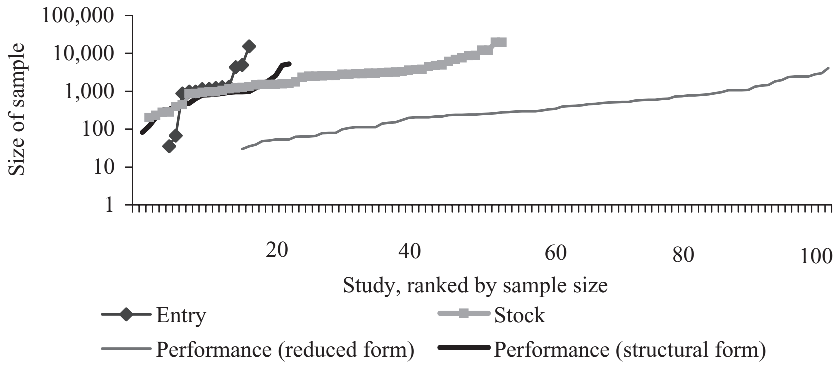
There are also some noteworthy trends in the literature. In particular, analyses of entrepreneurship have become more popular in recent years, although this interest appears to be waning. Perhaps more important, however, is the trend in the nature of the research in this field: structural form studies are a more recent phenomenon.

Sub-Saharan Africa dominates the geographical distribution of studies of entrepreneurship entry and performance, contributing 72 of 203 observations (36.5 percent). This is followed by Latin America and the Caribbean (31.5 percent), East and Southeast Asia (12.3 percent), Eastern European economies in transition (9.9 percent), North Africa and the Middle East (5.4 percent), and South Asia (4.9 percent).

Figure 1 depicts the sample size in each of the four different types of studies in the database, sorted by sample size from smallest to largest. Several studies did not report sample size; these are represented by the horizontal offset of the four

10. Many choices could fall under this heading. For example, it is often assumed that the individual is working anyway and that the only choice to be modeled is whether to be self-employed as opposed to working for a wage. However, this choice model could be augmented with many other choices: whether to work, whether to work in the public sector or the private sector, whether to work for a large corporate organization or for a smaller business with an environment similar to one's own enterprise, whether to work in an urban area or in a more rural setting, whether to quit schooling to take a job, and so on. Obviously, no study includes all of these features. The point is that structural studies attempt to remove the bias caused by ignoring one or more of these choices, but one could easily think of other omitted selectivity factors that still may bias the estimated returns to schooling. Therefore, although any comparison between reduced-form and structural model estimates has obvious limitations, the comparison of various structural studies is not entirely straightforward either.

Figure 1. Sample Size of Study Types in the Database



Source: Authors' analysis based on literature search described in the text.

charted lines (for example, 16 of the 105 studies on reduced-form performance did not report the size of their sample). Stock and entry studies tend to use larger samples than performance studies, for the simple reason that they include the nonself-employed to study the entrepreneurship choice. Seventy-three of the 89 reduced-form performance studies that reported sample size contained fewer than 1,000 observations, with one as low as 30. The trend is toward larger data sets: in general, the correlation between the size of the sample and the year the sample was gathered was positive (0.15).

In doing research on entrepreneurship choice and performance, there are good reasons for studying men and women separately because they face different constraints and act on different opportunities. At the same time, a household enterprise is often a joint activity of household members, with men and women working together for the benefit of the household more than of the enterprise. Stock and entry studies separate the sample by gender more often than performance studies do, but they are also more likely to treat the entrepreneurship choice as a household outcome than are performance studies (table 4). More than half of the performance studies use mixed-gender samples, frequently because the unit of observation is the enterprise rather than the entrepreneur.[11]

IV. Implementing the Meta-Analysis

Meta-analysis is a quantitative tool that is applied to synthesize previous research findings that share common aspects that can be addressed statistically. The set of meta-analytical techniques has been developed and applied mainly in the medical and natural sciences. Rare examples of the application of these

11. The appropriate education measure then pertains to the entrepreneur, the leader of the enterprise.

TABLE 4. Gender of Study Respondents

Type of Study	Female Only	Male Only	Both Male and Female	Household	Total	Number of Observations
Entry	5.6	61.1	16.7	16.7	100	18
Stock	25.0	25.0	37.5	12.5	100	56
Performance, reduced form	11.8	23.5	62.7	2.0	100	102
Performance, structural	20.8	16.7	50.0	12.5	100	24
Total	16.0	26.5	50.0	7.5	100	200

Source: Authors' analysis based on literature search described in the text.

techniques in economics are Phillips (1994), Card and Krueger (1995), Ashenfelter and others (1999), Nijkamp and Poot (2002), and van der Sluis and others (2003).

Constructing Subsets for the Meta-Analysis

Regression techniques are used in the analysis to "explain" the effect of schooling, referred to as b, by the various characteristics Z that were gathered for each study:

$$b = Z\beta + \varepsilon. \tag{1}$$

It is important to select subsets of studies for this regression analysis with homogenous definitions for education, enterprise performance, and entry/stock. The less variation there is across studies in the measurement of these variables, the more meaningful the meta-analysis results. Insisting on strict homogeneity, however, reduces the subset of eligible studies. In particular, the requirement of homogeneity conflicts with the fractured definitions of stock/entry, performance, and education. For example, studies that specify enterprise income in linear form end up in a different subset than those that use a logarithmic form; studies using years of schooling are separated from those specifying a set of dummy variables, and so on. Many of the resulting subsets are therefore too small to permit estimation of equation 1.

There is, however, a way to pool small subsets in meaningful ways. The t-statistics of b reflect the sign and significance of the estimated relationship, where it does not matter so much whether the dependent variable is measured in linear or logarithmic form. Better yet, one may pool across all forms of performance measures, as long as the parameter estimates and t-statistics are recorded in such a way that the hypothesized effect of education points in the same direction.

That approach is followed here. First, all the effects of schooling are recorded for performance measures for which "the more, the better" does not hold—exit from self-employment and the hazard out of self-employment.

Next, a recoded variable t^* is defined that takes a value of 0 for observations that find a significantly negative effect, 1 for those that find an insignificantly negative effect, 2 for those that find an insignificantly positive effect, and 3 for those that find a significantly positive effect. This ordered variable is then regressed on characteristics of the studies by means of the ordered probit model:

$$t^* = Z\beta + \varepsilon. \tag{2}$$

The advantage of this approach is that it allows different entrepreneurial performance indicators to be merged into a single analysis.

Thus three subsamples of performance studies are employed: Studies that measure performance as log income and can use a quantitative approach (estimation of equation 1); studies measuring performance in terms of any sort of income; and pooled performance studies, measured in any manner. The variation in the effect of education on performance in the second and third subsamples can be estimated qualitatively only, by means of the ordered probit model (equation 2).

Independence of observations is a crucial statistical requirement in building suitable subsets for regression analysis. At issue is whether studies represent independent measurements of the impact of education. Detailed examination suggests that some of the studies may violate the independence assumption. In many cases multiple observations of the same type (for instance, performance) come from a publication that uses a single data set. For example, many studies report several estimated models in an effort to demonstrate the robustness of the results. To preserve independence, only one of the estimated models is selected in these cases—the one that best shows the estimated relationship. However, where a single study presents separate estimates for men and women, for example, both are included in the database, because independence is not in danger.[12] If several studies use the same data source and (roughly) the same subsample to examine the same entrepreneurial outcome, independence requires that only one study be retained.[13] For this analysis this requirement led to the dropping of one observation (Lanjouw 1999).[14]

12. Two estimates drawn for different subsamples of a single study (or from two studies by the same author) inherit a scientific approach from a single source and might therefore still be correlated, statistically speaking, from the perspective of a meta-analysis. The use of the term *independence of observations* pertains to the statistical independence of the samples that generate the estimated education effects.

13. In a few other cases there is some overlap in the samples, such as one study that uses several rounds of a survey of which another study uses only one year. The gain in independence among observations was judged to be less than the loss of an observation, so no studies were dropped in such circumstances.

14. For different reasons, four studies are eliminated at this stage as well. Vijverberg (1995) and Henderson (1983) reported the effect of education interacted with some other variable; Honig (1996, 1998) reported *t*-statistics that were so high as to be implausible in light of the recorded *R*-squared statistic.

Determinants in Meta-Analytical Models

Because the subset sizes are not very large, parsimonious meta-analytical models are needed. There is always a temptation to create rich specifications and many "what if" scenarios, but subset sizes of at most 70 studies do not permit rich models. The effects that are estimated should be interpreted cautiously.

Theory provides limited guidance in generating hypotheses about the determinants of the returns to schooling for entrepreneurs or of the relationship between entry and schooling. If anything, theory provides only loose guidance for the following questions. Given that schooling is thought to be more beneficial in more vibrant economies, is the return to schooling or the effect of schooling on entry higher in the East Asia than in Africa, for example? Is it higher in urban areas than in rural areas? Is the return to schooling increasing over time? Theory also predicts that part of the returns to education derive from optimal choices of enterprise inputs and sector of economic activity. Thus, studies that control for input use or business sector should be reporting smaller estimated returns. This may also bear on the effect of using a structural model, although the impact of education on selection into entrepreneurship is not clear a priori, as argued earlier. Thus, eliminating self-selection bias by estimating a structural model instead of a reduced-form model may well affect the relationship between schooling and performance (or between schooling and entry), but the direction is not predicted by theory.

In other aspects the meta-analysis is more exploratory. Are returns higher for men than for women? Is there any distinction in the effect of education across schooling levels? Does the performance measure selected affect the estimated return to schooling? Do estimates vary by sample size, by the scientific weight of the journal, or by the field of the journal in which the study is published? Is there something like a publication or reporting bias in the sense that there is an overrepresentation of significant results? The following sections describe the explanatory variables used in the meta-analytical models.

SAMPLE CHARACTERISTICS OF OBSERVATIONS. The first group of control variables controls for three sample characteristics: the region of the world from which the sample is taken, the percentage of women in the sample, and the percentage of individuals in the sample living in urban areas.[15]

USE OF SECTOR AND INPUT CONTROL VARIABLES. As already hypothesized, the estimated impact of education may depend on whether the study includes controls

15. Sometimes, when the sample consisted of a mix of rural and urban residents and when the study did not supply the relevant statistics, the general ratio applying to the working population in the relevant country was used, based on World Bank statistics. Moreover, when the percentage of women was not reported, a value of 0.50 was used when the unit of observation was the household (when the research question was whether the household operates an enterprise), a value of 0.2 when there was a sense that the majority of respondents would be men, or World Bank statistics on the female labor force participation rates.

for sector of business (or whether the sample comprises enterprises in a single industry), and whether the regression model incorporates enterprise inputs.

MACROECONOMIC CONDITIONS. A variable is included that indicates the (earliest) year from which the observations in the sample have been drawn, to capture temporal effects associated with technology, level of development, and similar aspects. Other variables include the sectoral composition of the economy (agriculture, industry, services); income per capita, a more direct measure of development; gross investment, as human capital could be either a substitute for or a complement to physical capital; and rates of illiteracy, because human capital may be more precious in a context where people are less skilled. These variables are drawn from World Bank (2003). An effort was made to incorporate information about the competitiveness of the business climate as reported by the World Competiveness Scoreboard outcome (IMD 2002), but, this database included only 19 of the 50 countries in this study, too few to permit a meaningful analysis.

CHARACTERISTICS OF SOURCE DOCUMENTS. Forty-two of the 203 observations are drawn from working papers or book chapters. Where feasible, the analysis includes a dummy variable indicating whether the observation was found in a journal rather than a working paper or book. Preliminary analysis showed no effect of the branch of journal in which a study is published, so this variable is omitted. The impact of the journal is included in the equations as a proxy for journal quality. Studies published in the better quality journals should be of better quality, so if all better quality studies report higher (or lower) schooling effects, there is reason to believe that the "true" effect is indeed higher (or lower) than the simple average effect suggests. For journals without an impact factor and for working papers and books, the impact factor is set to 0.

PUBLICATION AND REPORTING BIAS. As Ashenfelter and others (1999) point out, it is possible that the observed universe of published results reflects solely studies with statistically significant results. Studies that failed to find a statistically significant rejection of the null hypothesis of no effect might not have been published. It is also possible that authors systematically drop insignificant determinants from their models and that a statistically insignificant education effect leads them to omit all education variables. If so, such studies would not appear in the database.

To test for such bias, the standard errors of the parameter estimate for education in the observed studies are included in the analysis. If there is no publication bias, standard errors should have no significant relationship with the coefficients. If there is publication bias, standard errors should exhibit a positive relationship with the coefficient of the schooling measure b.[16]

16. Hedges (1992) offers another approach to the study of publication bias. His method is briefly explored later to confirm the findings here.

In the ordered probit models of equation 2, the standard error cannot be used as a control variable because the dependent variables in these subsets are based on the *t*-statistics, which are partly determined by the standard errors. Therefore, the square root of the sample size *N* is included in these models because the standard error of the parameter estimate declines with the sample size at a rate of $N^{0.5}$. Consider the effect of $N^{0.5}$. If the true effect of the education variable is positive, its *t*-statistic is more likely to be significantly positive in a larger sample, and therefore the parameter on $N^{0.5}$ in the ordered probit model should be positive (and along the same lines, if the true effect is negative, the impact of $N^{0.5}$ will be negative). If the true effect of the education variable is 0, its *t*-statistic should hover around 0, no matter what the sample size, so that the parameter on $N^{0.5}$ should be near 0. If publication bias exists, studies with small data samples will also be reporting statistically significant education effects, so that, regardless of whether the true education effect is positive or negative, the parameter on $N^{0.5}$ should be near 0. It is this situation, therefore, that is indicative of publication bias. Yet caution applies. If the true effect of education varies such that it is positive in some places (samples) and negative in others, the parameter on $N^{0.5}$ could be near zero even in the absence of publication bias.

PERFORMANCE MEASURES. The meta-analytical regression models that are estimated on the subsets that pool all performance measures control for the types of performance measures used to assess whether the impact of schooling differs across those measures. After some preliminary attempts, a dummy variable for earnings-related performance measures is included in these equations.

ESTIMATION METHODS AND TYPES OF DATA. Finally, a dummy variable is included for whether a structural model has been used. In the few studies that used panel data, the panel aspect appears to be largely ignored, so this distinction is not explored further.

V. THE EFFECT OF SCHOOLING ON ENTREPRENEURIAL PERFORMANCE

This section explores the link between education and performance. The next looks at entrepreneurial choice.

Effect of Schooling

The preponderance of the evidence supports a relationship between schooling and entrepreneurship performance (table 5). But although the effect is positive, it is not always easily teased from the data. Perhaps the most successful specification is the one that uses years of schooling entered linearly. Thirty-three of 40 observations are positive, 19 of them significantly so. Attempts to uncover nonlinearity are not particularly successful, unless the evidence is interpreted as indicating that upper secondary schooling yields greater returns than primary or

TABLE 5. Impact of Education on Entrepreneurial Performance

Variable	Negative		Positive		
	Significant ($t < -1.96$)	Insignificant	Insignificant	Significant ($t > 1.96$)	Number of Observations
Years of schooling					
All years, entered linearly	1	6	14	19	40
Primary years		2	4	3	9
All secondary years			2	1	3
Lower secondary years		2	2	2	6
Upper secondary years			2	4	6
Years of schooling squared		3	12		15
Dummy variables					
Lower primary	1	1	2	1	5
Upper primary			2	3	5
All primary		3	10	4	17
Lower secondary		2	2	3	7
Upper secondary			1	6	7
All secondary	1	5	15	8	29
Post-secondary		3	5	8	16
College	1		4	4	9
Other human capital variables					
Training		7	7	5	19
Apprenticeships		3	2	1	6

Source: Authors' analysis based on literature search described in the text.

lower secondary schooling. But this is not convincing yet. Entering schooling in a quadratic form yields only insignificant parameter estimates (15 studies).[17]

Studies that use dummy variables generate the same kind of evidence. It should be noted that the database records the dummy variable effects in comparison with the base category of no schooling, even if a study actually used another group as the base category.[18] Upper elementary schooling shows clearer evidence of positive returns compared with lower elementary schooling, supporting the threshold notion that has been found in agriculture (Phillips 1994). However, the impact of lower secondary schooling is not more positive than

17. Note that with years of schooling entered in quadratic form, the overall effect of education is not recorded in table 4, nor is the effect of years per se, which is not interpretable without reference to the squared term.

18. This is not a fully innocuous choice, even if most studies use no schooling as the comparison group. People who have no education may be relatively heterogeneous in that some of them may not have had access to schooling in their youth and therefore have more native ability on average than those who chose to forgo schooling.

that of upper elementary schooling, and indeed the impact for postsecondary and college education is not always different from that of no schooling. Yet six of seven estimates for upper secondary schooling are significantly positive, which is consistent with the summary of the years of schooling effect, already mentioned. In all, therefore, the relationship appears to be positive but not strongly evident.

A small number of studies incorporate information about training and apprenticeships in the regression model. This is done by counting years or by using dichotomous indicator variables. As informal, heterogeneous means of accumulating human capital, both training and apprenticeships are difficult to capture precisely in a questionnaire. Across studies, mild evidence of a positive relationship emerges.

The most common model uses the log of earnings, enterprise income, or profits as the dependent variable.[19] On top of this, many of these studies use years of schooling as the measure of education. In such a model, b represents the proportional increase in income resulting from a marginal year of schooling. The estimates of all of these studies have been pooled. In cases where a splined relationship was estimated, the slope of each segment of the education-income function is treated as a separate observation: in effect, such studies yield several estimates of b pertaining to different levels of education. Because it is impossible to characterize the correlation among these estimates from the information in the studies, the slopes of the segments are assumed to be uncorrelated. Moreover, quadratic and interacted relationships are evaluated at the means (or, if means were not provided, at six years of schooling and 35 years of age).[20] In all, then, there is a subsample of 49 observations (tables 6 and 7). The average value of b is 5.5 percent, a very plausible rate of return per year of schooling. The standard deviation of 6.4 percent indicates a large spread around this mean across the 49 observations.

Explaining the Variation in Effects

To find the cause of this spread, several regression models are estimated, all variations of a base model that includes the proportion of women and urbanites in the study sample. The small sample size precludes using all variables at the same time. Thus, the base model is expanded by adding variables one (or one group) at the time.

19. The use of the logarithm, together with an assumption that hours of work are predetermined, allows such studies to be pooled regardless of the time dimension of the income concept. Estimation results from linear and log-linear models might also be made comparable by expressing the education effect in elasticity form or by standardizing the parameter estimates with the standard deviation of earnings, but that requires descriptive statistics on earnings and education values that are often not reported in the studies.

20. t-statistics were similarly adjusted, although that must be done informally since not all of the necessary information is available. For example, in a quadratic specification, if the linear and quadratic terms are both positive and the linear term tends toward statistical significance, a simple linear model most often yields a significant positive parameter estimate. But if the linear term is positive and the squared term has a negative parameter such that a fully inverted U-shape results, a simple linear model yields an insignificant coefficient. The exact t-statistic could be computed only if the covariance were reported, but that is never the case.

TABLE 6. Meta-Analysis of the Effect of Years of Schooling on Performance, Description of Subsample by Performance Measure

	Log Income	Any Income	Any Performance
Number of studies	49	52	69
Average value of b	0.055		
Standard deviation of b	0.064		
Significant negative ($t < -1.96$)		0	1
Insignificant negative		10	21
Insignificant positive		18	29
Significant positive ($t > 1.96$)		24	28

Source: Authors' analysis based on literature search described in the text.

The base model shows higher returns for women and in urban areas, by about 4 percentage points each (table 7). The gender effect is also observed in developed economies (van der Sluis and others 2003). With the inclusion of additional factors considered (groups A through M), the main finding is that b tends to be higher in studies that report a less precise estimate, which is consistent with the notion of a publication bias, but the effect of the standard error of b is significant at the 10 percent level only. The method designed by Hedges (1992) is used to explore this issue. The results show that the odds that a study with a statistically insignificant parameter estimate appears in the literature is only 0.65, but it is not statistically different from 1.0 at a p-value of 0.21.[21] Again, there is only weak evidence of publication bias. Thus, the entrepreneurship literature appears to be more tolerant of insignificant estimates than the parallel literature on the returns to education in wage earnings (Ashenfelter and others 1999), perhaps because a priori expectations among researchers and journal editors are not as strong.

Other explanations for the variation in b are weak. Estimated returns may be lower when the regression model includes sector dummy variables, thus conforming to expectations. Returns may be declining over time. Returns in Southeast Asia may be slightly lower than elsewhere. There is a hint that returns are lower in countries with a higher concentration of industry and higher where services contribute more to GDP. Returns may be lower in higher income countries. Human and physical capital appear to be substitutes, as the return diminishes in countries with greater rates of gross investment. However, none of these effects attain statistical significance.

Next, the subset is expanded to include all studies that examine enterprise income, earnings, or profits, whether in linear or logarithmic form, and the sign

21. This pertains to the version of Hedges's model that merely estimates the average rate of return. This model suggests an average return of 4.4 percent and a variability across studies of 3.5 percentage points. In the base model the unexplained variability across studies already declines to 2.9 percent. Moreover, the estimate of the odds rises to 0.69 with a p-value of 0.30, reinforcing the conclusion that the evidence of publication bias is weak.

TABLE 7. Meta-Analysis of the Effect of Years of Schooling on Performance, Meta-Analytical Regression Analysis of b and t^*

	Variable	b (ordinary least squares)		t^* (ordered probit)		t^* (ordered probit)	
		Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
	Base model						
	Intercept	0.012	0.58				
	Proportion female	0.040	1.96	0.787	1.93	0.769	2.04
	Proportion urban	0.037	1.58	1.118	2.43	0.675	1.80
	$N^{0.5}$			0.038	2.58	0.030	2.59
	Added variables (in groups)						
A.	Include inputs?	0.003	0.15	−0.499	1.23	−0.011	0.03
	Include sector?	−0.030	1.24	0.362	0.83	0.185	0.53
B.	Year of sample	−0.002	1.05	−0.006	0.18	0.024	0.88
C.	Structural model?	0.017	0.73	0.856	1.70	0.643	1.54
D.	Published in journal?	−0.042	1.40	−0.836	1.23	−0.385	0.64
	Impact factor	0.018	1.17	0.513	1.43	0.359	1.13
E.	Standard error of b	0.340	1.72				
F.	Earnings model					0.419	1.19
G.	Sub-Saharan Africa	0.038	0.98	0.786	0.91	0.777	1.30
	North Africa and Middle East	0.013	0.17	1.157	0.78	1.026	0.81
	South Asia	0.010	0.14	0.887	0.73	−0.054	0.06
	Southeast Asia[a]	0.000		0.000		0.000	
	Latin America	0.049	1.33	0.941	1.14	0.973	1.78
	Eastern Europe	0.022	0.51	1.309	1.42	1.234	1.72
H.	Proportion illiterate	−0.005	0.07	−0.452	0.39	−0.542	0.61
I.	Agriculture/GDP	−0.111	1.07	−0.980	0.52	−1.369	1.12
J.	Industry/GDP	−0.175	0.69	3.751	0.78	0.735	0.28
K.	Services/GDP	0.106	0.90	0.582	0.26	1.867	1.23
L.	Income per capita $* 10^5$	−0.241	0.63	0.373	0.05	4.470	0.71
M.	Gross investment/GDP	−0.213	1.14	−2.405	0.64	−2.460	0.86

[a]Omitted category among the regional variables in group G.

Source: Authors' analysis based on literature search described in the text.

and significance of the estimated relationship are examined through an ordered probit model of t^* (table 7, column 2). Once again, the higher the proportion of women and urbanites in the sample, the more likely it is that the study finds a positive and significant education effect. The base model also contains the square root of the sample size. The effect of $N^{0.5}$ is positive and significant, consistent with the hypothesis that education raises income and unsupportive of publication bias.[22] Among the other determinants examined, there is weak evidence that part of the effect of education plays through allocative input choices. Moreover, estimates tend to be more positive and significant in structural models.

When the subset is expanded to include all studies of enterprise performance that specify years of schooling, the main added finding is that enterprise earnings models may well find a higher proportion of significant positive education effects than studies of enterprise survival or technological efficiency, for example. This phenomenon is also observed in developed economies (van der Sluis and others 2003).

The entire exercise is repeated using studies that specify education through a series of dummy variables and with education sublevels combined into primary, secondary, and postsecondary schooling (tables 8 and 9). Once again, the base category is no schooling. On average, primary education yields a 19 percent ($= e^{0.174} - 1$) gain, which is comparable to the 5.5 percent annually shown in table 6, because the average person in this category has less than 6 years of schooling. Entrepreneurs with secondary schooling earn 34 percent ($= e^{0.294} - 1$) more than unschooled individuals, which on an annual basis is a bit lower than the returns reported in table 6. Those with postsecondary schooling gain 140 percent.

Each of these averages is accompanied by a large standard deviation: the variation among studies is large. Which factors are associated with this variation? The subsets are too small (15, 20, and 11 studies) to examine this issue with meta-analytical regressions or Hedges's model. The regression estimates should therefore be taken with a grain of salt. Only the base model results and a few more systematically significant factors are reported in table 9.[23] Returns to primary schooling appear lower in urban areas and in economies with larger service sectors. Secondary schooling returns are higher in more recent samples and in societies with more illiterate people, a larger agricultural sector, and a smaller industrial sector. But the strongest determinant is the effect of the standard error, suggesting a strong publication bias (consider also the *in*significance of $N^{0.5}$): large estimates with large standard errors are tolerated, but smaller estimates had better be more precise.

Adding all other income studies yields subsets of 20, 27, and 13 studies, all of them still small. Pooling all performance studies that use dummy variables for

22. The Hedges method cannot be applied to the ordered probit model of t^*.

23. No regressions were attempted to explain the variation in postsecondary returns. Furthermore, other factors, as listed in tables 8 and 9, were entered but did not provide sufficient explanatory power. The few that occasionally mattered are mentioned in the discussion.

TABLE 8. Meta-analysis of the Effect of Schooling Dummy Variables on Performance, Description of subsample by education level and performance measure

	Primary, Combined		Secondary, Combined		Postsecondary, Combined	
	Log Income	Any Performance	Log Income	Any Performance	Log Income	Any Performance
Number of studies	15	27	20	43	11	25
Average value of *b*	0.174		0.294		0.874	
SD of *b*	0.232		0.254		0.487	
Significant negative ($t < -1.96$)		1		1		1
Insignificant negative		4		7		3
Insignificant positive		14		18		9
Significant positive ($t > 1.96$)		8		17		12

Note: The categories "primary education" and "secondary education" combine lower and upper levels. Postsecondary education includes college.

Source: Authors' analysis based on literature search described in the text.

schooling raises the subsets to reasonable sizes (27, 43, and 25 studies).[24] For primary schooling the negative urban effect weakens. Larger (or more precisely estimated) education effects occur in societies with lower literacy rates and more extensive agricultural activity. For secondary schooling, the effect appears smaller for women and somewhat larger in agricultural societies. Other factors show little correlation with *b*. Returns to postsecondary schooling appear lower in regressions that include controls for inputs and perhaps for sector and are higher in illiterate agricultural societies and when estimated using a structural model. As before, the impact is also stronger on earnings than on other performance measures.

In sum, there is some evidence of higher returns for women and in urban areas, as well as in agricultural societies where literacy rates are lower. Inserting controls for inputs removes the allocative portion of the gain that education generates. Adding sector dummy variables removes another choice-related portion of the returns. Publication bias is evident in secondary schooling dummy variables. This suggests that researchers are using the dummy variables only if the results for secondary schooling are positive and significant. When designing a model, it is desirable to leave open the possibility of a nonlinear education effect, but though quadratic and splined functions are usually ineffective in detecting nonlinearity, dummy variables may be able to indicate a nonlinear relationship.

VI. THE EFFECT OF SCHOOLING ON THE CHOICE OF ENTREPRENEURSHIP

The second dimension of the impact of schooling deals with the choice of entrepreneurship. The logical focus of an analysis of this choice is the behavior

24. The meta-analytical results of the all-income samples are broadly similar to those of the all-performance samples.

Table 9. Meta-Analysis of the Effect of Schooling Dummy Variables on Performance, Meta-Analytical Regression Analysis of b and t^*

	Primary, Combined				Secondary, Combined				Secondary, Combined			
	b (ordinary least squares)		t^* (ordered probit)		b (ordinary least squares)		t^* (ordered probit)		b (ordinary least squares)		t^* (ordered probit)	
	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Base model												
Intercept	0.372	2.87			0.333	2.40						
Proportion female	0.018	0.14	0.152	0.27	−0.137	1.04	−0.601	1.33			0.327	0.53
Proportion urban	−0.269	1.82	−0.495	0.93	0.033	0.22	−0.256	0.55			−0.566	0.82
$N^{0.5}$			0.033	1.71			0.006	0.49			−0.008	0.38
Added variables (in groups)[a]												
E. SE of b	−0.422	0.27			1.762	2.90						
F. Earnings model			−0.530	0.81			0.020	0.04			2.283	2.96
H. Proportion illiterate	0.656	1.05	3.908	2.16	1.325	2.42	0.626	0.54			7.976	2.52
I. Agriculture/GDP	0.651	1.19	3.639	1.60	1.534	2.61	2.526	1.33			7.852	2.18

[a]For brevity, other groups of variables are omitted because they mattered less.

Note: The categories "primary education" and "secondary education" combine lower and upper levels. Postsecondary education includes college.

Source: Authors' analysis based on literature search described in the text.

of individuals as they make their career decisions: Who starts a business? Who goes into wage employment? Such studies of entry are relatively scarce, largely because of data limitations and researchers' inattention. The majority of studies examine being (rather than becoming) self-employed. Because the database is small, the stock and entry studies are aggregated. The estimated effects for stock and entry studies are also examined briefly to see whether they differ.

The literature offers many empirical models. Estimation methods vary from simple binomial models to elaborate structural models.[25] Studies also use many different comparison categories (see tables 1–3), because the choices available to people living in developing areas are broad. All this makes comparison across studies tedious.[26] To make parameter estimates comparable, they are expressed in terms of the marginal impact on the probability of nonfarm self-employment.

Table 10 describes the evidence from studies that analyze the impact of education on the self-employment choice, sorted by base category. The table shows only studies for which at least one type of education variable has been used more than five times. There is considerable consistency among studies that specify education in years of schooling and studies that employ education category variables. Overall, relative to a heterogeneous set of other forms of employment (panel A), education lowers the likelihood of nonfarm self-employment by an average of 1.3 percentage points per year of schooling. The effect is frequently statistically significant. The contrast with wage employment (panel C) is much more sharply negative, at a 6.8 percentage point decline per year. Moreover, a rise in schooling level pulls people out of farming (panel D) at a rate of 8.1 percent per year of schooling. Relative to a combination of nonemployment and all alternative forms of employment, education may weakly favor nonfarm self-employment (panel B). In combination, panels A and B suggest that more educated individuals are less likely to be nonemployed than

25. More advanced studies recognize that nonagricultural self-employment is one alternative among several and therefore that a multinomial choice model is preferable. The econometric model of choice is the multinomial logit model in which the parameters are identified relative to a base category. A multinomial probit model avoids the independence of irrelevant alternatives assumption but is more difficult to estimate. A nested multinomial logit model does not always produce plausible nesting structures.

26. However, different studies use different base categories (for example, farming, wage employment, or nonemployment), so the estimated schooling parameter of the self-employment selection equation cannot be compared across studies. Given the possible categories j (= 1,..., J, in general), studies report the estimates and t-statistics (or standard errors) of β_j and β_k, but not of $\beta_j - \beta_k$, for every combination of j and k. Of course, one may, and the meta-analysis does, compute estimated values of $\beta_j - \beta_k$, but studies do not provide enough information to conclude anything definite about the significance level of this difference. Because the aim of this study is to understand the impact of education on the self-employment choice in detail, some reasonable assumptions are made to enable evaluation of the significance levels of the impact of education on the choice between every combination of economic activities. For example, if β_j is significantly positive and β_k is insignificantly different from zero (or is significantly negative), $\beta_j - \beta_k$ is assumed to be significantly positive. Or if both β_j and β_k are significantly positive, $\beta_j - \beta_k$ is assumed to be insignificantly different from zero (but still positive if $\beta_j - \beta_k > 0$).

TABLE 10. Education and Entrepreneurship Choice: Descriptive Analysis

	Impact on Probability of Nonfarm Self-Employment			Negative		Positive	
Education Variable	Number of Observations	Mean	SD	Significant	Insignificant	Insignificant	Significant
A. Relative to any other form of employment							
Years	10	−0.013	0.036	6		4	
Primary, combined	3	−0.055	0.047	2	1		
Secondary, combined	6	−0.052	0.043	2	2	2	
Postsecondary, combined	3	−0.374	0.155	3			
B. Relative to any other form of employment or nonemployment							
Years	2	0.003	0.002			1	1
Primary, combined	12	0.023	0.039		5	4	3
Secondary, combined	10	0.053	0.068		2	5	3
Postsecondary, combined	8	0.013	0.057		4	4	
C. Relative to wage employment							
Years	24	−0.068	0.193	11	7	2	4
Primary, combined	19	−0.209	0.383	8	7	2	2
Secondary, combined	24	−0.350	0.520	14	4	2	4
Postsecondary, combined	16	−0.683	0.880	12	1	1	2
D. Relative to farming							
Years	7	0.081	0.128			4	3
Primary, combined	4	0.113	0.173		1		3
Secondary, combined	7	0.312	0.320			1	6
Postsecondary, combined	1	0.224					1
E. Relative to nonemployment							
Years	11	−0.008	0.018	1	6	4	
Primary	6	−0.059	0.177	4	1	1	
Secondary	6	−0.183	0.187	1	5		
Postsecondary	3	−0.397	0.600		2		1
F. Relative to no entry into nonfarm self-employment							
Secondary	10	0.118	0.165	2	2	6	

Note: The categories "primary education" and "secondary education" combine lower and upper levels. Postsecondary education includes college.

Source: Authors' analysis based on literature search described in the text.

to be engaged in a nonfarm enterprise, but this tends to be contradicted by the more often negative estimates summarizing the explicit comparisons between nonemployment and nonfarm self-employment (panel E). Finally, panel F explicitly compares entry and nonentry, but the 10 observations are from a single study on transitions into entrepreneurship after communism in Hungary. This evidence shows an ambiguous effect of education. Altogether, schooling is associated with a distinct sorting in the labor market of developing countries.

The comparison of wage employment and self-employment has been studied most often, although the subsets of studies are still quite small. Nevertheless, because the schooling impact appears fairly stable, as evident in table 10, with proper caution the subsets permit a deeper meta-analysis (table 11). As before, various hypotheses are explored from a base model that includes the proportion of the sample that is female and that resides in urban areas. The base model results suggest that as the level of education rises, a woman is more likely than a man to choose wage employment over nonfarm entrepreneurship. Similarly, a more educated urban resident is more likely to select a wage job than a more educated rural resident, though the estimated difference is not as strong as between the genders.

Adding variables one at the time helps explain the variation among studies.[27] The year in which the data were generated proves irrelevant: the global level of technology or globalization has no discernible impact on local labor market sorting patterns. In regard to the macroeconomic variables, the meta-analysis of the effect of years of schooling yields a distinctly different association pattern than the education category analyses. The years of schooling model suggests that b is more negative in agricultural societies with higher illiteracy: because educated workers are scarcer, education opens up more opportunities in wage employment. The education category models show no such association. The years of schooling model finds that b is less negative when the economy is more industrial; the education category models show the opposite. The education category models also show that b becomes smaller but remains negative in service-oriented economies; the association in the years of schooling model is inconclusive. Per capita income matters in the years of schooling model (reducing the size of b, which remains negative) but is largely absent in the education category models. The only macroeconomic variable on which all models agree is gross investment, which reduces the negative value of b, suggesting that in a faster growing economy there are more entrepreneurial opportunities for more educated individuals. Overall, the macroeconomic variables show a more plausible effect in the years of schooling model. Some of the estimated effects in the

27. Regressions not reported in the table examined the field of the journal publication, which did not matter, and the differences among regions, which showed significant parameters, but the sample is too small to draw any economic conclusions.

TABLE 11. Education and Entrepreneurship Choice: Meta-Analysis of the Choice between Wage Employment and Nonfarm Self-Employment

	Years ($n = 24$)		Primary, Combined ($n = 19$)		Secondary, Combined ($n = 24$)		Postsecondary, Combined ($n = 16$)	
Variable	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
A. Base model								
Intercept	0.124	1.26	0.349	1.12	0.494	1.87	0.841	0.69
Proportion female	−0.283	2.51	−0.418	2.11	−0.692	2.82	−1.031	2.15
Proportion urban	−0.082	0.90	−0.422	1.36	−0.703	2.73	−1.180	0.96
B. Added variables								
A. Year of sample	0.008	1.34	−0.047	0.95	−0.012	0.23	0.007	0.06
B. Structural model?	0.097	0.53	−0.084	0.22	−0.129	0.29	−0.038	0.04
C. Study of entry?	0.048	0.47						
D. Published in journal?	−0.058	0.44						
Impact factor	−0.016	0.17	0.420	0.75	0.679	1.05	1.620	0.95
E. SE of *b*	0.520	0.13						
F. Proportion illiterate	−0.368	2.58	−0.215	0.75	0.075	0.16	2.153	0.82
G. Agriculture/GDP	−1.244	2.39	0.604	0.59	1.404	1.38	2.916	1.34
H. Industry/GDP	1.470	2.29	−1.717	1.81	−2.456	2.56	−4.482	2.38
I. Services/GDP	0.497	0.62	6.777	3.56	7.630	2.84	13.017	2.51
J. Income per capita$*10^3$	0.055	2.26	−0.004	0.12	−0.017	0.42	−0.342	1.39
K. Gross investment/GDP	0.918	1.77	2.094	1.46	1.968	1.25	2.624	0.74

Note: The dependent variable is the parameter estimate (b) of the specified education variable in the model that explains the choice between wage employment (as the base) and nonfarm self-employment. The number in parentheses at the head of each column is the number of observations in each regression model. The categories "primary education" and "secondary education" combine lower and upper levels. Postsecondary education includes college. The meta-analytical regression models are estimated by ordinary least squares.

education category models are exceedingly large, possibly indicating the kind of spurious effects sometimes found in regressions run on small samples.[28]

In sum, the literature shows that more educated workers typically end up in wage employment, shunning nonfarm entrepreneurship. This effect is stronger for women, possibly stronger in urban areas, and also stronger in developing economies, where agriculture is more dominant and literacy rates are lower. Relative to farming, however, more educated workers seek out nonfarm entrepreneurship opportunities.

VII. Conclusions and Suggestions for Further Research

The meta-analysis shows that an additional year of schooling raises enterprise income in developing economies by an average of 5.5 percent. This is somewhat lower than the return to education in wage employment in developing areas, which ranges from 7.2 percent per additional year of schooling on average to more than 11 percent (Psacharopoulos 1994).[29] The pattern and values are similar to those for the United States, where the average return to schooling in entrepreneurial pursuits is 6.1 percent, compared with 7–9 percent for returns to wage employment. The return in developing economies tends to be higher for women, as in industrial countries, and for urban residents, but also higher in agricultural societies where literacy rates are lower. As is to be expected, the measured return is sensitive to model specification: for example, inserting controls for inputs removes the allocative portion of the gain that education generates.

With respect to entrepreneurship choice, the descriptive summary of the effect of education indicates that more educated workers typically end up in wage employment, shunning nonfarm entrepreneurship. Relative to farming, however, more educated workers seek out nonfarm entrepreneurship opportunities. For reasons of sample size limitations, a meta-analysis to explain the heterogeneity of results is feasible only for the comparison between wage employment and nonfarm self-employment. The education effect that separates workers out of self-employment into wage employment is stronger for women, possibly stronger in urban areas, and also stronger in less developed economies, where agriculture is more dominant and literacy rates are lower. Many studies report that uneducated women are concentrated in low-income sectors of food

28. Whether the author formulated a structural model or examined entry rather than stock makes no difference. Publication bias is not evident. The standard error of b is not included in the education category equations because this standard error cannot be derived from studies in which the authors used a different base category for their multinomial logit model than wage employment.

29. Psacharopoulos (1994, p. 1330) also reported a 10.8 percent average rate of return to education in self-employment, which, as found here, is less than the 12.2 percent average return in "dependent employment." This value of 10.8 percent is a summary of estimates from a small early entrepreneurship literature and is, given the large standard error in tables 8 and 9, not necessarily out of line with the average of 5.5 percent found here.

commerce and textiles. Thus, it appears that education leads women toward the more rewarding opportunities that are to be found not in higher income entrepreneurial activities but in wage jobs.

The differential in the labor market sorting process that education brings about in developing economies stands in contrast with the lack of relationship between an individual's schooling level and the probability of selection into entrepreneurship found for industrial countries. Economic theory points out that education could have opposing effects on entrepreneurship entry, which may play out differently in developing economies: for example, the opportunity set in developing economies is larger, as are the income differentials between the sectors.

Bosworth and Collins (2003), in discussing the discrepancy between macroeconomic and microeconomic studies of the returns to education, debate the difference between social and private returns, the problem of properly measuring education, and the difficulty of comparing the quality of education across countries. The meta-analysis here adds two elements to this list. First, evidence of systematic heterogeneity in the returns to education as implied by the outcomes of the meta-analysis suggests that the macroeconomic parameter measuring the returns to education should be treated as a function of societal characteristics or as a random (rather than a constant) coefficient. Second, there is some evidence of publication bias, suggesting that the published positive microeconomic evidence might be overstating the true returns to education.

As benchmarked against the common practice in the returns-to-schooling research in the employment literature, the state-of-the-art of research into the effect of education on entrepreneurship is somewhat disappointing. Though much effort has been directed toward the issue, many lacunae remain—issues that have not been addressed or that have been addressed inadequately.

A first drawback is the lack of homogeneity in the definitions of schooling, performance, and entrepreneurship. Only about 35 percent of the studies use a simple years of schooling as the measure of educational attainment. Most researchers use a widely varying set of dummy variables for specific levels of schooling in their entrepreneurship performance and entry equations: the comparison group varies so much across studies that it is difficult to generalize. The same holds true for performance, for which various definitions are used (by themselves useful), and for entrepreneurship selection, where comparison groups are quite varied. It should be acknowledged that many of the data sets used to study self-employment activities are not specifically designed to analyze entrepreneurship. Still, to build a body of knowledge, researchers ought to pay more attention both to the systematic operationalization of entrepreneurship concepts and to the reporting of the results (including, it must be said, a proper description of the data). Novelty for the sake of product differentiation does not have as much value in the scientific realm as it does in the marketplace.

A second issue that should receive more attention is the role of ability and other often unobserved factors in determining entrepreneurial selection and performance. It is quite plausible that the "effect" of schooling that is typically estimated is not completely causal and is therefore biased: ability and other factors might increase performance and also lead to more schooling, thus potentially leading to a spurious positive effect of schooling on performance. A deeper theoretical concern is that schooling itself is endogenous to performance in the labor market: although future earnings are not the only reason to pursue an education, the prospect of earning higher incomes induces many students to stay in school longer (see, for example, Glewwe 1999). In the established returns-to-schooling literature that focuses on wage employment, this issue is well recognized. Whenever the data permit, researchers attempt to correct for the ability bias and the endogeneity of schooling by including measures of innate ability in the specifications, by using instrumental variables, or by running controlled experiments, as in twin studies. In the entrepreneurship counterpart of this literature, none of the studies mentions the endogeneity of schooling,[30] and there are virtually no studies that incorporate any kind of ability measure.[31]

Of the 129 studies on performance that were surveyed, 19 percent corrected for selection biases and 81 percent did not. Omission of such a correction should be acknowledged in the type of recommendations made by these studies. Furthermore, the standard model that many researchers use to correct for selectivity can be questioned. The multinomial logit model assumes that each person makes one and only one labor market choice. However, it is clear that many labor market participants, including the nonfarm self-employed, are active in more than one sector at a time or during the course of a year (Lanjouw 2001; Vijverberg 1992; Vijverberg and Haughton 2002). The multinomial logit model is not suited to analyzing such behavioral patterns (nor, by extension, are the logit and probit models), and the selectivity correction may therefore not be appropriate either.[32]

For employees the distinction between the effects of general education and specific education is quite well known. For entrepreneurship much remains to be explored about the type of curriculum, the effect of training, and the benefits of apprenticeships. It may well be true that the type of curriculum is more important than the level of schooling, and it is conceivable that both curriculum

30. This kind of analysis is further complicated by the fact that because of cultural differences, financial constraints, or availability of schools, people with zero years of schooling may be a heterogeneous group.

31. Exceptions are Escher and others (2002), who found that cognitive ability mattered but did not control for educational attainment, and Vijverberg (1999), which found an insignificant effect for various ability measures.

32. One attempt to develop a solution to this issue is found in Vijverberg (1986). A related issue that has never been discussed is the potential bias resulting from nonrepresentative participation in samples. It might well be the case that more successful entrepreneurs do not take the time to fill out questionnaires or, conversely, that poorly performing entrepreneurs are unwilling to reveal their bad state of affairs in a questionnaire.

and level of schooling affect entrepreneurial outcomes through productivity (human capital theory) and sorting (screening or signaling theory; see Wolpin 1977 and Riley 2002). A limited number of related studies include prior entrepreneurship experience of the respondent or of the respondent's parents as a determinant of the likelihood that the person pursues entrepreneurial interests, but the precise process that leads to this choice remains unclear and likely constitutes a fruitful area of future research.

Finally, entrepreneurship might be described as the process of bringing inputs, technologies, and output markets together. An important part of this process is acquiring financial capital during start-up and expansion. Obtaining credit might be viewed as one of the many dimensions of entrepreneurial performance, and indeed there is little doubt that schooling is related to the likelihood of getting loans (Bigsten and others 2000; McKernan 2002; Parker and van Praag 2003; Raturi and Swamy 1999). Yet though there is therefore a close link with this branch of the finance literature, a review of the precise role of education is left as a future task.

To summarize, many challenges remain in the study of the relationship between entrepreneurship and education, both qualitatively and quantitatively. This article should stimulate efforts toward a deeper, more robust understanding of the role of education in determining the decision to become an entrepreneur and in determining the returns to education among entrepreneurs. If this meta-analysis demonstrates anything, it is that in developing economies the choice of becoming an entrepreneur seems to be rising at low levels of formal education and to be falling at higher levels, and that performance has a positive relationship to education pursued. It is well known that schooling raises wage earnings, but if schooling is also positively related to entrepreneurship performance, this makes a stronger case for investment in human capital through schooling (perhaps including lifelong learning) at all levels.

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