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A Complementarity between Schooling and Wage-work Experience

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October 2015

Abstract: What makes a successful entrepreneur? Using Danish register data, we find strong support for the hypothesis that theoretical skills from schooling and practical skills acquired through wage-work are complementary inputs in the human capital earnings function of entrepreneurs. In fact, we find that schooling only pays off in combination with wage-work experience, as the returns to schooling are insignificant when the entrepreneur has no wage-work experience. The results are extremely robust towards more flexible specifications, including fixed-effects estimations dealing with unobserved heterogeneity. Furthermore, the interaction term is negligible for non-entrepreneurs, suggesting that the complementarity between wage-work experience and schooling is a distinctive characteristic of entrepreneurs.

Keywords: complementarity, entrepreneurs, experience, human capital, schooling

JEL: I21, J24, J4

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1. Introduction

What makes a successful entrepreneur? Both personal characteristics and the right framework conditions are believed to be important. In this paper, we focus on the former and study the "entrepreneurial human capital". Specifically, we point to an important but – until now – unnoticed determinant of entrepreneurial success, namely a complementarity between formal schooling and wage-work experience.

Traditional models of human-capital formation typically treat schooling and experience as perfect substitutes. That is, the return to schooling is independent of experience; and the return to experience is independent of schooling. This is most clearly reflected in the Mincer equation (Mincer, 1974), which has become the workhorse of most empirical studies estimating the earnings effects of schooling and experience; see, *e.g.*, Heckman *et al.* (2006) and van der Sluis *et al.* (2008). In the Mincer equation, log earnings are assumed to be additively separable in schooling and experience. While this may be an appropriate assumption in the case of (non-managerial) wage earners, we argue that schooling and (especially wage-work) experience result in skills that are likely to be strong complements for entrepreneurs (and managers). In other words, skills acquired in school cannot be fully utilized in entrepreneurship unless they are matched with the right practical experience.

The reason, we argue, is that entrepreneurs must have two different sets of skills in order to be successful. A theoretical skill set that endows the individual with the potential to found a profitable business, and a practical set of skills related to the management of a business. Think of the IT programmer. Upon leaving school she has a specialized and theoretical skill set that gives her the potential to start a more successful business than if she had only vocational training. However, to realize this potential she must know how to handle the day-to-day job of running a business, *i.e.*, know how to keep books, obtain funds, hire employees, and market her product. It is only upon obtaining these practical skills that she can fully realize the larger potential of her IT business.

Our hypothesis is that whereas the theoretical skills are obtained in school, the practical skills are more effectively obtained in wage employment under the supervision of more experienced individuals or by observing how others perform the tasks. We test our hypothesis in the simplest possible way by estimating a Mincer equation extended with an interaction term between years of schooling and years of wage-work experience. In this way, we closely follow the approach in the existing literature on the returns to schooling and experience in entrepreneurship, while we are still able to test the essence of our hypothesis, namely that success as an entrepreneur requires a combination of theoretical and practical skills. The existing literature usually includes both schooling and experience in the Mincer equation, but not the interaction between the two; see, *e.g.*, van der Sluis *et al.* (2008).

The Danish register data that we use are particularly well suited for testing our hypothesis as the data allow us to compute measures of actual labor market experience at the individual level. Hence, we are not forced to use potential labor market experience as typically done in the literature;

see Hamilton (2000) and Card (1999). This is important because potential experience may include idle years and because some individuals may acquire wage-work experience while still in school. Moreover, the data allow us to split actual labor market experience into experience from self-employment and wage-work experience. The data therefore allow us to pinpoint the type of labor market experience in which practical skills are more effectively obtained.

We test our hypothesis about the complementarity between years of schooling and wage-work experience using two groups of "entrepreneurial" individuals. The first group consists of the self-employed individuals. This is the most commonly used definition of entrepreneurs in the literature on entrepreneurship; see, *e.g.*, Hamilton (2000) and van der Sluis *et al.* (2008). The second group is wage-employed managers. We do not literally intend to classify employed managers as "entrepreneurs". Instead, we argue that entrepreneurs and managers have similar human-capital requirements: they are both likely to need a combination of theoretical skills from schooling and practical skills acquired through wage-work in order to succeed. Therefore, we use wage-employed managers as a second group of entrepreneurial individuals.

The similarity between managers and entrepreneurs is in fact fully consistent with arguments found elsewhere in the literature on entrepreneurship and leadership; see, *e.g.*, Lazear (2005, 2012).[1] In these contributions, both entrepreneurs and managers are considered to be generalists rather than specialists because they confront a wide variety of choices and because these choices span many fields. As a consequence, they need a balanced skill set. We are inspired by this approach and as discussed above hypothesize that both self-employed and managers need a mix of practical and theoretical skills. In the following, we refer to both self-employed and managers as entrepreneurs.

We find that formal schooling and wage-work experience are indeed strong complements in the earnings equation of entrepreneurs. The coefficient on the interaction term in an OLS regression is positive, statistically significant, and economically important for both groups of entrepreneurs. In fact, we find that schooling only pays off in combination with wage-work experience, as the return to schooling is insignificant when the entrepreneur has no wage-work experience. In contrast, an individual with 10 years of wage-work experience earns more than 30 percent more if he has 18 instead of nine years of schooling. We also point out that using actual experience, in contrast to

[1] Lazear (2012) states: "In fact, entrepreneurs are a subset of leaders and the distinction between entrepreneurs and leaders is somewhat blurred. Most successful entrepreneurs view themselves as leaders because they had the vision that enabled them to provide a valuable good or service cost effectively. Starting a successful business requires the ability to navigate through a vast array of potential hazards. Conversely, most leaders of large corporations think of themselves as entrepreneurial, whether they founded the company or not. High profile CEOs include a few founders, but are comprised primarily of those who improved or redesigned existing companies to produce higher profits and shareholder value", (p. 93).

potential experience, is crucial for our results, as using the latter measure does not reveal any complementarity. This may explain why previous studies in this literature have not uncovered the complementarity between schooling and wage-work experience that we point to in this paper.

We also find that the interaction term between wage-work experience and years of schooling is negligible for non-entrepreneurs, *i.e.*, non-managerial wage workers. This confirms that the complementarity is something that applies to entrepreneurs only.

Our results are extremely robust. The coefficient estimate of the interaction term is hardly affected by the use of a more flexible functional form in our regressions, or by the use of different sample periods, measures of wage-work experience, and definitions of entrepreneurs. We also argue, and provide some evidence that the results are not driven by endogeneity problems in the regressions.

The rest of the paper is structured as follows. Section 2 discusses existing literature. Section 3 outlines our theory and the empirical framework. The data are presented and econometric considerations are discussed in Section 4, while Section 5 contains our main results. Section 6 is devoted to an extensive robustness analysis, and finally Section 7 concludes.

2. Existing Literature

For at least three decades entrepreneurship researchers have studied the relationship between human capital and entrepreneurial success. In the literature, many different human capital measures are applied including education, experience, knowledge and skills. Moreover, many different measures of entrepreneurial success have been applied, including size of the firm as measured by, *e.g.*, the number of employees or the sales volume; profitability as measured by, *e.g.*, profit or personal income; and growth as measured by, *e.g.*, growth in sales or growth in employment.

Unger *et al.* (2011) perform a meta-analysis of the literature focusing on the relationship between human capital and entrepreneurial success. The overall conclusion from their study is that there is a positive and significant relationship between human capital and entrepreneurial success. However, the magnitude of the relationship is small. Moreover, some types of human capital have higher returns than other types. Specifically, this is the case for task-related human capital compared to nontask-related human capital, where task-related human capital is measured by, *e.g.*, owner experience, start-up experience, and industry experience, whereas nontask-related human capital is measured by, *e.g.*, years of schooling and wage-work experience. If we use this division of human capital into task-related and nontask-related human capital, we investigate a potential complementarity between two types of nontask-related human capital and demonstrate that nontask-related human capital can indeed have a significant return in this case.

The empirical approach we use in this paper is related to the literature on returns to schooling for entrepreneurs, see van der Sluis *et al.* (2008) for a review, as well as the studies by Hamilton (2000) and Parker and van Praag (2006). None of these studies, however, consider the

potential complementarity between schooling and wage-work experience.

van der Sluis *et al.* (2008) conduct a meta-analysis of studies that estimate the returns to schooling for entrepreneurs. They conclude that the average effect of an extra year of schooling is 6.1 percent. Iversen *et al.* (2010) challenge this result by showing that the average effect reflects a highly non-linear relationship with very low returns to schooling in self-employment for most educational levels, and only substantial returns when schooling reaches 18 years. Parker and van Praag (2006) investigate the interaction between capital constraints, human capital, and performance. Using Mincer-style regressions, they find that human capital affects performance both directly and also indirectly by relaxing the capital constraint. Related to the two latter studies, we also focus on non-linearities in the return profiles for entrepreneurs.

The focus of Hamilton (2000) is on comparing the earnings-experience profiles of entrepreneurs and wage-workers. He estimates Mincer equations for both these groups and shows that wage-work is associated with a substantial earnings premium compared to entrepreneurship. Related to this finding, we also study and find differences in the relationship between earnings and experience for wage-workers and entrepreneurs.

A related literature investigates the formation of human capital in entrepreneurship education. For a meta-analysis, see Martin *et al.* (2013) who find a value of entrepreneurship education. They find a positive and significant relationship between entrepreneurial human capital and entrepreneurship education as well as a positive and significant relationship between entrepreneurship education and entrepreneurship outcomes including entrepreneurial performance. An obvious question related to our study is whether entrepreneurial education and training programs can provide prospective entrepreneurs with practical skills that are otherwise acquired by working with others. We do not address this question due to lack of data.

Another interesting stream of literature is the "Jacks-of-all-Trades" theory of Lazear (2004, 2005), which argues that entrepreneurs should be generalists, whereas wage-workers should be specialists. Consistent with his theory, Lazear finds that for a group of Stanford MBAs, the probability of becoming an entrepreneur increases with the number of prior roles in previous employment and with a more field-dispersed set of courses in the MBA program.

The "Jacks-of-all-Trades" theory has been investigated in a number of papers. Hartog *et al.* (2010) apply measures for cognitive (math, language, verbal) and social ability. They find that general ability has a stronger impact on income in the case of entrepreneurs than in the case of wage-employment. Moreover, they find that a balance in abilities generates a higher income, but only for entrepreneurs. Lechmann and Schnabel (2014) find that self-employed individuals perform more tasks and that their work requires more skills than that of paid employees. Moreover, they conclude that self-employed individuals not only need more basic skills but also more expert skills than employees. Bublitz and Noseleit (2014) find that employees in large businesses tend to have a lower balance in their skill set than those working in small businesses, but that the skill balance for entrepreneurs

remains the largest. Moreover, they find a positive relationship between skill balance and income to be strongest for entrepreneurs. In conclusion, a number of studies find support for the "Jack-of-all-trades" hypothesis.

The contribution of the present paper to the literature is the identification of a complementarity (an interaction effect) between two types of human capital: Theoretical skills from schooling and practical skills acquired through wage-work. The empirical importance of this complementarity remains unstudied despite the facts that many measures of entrepreneurial human capital have been applied in the literature.

According to our knowledge, the only other study that explicitly investigates interaction effects between human capital measures in entrepreneurship is Chowdhury *et al.* (2014). Their study analyzes and establishes evidence for a complementarity between the education of employees and their work experience obtained within small businesses. The study thereby differs from our with respect to two important aspects. First, it focuses on human capital of employees; not of entrepreneurs. Second, it focuses on work experience obtained within the firm, not wage-work experience obtained prior to the establishment of the entrepreneurial firm.

3. Theory and Empirical Framework

The traditional human-capital earnings function from Mincer (1974) assumes that schooling and on-the-job training are substitutes in the production of human capital. According to this approach, the human capital (or earnings capacity) of an individual at age *t* is a function of her initial human capital and subsequent "investments" in schooling and on-the-job training:

$$HC_t = HC_0 \cdot (1 + r_s)^S \cdot \prod_{j=S+1}^{t} \left(1 + r_X k_j\right), \quad t > S$$

HC_0 is the human-capital level when entering school (which happens at the age of zero to simplify notation) and S is the number of years spent in school with an annual return rate of r_s. Similarly, r_X is the annual return from on-the-job training, and k_j is the share of time invested in or devoted to training in year j.

In its simplest specification, Mincer (1974) assumed a linearly declining investment profile in on-the-job training. In this case, the log of the human-capital level (or earnings capacity) can be expressed as:

$$\log(HC_t) = \log(HC_0) + r_s \cdot S + \beta \cdot X + \gamma \cdot X^2$$

where $X = t - S$ is the number of years of work experience at age *t*, and β and γ are constants. By adding an error term, and using income, *Y*, as a measure for the earnings capacity, the equation above gives us the well-known Mincer equation, which has for many years been the workhorse for estimating the earnings effects of schooling and work experience for both wage-workers and

entrepreneurs; see, *e.g.*, Heckman *et al*. (2006) and van der Sluis *et al.* (2008). The typical Mincer equation thus looks like the equation in (1):

$$\log(Y) = b_0 + b_1 \cdot S + b_2 \cdot X + b_3 \cdot X^2 + \gamma \cdot Z + e \quad (1)$$

where Z contains other controls, such as dummies for gender and location, and e is the error term.

In (1), substitutability between schooling and work experience (or on-the-job training) is reflected in the linear additive form where the cross derivative of $\log(Y)$ with respect to S and X equals zero. In other words, schooling and work experience are considered to be perfect substitutes in the typical Mincer equation.

Mincer (1974) actually relaxed the restrictive assumptions of (1) about the shape of experience as a quadratic function and identical rates of return to schooling at all levels of schooling. He did this in a parametric manner by including S^2 and $S \cdot X$ terms to allow for systematically different rates of return to schooling at different levels of schooling, and to allow for experience (or on-the-job training) to interact with levels of schooling in affecting earnings. However, Mincer (1974) found that when weeks worked were included as control variable in regressions of individual earnings, these two additional variables became insignificant and as a consequence they were disregarded.

While the assumption of substitutability between schooling and experience may be reasonable in the case of wage-workers, our argument is that the assumption is unlikely to hold in the case of entrepreneurs. Here, schooling and on-the-job training as proxied by work experience – in particular by wage-work experience – are likely to constitute complementary types of human capital. Consequently, we hypothesize that the $S \cdot X$ term is important in the specification of the human-capital earnings function of entrepreneurs. Therefore, the modified Mincer equation that will be used for the estimations in the present paper becomes:

$$\log(Y) = \mathrm{b}_0 + b_1 \cdot S + b_2 \cdot X + b_3 \cdot X^2 + b_4 \cdot S \cdot X + b_5 \cdot Z + e, \quad (2)$$

According to our hypothesis, we expect the coefficient, b_4, of the interaction term, $S \cdot X$, to be positive for entrepreneurs. In other words, a higher level of experience will increase the (relative) effect of schooling on income, and *vice versa*.

The starting point of our hypothesis is the belief that, first, an individual with a larger set of theoretical skills has the potential to found a more profitable business, all things being equal, and, second, that theoretical skills constitute a necessary but not sufficient condition for an individual to be fully successful as an entrepreneur. To succeed the entrepreneur must also possess the practical skills of handling the day-to-day job of running a business. Under these conditions there will exist a complementarity between the theoretical and practical skills of the entrepreneur, as the productivity enhancing effects of the theoretical skills can only be fully utilized after acquiring the relevant practical skills. If theoretical skills are obtained through schooling and practical skills are obtained by working for others in existing businesses, we should observe a complementarity between schooling

and wage-work experience in forming entrepreneurial human capital. Alternatively, some of the practical skills may be acquired through one's own self-employment experience – but we expect such a trial-and-error approach to be less effective.

While Lazear (2004, 2005) focused on the different skills that individuals can acquire by holding different occupations or choosing different educational subjects, our hypothesis is somewhat different. We believe that the successful entrepreneur needs a mix of practical and theoretical skills. We can think of the theoretical skills as the codified knowledge acquired in school, whereas the practical skills can be interpreted as the tacit knowledge which is often better acquired through actual work experience, *e.g.*, through on-the-job training or by working for others and learning and observing how to run a business.

Our reasoning so far, perhaps, applies best to a self-employed individual. A similar line of reasoning can, however, be applied to managers. Lazear (2005) has previously argued that self-employed and managers possess the same types of skills; they are generalists and need a broad and balanced skill set to run a business. Furthermore, Lazear (2012) studies leaders as measured by individuals in c-level positions and argue that leaders, just as entrepreneurs, are generalists. *I.e.*, the relevant human capital earnings function is well described by (2). Therefore, we expect the coefficient, b_4, of the interaction term, $S \cdot X$, to be positive for managers as well, because they need a broad skill set to be successful.

For (non-managerial) wage-workers, on the other hand, formal schooling and wage-work experience should not constitute complementary types of human capital at the individual level, as wage-workers perform more specialized tasks and hence do not need a mix of theoretical and practical skills. The full productivity-enhancing effects of schooling can in this case be achieved without the individual herself having practical wage-work experience. The relevant human-capital earnings function is well described by log earnings being additively separable in schooling and experience. Consequently, we expect that b_4 is negligible for (non-managerial) wage-workers, thereby confirming the typical Mincer equation in (1).

In sum, we hypothesize a modification of the typical human-capital earnings function in the case of entrepreneurs to account for a complementarity between theoretical skills from formal schooling and practical skills obtained through (wage-work) experience. We provide a first test of this hypothesis by estimating a slightly extended version of the traditional Mincer equation, *cf.* (2), where we include an interaction term between schooling and experience, and where experience is measured as actual wage-work experience rather than potential experience.

4. Econometric, Data and Measurement Issues

4.1 Econometric Issues

In most of the estimations of (2), we shall rely on OLS allowing for heteroscedasticity in the error terms. As will be explained in Section 6, we run several robustness checks with respect to the functional form, the sample, and the income and experience measures used.

A general weakness of using OLS on (2) is that schooling (as well as experience) may be endogenous due to the presence of unobserved individual heterogeneity (typically in the form of ability differences) showing up in the error term, which leads to an omitted variable bias. We would, *e.g.*, expect the estimated coefficient on S to be upward biased if unobserved individual ability is positively correlated with both schooling and income, as more able individuals will both earn more and choose more schooling. In this case, the estimated effect of schooling may thus (partly) reflect an unobserved ability effect. Following the same line of reasoning, there may also be endogeneity problems associated with the experience measure, since more able individuals may need less time to absorb the relevant practical knowledge. Similarly, if for a given level of schooling, more able individuals have both more experience and earn more, we would expect the coefficient of $S \cdot X$ to become upward biased.

The problem with the potential endogeneity of schooling has been repeatedly stressed in the literature on returns to schooling; see, *e.g.*, Griliches (1977) and Card (1999). Various instruments for schooling have also been proposed to overcome this problem, but the suggested instruments have been criticized for not being exogenous or for being too weak to offer credible inference; see Carneiro and Heckman (2002) and Heckman *et al.* (2006). Card (2001) concludes that IV estimates are typically very imprecise, and do not offer decisive evidence about the potential ability bias in the OLS estimates. It should also be emphasized that the challenge of finding suitable instruments is even harder in the present analysis than in the standard instrument-variable case because we have two endogenous variables and an endogenous interaction term. Even though it would strengthen the analysis if we could use exogenous variation in an instrument-variable approach, we choose OLS as our main method of estimation in this paper.[2]

However, we do two things to check the importance of unobserved ability for the estimate of the coefficient of the interaction term. First, the coefficient of the interaction term can also be identified in an individual fixed-effects (FE) estimation of (2) for one of our two groups of entrepreneurs: The managers. The reason is that wage-work experience changes over time for this

[2] We have actually tried to use the father's years of schooling as an instrument for years of schooling; see also Hoogerheide *et al.* (2012). The results are reported in footnote 18 of Section 6.2. Here we assume that X is exogenous and treat S as endogenous, and thereby instrument $S \cdot X$ and S. In doing this, we follow the method suggested by Balli and Sørensen (2013).

group, as they are formally wage employed.[3] This allows us to purge the estimate of b_4 from any bias resulting from unobserved individual heterogeneity and hence provides a strong robustness check of the OLS results.[4]

Second, we also run the OLS regression for non-managerial wage-workers. For this group, we do not expect formal schooling and wage-work experience to constitute complementary types of human capital at the individual level, since wage-workers perform more specialized tasks and hence do not need a mix of theoretical and practical skills. In other words, the full productivity-enhancing effects of schooling can in this case be achieved without the individual herself having practical wage-work experience. If we find a positive coefficient in the case of self-employed/managers but not in the case of non-managerial wage-workers, it is unlikely that the positive coefficient in the former case reflects an omitted-variable bias as we have no reason to expect that the problem with unobserved ability is different across the groups.

4.2 Data and Measurement Issues

Our data come from the Integrated Data Base for Labor Market Research ("IDA") compiled by Statistics Denmark and cover the period 1980-2002. These data contain register-based information for all individuals with Danish residency since 1980. The data provide detailed information on labor-market performance, such as occupation, earnings, and experience, as well as a wide range of individual characteristics like education and family background. For more information on the IDA data, see Abowd and Kramarz (1999).

In most of the estimations, we use a cross section of individuals from the private (non-primary) sector in 2002, but we exploit the historical information in IDA to construct the experience measures.[5] For some of the robustness checks, we use different sample years, and when we consider fixed effects we exploit the panel dimension of the data.

Moreover, we limit our sample to include only individuals who were born between 1960 and 1969, *i.e.*, individuals are aged between 33 and 42 years at the end of 2002. This choice excludes individuals with (extensive) work experience in 1980, as the oldest individuals are at most 20 years old when we begin to measure actual labor-market experience in 1980. This is important, as we cannot compute actual experience before 1980. Individuals born after 1969 are also excluded from the sample, implying that the youngest individuals are at most 33 years old in 2002. Because we want to have individuals with all education lengths including long further education with 18 years of

[3] Note that we cannot identify the coefficient of $S \cdot X$ for self-employed, since neither schooling nor wage-work experience varies over time for these individuals.

[4] Bloom *et al.* (2012) use a similar estimation strategy when studying the relationship between IT and people management for firm performance.

[5] Data also exists for 2003. However, since 2003 was a recession year we use 2002 that is a more normal year in the analysis.

schooling, as well as individuals who potentially have some wage-work experience before becoming self-employed or a wage-employed manager, we exclude individuals born later than 1969. In this respect, it should be noted that individuals with 18 years of schooling have a median graduation age of around 28 years, see Ministry of Higher Education and Science (2013). This implies that individuals born in 1969 with median graduation age of 28 at most have 4 years of wage-work experience before going self-employed in 2002.

There are three major measurement issues related to the estimation of (2): How to identify the entrepreneurs, how to measure their income, and how to measure their human capital, *i.e.*, their schooling and experience levels. We discuss each of these issues in turn.

Regarding the first issue, we use two different groups of individuals with entrepreneurial characteristics. First, we use the group of self-employed individuals, which is the most commonly used definition of entrepreneurs in the literature; see van der Sluis *et al.* (2008) and Hamilton (2000). Second, we use the group of wage-employed managers. We do not intend to classify employed managers as "entrepreneurs". Instead, we argue that entrepreneurs and managers have similar human-capital requirements: they are both likely to need a combination of theoretical skills from schooling and practical skills acquired through wage-work in order to succeed. Using managers also addresses the concern raised by Parker (2004) that managers of incorporated businesses are an important class of entrepreneurs not included in the usual self-employment definition. Furthermore, the income of managers is likely to be measured with less noise, as they are formally wage-workers.

The second issue concerns how to measure entrepreneurial income. For managers, the solution is straightforward since we have detailed data on their wages. For self-employed, the problem is that we typically have different measures of the reported income, and that reported income need not perfectly reflect generated income; see Hamilton (2000). In this paper, we rely on a measure of the annual surplus from self-employment activities which is comparable to the net profit measure used by Hamilton (2000).[6] This is the amount reported to the tax authorities, which is not, necessarily, the same as the amount withdrawn for personal consumption, as some of the surplus may be kept in the firm.

The third issue relates to the measurement of schooling, S, and experience, X. We measure schooling by years of formal education. The Danish educational system contains a variety of formal educational levels, including vocational education as well as short, medium, and long further educational levels. Primary and lower secondary school correspond to nine and 10 years of education, respectively, where nine years is the mandatory level in Denmark. A high-school degree corresponds to 12 years. Vocational education is an alternative to high school with a typical duration of three years, resulting in a total of 12 years of education. The different education programs are managed by

[6] According to Hamilton (2000), net profit is analogous to the amount reported to the Internal Revenue Service. Similarly, annual surplus is also the surplus that is reported to the Danish tax authorities.

the public sector, which means that the quality and content are harmonized across schools. A high-school degree can be followed by additional education. A long further educational program corresponds to the Master or PhD level (18+ years of total education). Medium further education corresponds to the Bachelor level (16 years), while short further education is more practical and results in a total of 14 years.

Experience, X, is in most regressions a measure of actual years of wage-work experience, which we construct from the historical information about the labor market status for each individual since 1980. Hence, we do not rely on potential experience measured as $\text{Age} - S - 6$. Potential experience is the typical measure used in the literature, but it implicitly assumes that the individual started school at the age of six and began working right after school – and not before. We stress this distinction because it is important for the results we report below.

The availability of actual experience measures is also important as it allows us to distinguish between experience from wage employment and experience from self-employment. Each year, we know whether individuals are wage employed, self-employed, non-employed, or unemployed. We use this to construct separate measures of experience in wage employment and self-employment.[7] This split is especially important for the present analysis, as our theoretical hypothesis is that entrepreneurs acquire their practical skills from being employed by others. In other words, we expect the complementarity to be stronger between schooling and wage-work experience than between schooling and self-employment experience. However, this is not a hypothesis that we can test directly because self-employment experience is likely to capture other effects than human-capital accumulation. If self-employed individuals invest in their firms when they are young and disinvest later on, this will create a positive correlation between the measured annual surplus and self-employment experience. Hence, even if we find a complementarity between schooling and self-employment experience, we cannot be sure that it reflects a human-capital effect. This also highlights the importance of being able to separate out self-employment experience from wage-work experience.

Using the above sampling requirements, and excluding self-employed individuals with negative earnings, results in two samples for 2002 with 26,116 self-employed[8] (of which 11,579 have employees) and 10,509 managers[9], respectively.

[7] We also use an alternative measure of wage-employment experience, which converts years of wage-work experience into full-time equivalents; see Section 6.1.

[8] Self-employed individuals with negative earning are excluded from the sample because the Mincer equation is formulated using log of income as the dependent variable. Since we cannot take the log of negative income, the observations drop out. To be precise, 3,266 self-employed with negative income are excluded from the sample. If we estimate the earnings function using income levels instead of log-income, self-employed individuals with negative income can be included. The results with and without self-employed with negative income are qualitatively similar.

The distributions of schooling and experience for the 2002 samples of self-employed and managers are shown in Table 1. It is seen that the largest groups of both self-employed and managers have 12 years of schooling, but that the distributions are skewed towards fewer years of schooling for the self-employed and more years of schooling for the managers. More interestingly, all groups of self-employed have 10-12 years of wage-work experience on average. For managers, the average level is somewhat higher, but still relatively constant across education groups. This is in stark contrast to the amount of potential experience presented in the last column. Using this measure of experience, a strong negative correlation with years of schooling emerges.

<Table 1 about here>

As controls in the estimations we use a range of socio-demographic variables, including age, gender, marital status, a dummy for living in a city, an immigrant dummy, and a dummy for whether the spouse assists in the firm.[10] It is important to control for the latter variable when considering the group of self-employed since an assisting spouse is likely to increase the annual surplus because the remuneration for this work is not (fully) deducted in the surplus. Finally, we also include a full set of industry dummies referring to the industry in which the self-employed/manager has her economic activity. Summary statistics of all variables (except industry dummies) used in the empirical analysis are presented in Table 2.

The main difference between the two samples is that income, log(earnings), is lower for self-employed and varies more for self-employed than for managers. Moreover, self-employed have about one year less schooling than managers, whereas managers are more often males compared to self-employed, and self-employed are more often immigrants.

<Table 2 about here>

In Table 3, we focus on correlations between all the included variables in the analysis. In addition to the variables included in Table 2, we also include the interaction term between years of schooling and wage-work experience.

<Table 3 about here>

The first point to note is that the explanatory variables have higher correlation with the dependent variable, *i.e.*, log(earnings), for managers than for self-employed. This likely reflects the high variation in log(earnings) for self-employed as documented in Table 2. The second point to note is that all human-capital measures are positively correlated with log(earnings).

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[9] Managers with previous self-employment experience have been excluded from the sample, because we want to study as clear-cut a group of managers as possible. Therefore, we do not want to include individuals with experience in both self-employment and leadership. 1,555 individuals with both managerial experience and self-employment experience are excluded from the sample. The qualitative results are, however, robust to the inclusion of these individuals.

[10] Note that age can be included in the regressions together with S and X when X is measured as actual instead of potential experience.

5. Empirical Results

In this section, we present our main results. Section 5.1 contains the results from estimating our baseline specification and provides some insights into the quantitative importance of the complementarity. Section 5.2 discusses which kind of labor-market experience is most important in generating the complementarity.

5.1 Baseline Results

Table 4 presents the results from the estimation of (1) and (2) for self-employed and managers, respectively. That is, estimations have been performed with and without the interaction term between schooling and wage-work experience included for both groups. The table only contains the estimated coefficients for the human-capital variables. A full set of estimation results can be found in Table A1 in the appendix.

<Table 4 about here>

A number of results can observed from the table. First, the interaction term is significantly positive for both managers and self-employed, which indicates that schooling and wage-work experience are indeed complements in the human-capital formation for entrepreneurs.[11] Second, the estimated coefficients are quantitatively of the same magnitude for self-employed and managers. Third, the estimated coefficient of schooling, *S*, becomes insignificant for both types of entrepreneurs with the inclusion of the interaction term. Thus, not only do schooling and wage-work experience complement each other for entrepreneurs, there is virtually no return to schooling in the absence of wage-work experience. A fourth observation is that for managers, the linear and quadratic terms in experience become insignificant when controlling for the interaction term between schooling and experience. Hence, for managers both schooling and experience do not seem to carry any return by themselves.

To provide an illustration of the quantitative importance of these results, Figure 1 shows the estimated log income-experience profiles for self-employed and managers with nine and 18 years of schooling, respectively. The effect of nine additional years of schooling, conditional on a given experience level, is thus the vertical difference between the two curves for self-employed and managers, respectively.[12]

[11] We have also estimated (2) using an additional control variable that is similar to weeks worked. As stated in Section 3, Mincer (1974) found that when weeks worked were included as control variable in regressions of individual earnings, these interaction term became insignificant. Specifically, we include the share of time within a year an individual is unemployed. The results of Table 4 are robust to the inclusion of this variable.

[12] The profiles for managers and self-employed are not directly comparable due to the different income measures used for the two groups of entrepreneurs and the presence of different controls in the underlying regressions; *cf.* Table 4. Also note that the curves are computed for a given level of self-employment experience. Hence, in contrast to the curves for managers, the curves for self-employed cannot be interpreted as earnings profiles for self-employed individuals with different schooling levels.

<Figure 1 about here>

The figure clearly illustrates how the effects of schooling kick in for individuals with more experience from wage employment. While the estimated effect of schooling in the absence of wage-work experience (*i.e.*, when $X = 0$) is insignificant for both groups, a positive effect of schooling materializes for individuals with more wage-work experience. Thus, for instance, a self-employed individual with 10 years of wage-work experience earns 34 percent more with 18 instead of nine years of schooling.[13] Strikingly, the extra income generated by having 18 years rather than nine years of schooling is almost the same for managers as for self-employed and equals 32.5 percent. For wage-work experience equal to or below 11 years, the extra income is larger for self-employed, whereas it is larger for managers in the case of more than 11 years of wage-work experience.

In sum, these results point to a strong complementarity between formal schooling and wage-work experience for both types of entrepreneurs. We also conclude that the complementarity is economically significant as the combination of schooling and several years of wage-work experience increase entrepreneurial income by a non-negligible percentage.

5.2 Which Type of Experience Matters?

In this subsection we examine whether the specific nature of experience is important for our results. Our hypothesis is that practical skills acquired through wage-work experience complements the theoretical skills acquired through formal schooling. Theoretical skills, however, may be obtained within different fields of study. A relevant question is therefore whether different types of theoretical skills are equally important complements to wage-work experience.

Table 5, column 2 sheds light on this question by distinguishing between four different types of education and thereby including four different measures of years of schooling and four different interaction terms in equation (2), which measure the interaction between years of schooling and wage-work experience for each type of education. Thus, we estimate the following equation:

$$\log(Y) = \mathrm{b}_0 + \sum_{i=1}^{4} b_{1i} \cdot S_i + b_2 \cdot X + b_3 \cdot X^2 + \sum_{i=1}^{4} b_{4i} \cdot S_i \cdot X + b_5 \cdot Z + e.$$

The four types of education are technical, social science, humanities and education without a field. It is evident that all the interaction terms for all four types of education are positive and significant and of magnitudes not too far from the baseline result that is presented in column 1. Hence, we can conclude that our main result is robust to distinguishing between different fields of education.

< Table 5 about here >

Wage-work experience may be obtained within different sectors of the economy. A relevant question is therefore whether different types of wage-work experience are equally important complements to theoretical skills. Table 5, column 3 sheds light on this question by distinguishing

[13] The difference in earnings is calculated as the exponential of the difference in log earnings minus 1.

between three types of sectoral wage-work experience; wage-work experience from manufacturing, from services and from other sectors including the public sector. Again we distinguish between types of wage-work experience both for wage-work experience in itself and for the interaction terms.[14] *I.e.*, we estimate the following:

$$\log(Y) = \mathrm{b}_0 + b_1 \cdot S + \sum_{i=1}^{3} b_{2i} \cdot X_i + \sum_{i,j=1}^{3} b_{3ij} \cdot X_i X_j + \sum_{i=1}^{3} b_{4i} \cdot S_i \cdot X + b_5 \cdot Z + e.$$

It is seen from the Table that for all types of wage-work experience, the interaction term enters with a positive sign. However, the effect is not significant for self-employed in the case of experience from the manufacturing sector or from "other" sectors. One potential explanation is that around three quarters of self-employed are active in the service sector, whereas less than 10 percent of the self-employed are active in manufacturing. Thereby, it makes sense that wage-work experience from the service sector is more relevant for the complementarity than wage-work experience from other parts of the economy. For managers, it is seen that both experience from manufacturing and from the service sector are important for the complementarity. This makes sense, because the sample here is more balanced across sectors, *i.e.*, one third of managers are employed in the manufacturing sector, whereas 60 percent are employed in the service sector.

In sum, we find that the theoretical skills can be acquired within all types of education and that wage-work experience can be acquired in all sectors with the modification that it may be an advantage to obtain sector-relevant wage-work experience.

A related question is whether the self-employed may alternatively acquire the relevant practical skills on the job, *i.e.*, while self-employed. In this case it would be general work experience rather than wage-work experience that matters for the complementarity. This is investigated by including an interaction term between self-employment experience and years of schooling in the baseline regression. However, caution should be exercised when interpreting this coefficient, as self-employment experience is likely to capture other effects in addition to human-capital accumulation. If self-employed individuals invest in their firms when they are young and disinvest later on, this will create a positive correlation between the measured annual surplus and the amount of self-employment experience. Hence, even if we find a complementarity between schooling and self-employment experience, it may indeed reflect other effects that a human-capital effect.

The inclusion of this additional interaction term increases the coefficient of the interaction term between wage-work experience and schooling, as can be seen from column 4 in Table 5. The additional interaction term between self-employment experience and schooling is also positive but insignificant. Thus, this result seems to confirm the hypothesis that the practical skills required to benefit from formal schooling are acquired most effectively in wage employment.

[14] Since we extend the term X^2 to include three types of industry experience, both squared and interaction terms of different types of experience are included in the equation.

Finally, we analyze the importance of using potential experience rather than actual wage-work experience. To do this, we re-estimate (1) and (2) for self-employed and managers using potential experience as defined in Section 4.2 as our measure of X, *i.e.*, $X = Age - S - 6$. The results of this are shown in Table 6. The interaction effect is now insignificant for self-employed and significantly negative for managers. Note also that the coefficient of schooling becomes much larger than in Table 4 and is now also significant.

<Table 6 about here>

The fact that the positive interaction terms disappear when we use potential experience may explain why existing studies of returns to schooling in entrepreneurship have not discovered the apparent complementarity between schooling and wage-work experience; see, *e.g.*, Hamilton (2000).

6. Robustness Checks and Endogeneity Issues

In Section 5, we found a positive interaction effect between schooling and wage-work experience for managers and self-employed. In this section, we present a number of robustness checks of this result and document that it is very robust towards changes in the samples, the definition of self-employed individuals, and the measurement of the level of experience, as well as more flexible specifications of the regressions. We also examine whether our results are caused by schooling and/or experience being endogenous in our regressions, and argue that this is not the case.

6.1 Robustness Checks

A potential problem is that the significant coefficient of the interaction term may pick up omitted higher-order terms in schooling and/or wage-work experience rather than a complementarity between the two. To check whether this is the case, we re-estimate (2) using a completely flexible specification for the separate effects of schooling and experience by replacing S and X with dummies for different levels of schooling and wage-work experience. The result of this exercise is shown in column 2 of Table 7.

As can be seen, this change hardly affects the size of the coefficient of $S \cdot X$. In fact, the point estimate is remarkably robust towards these changes in the specification for both managers and self-employed. Hence, it can be concluded that the positive interaction effect does not reflect separate non-linear effects of schooling and wage-work experience.

<Table 7 about here >

Another potential problem is the inclusion of all individuals born between 1960 and 1969 and therefore aged between 11 and 20 years in 1980 in our samples. As some individuals may gain considerable wage-work experience before the age of 20, and since we can only measure experience from 1980 and onwards, we may end up with biased measures of wage-work experience. This can potentially distort our results.

To deal with these issues, we re-estimate (2) for two different cohorts broken down by intervals of birth year. The first cohort includes individuals born between 1960 and 1964 and the second includes individuals born between 1965 and 1969. The two cohorts each contain around half of the full sample. The results from these estimations are reported in Table 7, columns 3-4.

Splitting the samples into two cohorts implies positive and significant interaction terms for both cohorts. Also, the interaction terms are of the same magnitude. For self-employed the interaction terms equal 0.002 for both cohorts, whereas they equal 0.0024-0.0029 for managers. Thus, the interaction terms are still positive and significantly different from zero and are all statistically significant.

A third issue is that the measures of self-employment experience and wage-work experience are constructed from annual observations of individuals in the Danish labor market ignoring experience obtained abroad. As a consequence, the experience measures for immigrants may be biased. If an immigrant arrives in Denmark in, say, 1992, she can at most have 10 years of recorded wage-work experience in 2002. This only constitutes a problem, however, if the experience gained before arrival is relevant for entrepreneurial earnings in Denmark. To check whether this affects our results, we re-estimate the model for self-employed and managers dropping all immigrants from the samples. As can be seen from column 5 in Table 7, this has only a minor influence on the estimates.

Furthermore, our preferred definition of a self-employed individual is based on his or her primary occupation in the last week of November. This is the definition used by Statistics Denmark to determine the labor market status of individuals. There are at least two data problems associated with this definition: (i) some individuals are both self-employed and wage employed at the same time, and (ii) a number of individuals change status during the year, and because we rely on annual observations, we have to determine whether or not such individuals should be included in the group of self-employed. To address these problems we employ an alternative definition where we select the subset of self-employed with employees. These self-employed are less likely to have switched in and out of self-employment during the year and are also less likely to hold additional jobs. Hence, they are perhaps more likely to provide a "stable" group of self-employed, and we should expect their annual earnings to reflect the income from a full year in self-employment. Columns 6 and 7 of Table 7 therefore split the sample of self-employed into employers and non-employers. As the table shows, the order of magnitude of the estimated coefficient of the interaction term is the same in both cases, although the coefficient for employers is slightly higher.

A fourth potential problem with the measure of wage-work experience used above is that a year of part-time employment counts as a full year of wage-work experience. This is reasonable if experience is not so much about the time spent in the job as the time spent as an employee. However, it can also be argued that experience should be calculated in full-time equivalents such that a part-time position counts less than full-time employment.

From data on wage earners' supplementary pension schemes, we are able to construct a measure of experience in wage employment in full-time equivalents. Because these payments follow the individual's number of working hours, we use this information to obtain a weighted measure of experience from wage employment. The results from using this alternative measure of wage-work experience are presented in Column 8. Whereas the estimated coefficients for both self-employed and managers are a bit lower compared to the baseline case, the coefficients are still statistically significant.[15]

Finally, we present, in Table 8, results using a different sample year, 1998. This reduces sample sizes somewhat since the oldest individuals in the samples are now 38 years old. The estimated coefficients are, however, relatively robust towards these changes. The interaction term remains significant and in fact becomes quantitatively more important for self-employed in 1998. For managers the interaction term for 1998 is significant but attains a lower value. We also ran the regressions for the years 1999, 2000, and 2001 and found that the interaction term enters positively and significantly. These results are available upon request.

<Table 8 around here>

6.2 Endogeneity Issues

As discussed in Section 3, the schooling and experience variables may be endogenous due to the presence of unobserved differences in ability across individuals, which will create a correlation between schooling and experience on the one hand and the error term on the other hand. We examine whether endogeneity issues are important for our results using two alternative approaches.

First, we check the importance of unobserved ability bias by exploiting the panel structure of our dataset and control for individual fixed effects. Given our hypothesis that X is wage-work experience, managers attain additional years of experience while on the job. Hence, the interaction term between schooling and experience varies over time for managers, implying that we can identify the coefficient of this variable in a fixed-effects regression. For self-employed, this is not the case, as wage-work experience does not vary over time for these individuals. Hence, we re-estimate (2) on a panel of managers using a fixed-effects estimation to eliminate unobserved (time-invariant) individual effects. The results of this are presented in Table 9. The panel used covers the years 1996-2002 with the same restrictions as in the case of the cross section from 2002. Hence, we consider only individuals born between 1960 and 1969 with no prior self-employment experience.

[15] A potential problem with the full-time equivalent experience measure is that the maximum number of hours worked follows the normal work week in the Danish labor market. This implies that nobody is registered to work more than 37 hours per week. This restriction reduces the quality of the experience measure especially for managers since survey data suggest that a high share of managers work more than 37 hours. Thus, the results presented in column 8 of Table 7 should be interpreted with caution.

< Table 9 around here>

The coefficients of the interaction term presented in column 2 of the Table show that the complementarity between schooling and wage-work experience remains significant under this alternative estimation strategy.[16] In fact, we find a significant effect of quantitatively the same magnitude (slightly higher, in fact) as in the previous Tables. This provides a strong indication that the OLS estimates do not suffer seriously from an omitted-variable bias.

Second, we can run our baseline regression on a sample of wage-workers. A priori, we have no reason to expect the endogeneity bias to be any different for wage-workers than for entrepreneurs. Hence, if we do not find a positive coefficient of the interaction term between schooling and experience in the case of wage-workers, it seems unlikely that the positive coefficient for entrepreneurs reflects an omitted-variable bias.

Table 10 shows the results from estimating (2) for wage-workers (excluding managers). In this case, the estimated coefficient of the interaction term is close to zero and insignificant as shown in column 2.[17] Furthermore, the partial effect of schooling with experience equal to zero is now significantly positive and economically important with a coefficient of schooling of 0.065.

< Table 10 around here>

In sum, the interaction term is close to zero and statistically insignificant for wage-workers. If this reflects the extent to which endogeneity bias affects the estimate on the interaction term for both wage-workers and entrepreneurs, we can conclude that it constitutes a negligible part of the explanation for the significant complementarity found for entrepreneurs.[18]

[16] Note that the coefficient of schooling is not identified because the relatively few individuals changing their level of schooling between 1996 and 2002 have been excluded. Furthermore, with year dummies included, the coefficient of wage-work experience is only identified from individuals with multiple spells as managers in the panel. Hence, we do not wish to push the interpretation of this coefficient too far.

[17] We have restricted the sample to exclude workers with self-employment experience, implying that wage-work experience equals total experience

[18] As mentioned in Footnote 2, we have also addressed the relationship between years of schooling and the interaction term between years of schooling and wage-work experience using the father's years of schooling as an instrument; see also Hoogenheide *et al.* (2012). More precisely, we treat wage-work experience as exogenous and therefore instrument S and $S \cdot X$ by father's years of schooling and father's years of schooling interacted with wage-work experience of the individual, following the approach in Balli and Sørensen (2013). For managers, we find similar results as in Table 4, *i.e.*, schooling and wage-work experience in itself bear no returns, whereas the interaction term does with a point estimate of around 0.005. For self-employed the results are not as clear-cut. Here, we find a negative and significant direct return to years of schooling of -0.12 and a positive and significant interaction term of 0.009.

7. Conclusion

In this paper, we have tested the hypothesis that schooling and wage-work experience are complementary types of human capital for entrepreneurs. Using two different groups with entrepreneurial characteristics – self-employed and managers – we have found strong empirical support for this hypothesis, as the interaction term between schooling and actual wage-work experience enters positively and significantly (statistically and economically) in an extended Mincer equation, whereas the partial effect of schooling in the absence of wage-work experience is insignificant. These findings are extremely robust towards changes in the samples, refinements of the experience measure used, and more flexible specifications.

Furthermore, we argue that the results are unlikely to reflect unobserved individual heterogeneity and thereby to reflect an omitted-variable bias. First, the positive coefficient of the interaction term is not sensitive to the inclusion of fixed effects to control for unobserved individual differences. Second, in a similar regression for non-managerial wage-workers – where we expect a potential bias from unobserved heterogeneity to be similar – we do not find an economically important coefficient of the interaction term.

The finding that the return to schooling is insignificant when the entrepreneur has no wage-work experience suggest that practical skills are important for entrepreneurs if they are to benefit fully from the more theoretical skills acquired in school. We also find that these skills are acquired most effectively through wage-work, as the complementarity between self-employment experience and schooling is much weaker. Taken at face value these findings suggest that potential entrepreneurs should not become entrepreneurs until they have gained wage-work experience because they will not earn any return on the human capital acquired in school. Moreover, policies that provide incentives for young entrepreneurs to start-up are not necessarily appropriate since they may imply that potential entrepreneurs' start-up too early to have accumulated sufficient theoretical and practical skills.

The results of this paper open up a number of additional questions: Exactly which skills acquired by working with others are then useful in entrepreneurship? And can some of these skills be learned in school if education programs become increasingly targeted towards entrepreneurship? It is often argued that higher education should to a greater extent be designed to promote entrepreneurship; see, *e.g.*, OECD (2008). However, it is not clear whether such changes will have an impact on the returns to schooling in the absence of wage-work experience and thereby the optimal timing of entry into entrepreneurship. We leave these questions for future research.

Our results also show that measuring experience as actual wage-work experience instead of potential labor-market experience is important. If we use the latter measure, as is typically done in the literature, the positive interaction effect between schooling and experience disappears and we are back to the standard Mincer specification. Hence, we find that using potential experience as a proxy for actual wage-work experience leads to markedly different conclusions in the case of entrepreneurs. But

by encompassing existing findings in this way, our results appear to be of general relevance and not just a specific feature of the Danish entrepreneurs.

In the analysis in the present paper, we investigate the potential endogeneity problem stemming from unobserved individual heterogeneity using both fixed-effects estimations for managers and the logic that the omitted-variable bias should persist across self-employed, managers and non-managerial wage-workers alike if it constitutes a problem. Even though we are in this way able to handle the potential omitted-variable bias to some extent, we still believe that the non-existence of good instruments limits our analysis. With good instruments at hand, it would be possible to obtain exogenous variation in both years of schooling and wage-work experience and also take other sources of endogeneity into account such as measurement issues in wage-work experience. We must, however, leave this issue for future research.

Another interesting issue is the comparison of earnings across self-employed and managers, but also between non-managerial wage-workers and the other groups. Such an analysis would enable an investigation of relative income differences between different individuals without, *e.g.*, wage-work experience. Such a comparison would reveal important information about whether earnings are lower in entrepreneurship or wage-employment when individuals enter the labor market after finishing school as well as information about the optimal timing of switching from wage-employment to entrepreneurship. We also leave this analysis for future research.

Appendix: Detailed Estimation Results

This appendix contains the full set of estimation results from the regressions in Tables 4, 6, and 10 in the paper.

<Table A1 about here>

<Table A2 about here>

<Table A3 about here>

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Table 1: Schooling and Labor Market Experience of Entrepreneurs, 2002

	Self-Employed				
Years of schooling	Share of individuals	Years of experience	of which wage worker	of which self-employed	Years of potential experience
9	14.2%	16.8	9.9	6.9	23.7
10	9.1%	18.4	11.0	7.4	22.8
12	59.3%	19.2	12.2	7.0	20.5
14	5.9%	17.4	11.7	5.7	18.6
16	6.9%	16.4	11.1	5.3	16.7
18	4.7%	16.3	11.2	5.2	14.9
All	26,116	18.3	11.6	6.7	20.5

	Managers				
Years of schooling	Share of individuals	Years of experience	of which wage worker	of which self-employed	Years of potential experience
9	2.5%	20.5	20.5	0	24.0
10	3.9%	21.0	21.0	0	23.8
12	46.5%	20.7	20.7	0	20.5
14	7.8%	19.6	19.6	0	18.1
16	21.5%	19.4	19.4	0	16.7
18	17.8%	18.3	18.3	0	14.6
All	10,509	19.9	19.9	0	18.7

Note: The samples include all self-employed and managers aged between 33 and 42 years at the beginning of 2002 and active in the non-primary private sector.

Table 2: Summary Statistics: Means, Standard Deviations, Minimum and Maximum, 2002

	Self-employed				Managers			
	Mean	Std. dev	Min	Max	Mean	Std. dev	Min	Max
Log(earnings)	12.291	1.093	1.099	16.560	13.120	0.478	6.620	16.290
Wage-work experience (in years)	11.605	5.449	0	22	19.919	3.311	1	23
Self-employment experience (in years)	6.738	4.601	1	23	0	-	0	0
Schooling (in years)	12.068	2.159	9	18	13.927	2.612	9	18
Age (in years)	38.583	2.793	33	42	38.591	2.786	33	42
Male (dummy)	0.767	-	0	1	0.810	-	0	1
Married (dummy)	0.799	-	0	1	0.873	-	0	1
City (dummy)	0.678	-	0	1	0.763	-	0	1
Immigrant (dummy)	0.104	-	0	1	0.019	-	0	1
Assisting spouse (dummy)	0.025	-	0	1	-	-	-	-

Note: The samples include all self-employed and managers aged between 33 and 42 years at the end of 2002 and active in the non-primary private sector.

Table 3: Summary Statistics - Correlations, 2002

Variables	1	2	3	4	5	6	7	8	9	10	11
						Self-employed					
1 Log(earnings)	1.00										
2 Wage-work experience (in years)	0.08	1.00									
3 Self-employment experience (in years)	0.24	-0.57	1.00								
4 Schooling (in years)	0.03	0.05	-0.12	1.00							
5 Schooling x Wage-work experience (in years)	0.09	0.93	-0.55	0.37	1.00						
6 Age (in years)	0.05	0.01	0.24	0.01	0.01	1.00					
7 Male (dummy)	0.18	0.08	0.09	-0.06	0.05	0.00	1.00				
8 Married (dummy)	0.07	0.05	0.02	0.01	0.05	0.02	-0.01	1.00			
9 City (dummy)	-0.03	-0.07	-0.06	0.09	-0.03	-0.02	0.01	-0.07	1.00		
10 Immigrant (dummy)	-0.16	-0.43	-0.09	-0.04	-0.41	-0.01	0.03	0.02	0.16	1.00	
11 Assisting spouse (dummy)	0.09	-0.05	0.07	-0.03	-0.05	0.02	0.03	0.08	-0.02	0.03	1.00
						Managers					
1 Log(earnings)	1.00										
2 Wage-work experience (in years)	0.07	1.00									
3 Self-employment experience (in years)			-								
4 Schooling (in years)	0.33	-0.27	-	1.00							
5 Schooling x Wage-work experience (in years)	0.35	0.56	-	0.63	1.00						
6 Age (in years)	0.15	0.42	-	-0.01	0.31	1.00					
7 Male (dummy)	0.24	0.12	-	0.02	0.10	0.05	1.00				
8 Married (dummy)	0.07	0.05	-	0.02	0.05	0.04	0.10	1.00			
9 City (dummy)	0.18	-0.07	-	0.15	0.07	-0.01	-0.04	-0.04	1.00		
10 Immigrant (dummy)	0.00	-0.34	-	0.04	-0.23	0.01	-0.02	-0.01	0.03	1.00	
11 Assisting spouse (dummy)	-	-	-	-	-	-	-	-	-	-	-

Note: The samples include all self-employed and managers aged between 33 and 42 years at the end of 2002 and active in the non-primary private sector. The table shows correlations for individual variables for the sample of 26,116 self-employed and 10,509 managers.

Table 4: Effects of Schooling and Wage-Work Experience for Entrepreneurs

	(1)	(2)	(3)	(4)
	Self-employed		Managers	
Schooling (in years)	0.034**	0.012	0.057**	0.004
	0.003	*0.007*	*0.002*	*0.012*
Wage-work experience (in years)	0.104**	0.079**	0.027	-0.021
	0.005	*0.008*	*0.014*	*0.015*
Wage-work experience squared	-0.002**	-0.002**	-0.000	-0.000
	0.000	*0.000*	*0.000*	*0.000*
Schooling * Wage-work experience	-	0.0021**	-	0.0027**
	-	*0.0006*	-	*0.0006*
Number of observations	26,116	26,116	10,509	10,509
R^2	0.1740	0.1745	0.2760	0.2785

Notes: The dependent variables used are: Annual surplus (for self-employed) and total wage income (for managers). The regressions include the following variables as additional controls: Male (dummy), married (dummy), city (dummy), and immigrant (dummy). Columns (1) and (2) also include a dummy for an assisting spouse and years of self-employment experience. All regressions include full sets of industry dummies and birth year dummies. A full set of estimation results can be found in Table A1 in the Appendix. Robust standard errors in italics. ** = significant at 1% level; * = significant at 5% level.

Table 5: Effects of Schooling and Wage-Work Experience for Entrepreneurs, Type of Education and Experience

	(1)	(2)				(3)			(4)
		(a)	(b)	(c)	(d)	(a)	(b)	(c)	
	Baseline specification from Table 4	Technical	Social Sciences	Humanities	Other	Manu	Serv	Other	Self-employed and wage-work
Self-employed:									
Schooling * Wage-work experience	0.0021**	0.0026**	0.0028**	0.0019*	0.0032**	0.0011	0.0039**	0.0009	0.0031**
	0.0006	*0.0009*	*0.001*	*0.001*	*0.0011*	*0.001*	*0.0009*	*0.0008*	*0.0007*
Schooling * Self-employment experience									0.0012
									0.0009
Number of observations	26,116		26,116				26,116		26,116
R^2	0.1743		0.1762				0.1801		0.1803
Managers:									
Schooling * Wage-work experience	0.0026**	0,0027**	0,0027**	0,0034**	0,0031**	0.0036**	0.0023**	0.0024**	-
	0.0004	*0.0007*	*0.0007*	*0.0009*	*0.0010*	*0.0006*	*0.0006*	*0.0007*	-
Number of observations	10,509		10,509				10,509		-
R^2	0.2778		0.2908				0.2871		-

Notes: The dependent variables used are: Annual surplus (for self-employed) and total wage income (for managers). All regressions include the following variables as additional controls: Male (dummy), married (dummy), city (dummy), and immigrant (dummy). The regressions for self-employed also include a dummy for an assisting spouse and years of self-employment experience. Moreover, a full set of industry dummies and year of birth dummies are included in all regressions. All regressions include full sets of industry dummies and birth year dummies. A full set of estimation results is available from the authors upon request. Robust standard errors in italics. ** = significant at 1% level; * = significant at 5% level.

Table 6: Effects of Schooling and Potential Experience for Entrepreneurs

	(1)	(2)	(3)	(4)
	Self-employed		Managers	
Schooling (in years)	0.040**	0.019	0.077**	0.142**
	0.004	*0.028*	*0.002*	*0.016*
Potential experience (in years)	0.061**	0.028	0.058**	0.170**
	0.019	*0.046*	*0.009*	*0.029*
Potential experience squared	-0.001*	-0.001	-0.001**	-0.003**
	0.000	*0.001*	*0.000*	*0.000*
Schooling * Potential experience	-	0.0010	-	-0.0035**
	-	*0.0014*	-	*0.0009*
Number of observations	26,116	26,116	10,509	10,509
R^2	0.0881	0.0881	0.2694	0.2705

Notes: The dependent variables used are: Annual surplus (for self-employed) and total wage income (for managers). Potential experience is calculated as: Age minus years of schooling minus 6. All regressions include the following variables as additional controls: Male (dummy), married (dummy), city (dummy), and immigrant (dummy). Columns (1) and (2) also include a dummy for an assisting spouse. All regressions include a full set of industry dummies. A full set of estimation results can be found in Table A2 in the Appendix. Robust standard errors in italics. ** = significant at 1% level; * = significant at 5% level.

Table 7: Effects of Schooling and Wage-Work Experience for Entrepreneurs, Robustness Checks

	(1) Baseline specification from Table 4	(2) With dummies for education and experience	(3) Cohorts 1960-64	(4) Cohorts 1965-69	(5) Without immigrants	(6) Employers	(7) Non-employers	(8) Experience in full-time equivalents
Self-employed:								
Schooling * Wage-work experience	0.0021**	0.0020**	0.0020**	0.0020**	0.0021**	0.0027**	0.0018**	0.0016*
	0.0006	*0.0006*	*0.001*	*0.001*	*0.0008*	*0.0010*	*0.0007*	*0.0006*
Number of observations	26,116	26,116	13,239	12,877	23,387	11,579	14,537	26,116
R^2	0.1743	0.1779	0.1897	0.1597	0.1545	0.1581	0.1614	0.1699
Managers:								
Schooling * Wage-work experience	0.0027**	0.0028**	0.0029**	0.0024**	0.0024**	-	-	0.0020**
	0.0006	*0.0006*	*0.0011*	*0.0008*	*0.0007*	-	-	*0.0005*
Number of observations	10,509	10,509	5,368	5,141	10,313	-	-	10,509
R^2	0.2785	0.2829	0.2776	0.2587	0.2830	-	-	0.2728

Notes: The dependent variables used are: Annual surplus (for self-employed) and total wage income (for managers). All regressions include the following variables as additional controls: Male (dummy), married (dummy), city (dummy), and immigrant (dummy; except in column 5). The regressions for self-employed also include a dummy for an assisting spouse and years of self-employment experience. All regressions include full sets of industry dummies and birth year dummies. A full set of estimation results is available from the authors upon request. Robust standard errors in italics. ** = significant at 1% level; * = significant at 5% level.

Table 8: Effects of Schooling and Wage-Work Experience for Entrepreneurs, Selected Years

	(1)	(2)	(3)	(4)
	Self-employed		Managers	
	1998	2002	1998	2002
Schooling (in years)	0.025**	0.012	0.031*	0.004
	0.008	*0.007*	*0.013*	*0.012*
Wage-work experience (in years)	0.081**	0.079**	0.012	-0.021
	0.011	*0.008*	*0.018*	*0.015*
Wage-work experience squared	-0.002**	-0.002**	-0.000	-0.000
	0.000	*0.000*	*0.000*	*0.000*
Schooling * Wage-work experience	0.0026**	0.0021**	0.0015*	0.0027**
	0.0008	*0.0006*	*0.0007*	*0.0006*
Number of observations	23,614	26,116	9,341	10,509
R^2	0.2167	0.1745	0.2910	0.2785

Notes: The dependent variables used are: Annual surplus (for self-employed) and total wage income (for managers). All regressions include the following variables as additional controls: Male (dummy), married (dummy), city (dummy), and immigrant (dummy). Columns (1) and (2) also include a dummy for an assisting spouse and years of self-employment experience. All regressions include full sets of industry dummies and birth year dummies. A full set of estimation results is available from the authors upon request. Robust standard errors in italics. ** = significant at 1% level; * = significant at 5% level.

Table 9: Effects of Schooling and Wage-Work Experience for Managers, Fixed Effects

	(1)	(2)
	Managers	
Schooling (in years)	-	-
	-	-
Wage-work experience (in years)	0.252**	0.186**
	0.028	*0.028*
Wage-work experience squared	-0.002**	-0.002**
	0.000	*0.000*
Schooling * Wage-work experience	-	0.0039**
	-	*0.0003*
Number of observations	61,033	61,033
Number of individuals	15,886	15,886
R^2 (within)	0.2966	0.3027

Notes: Estimations are based on a panel of managers for the years 1996-2002 and exclude individuals who change their level of schooling in the period 1996-2002. The dependent variable used is total wage income. All regressions include the following variables as additional controls: Married (dummy), city (dummy), years (dummies) and individual fixed effects. A full set of estimation results is available from the authors upon request. Robust standard errors in italics. ** = significant at 1% level; * = significant at 5% level.

Table 10: Effects of Schooling and Experience for Wage Workers

	(1)	(2)
	Wage workers	
Schooling (in years)	0.067**	0.065**
	0.000	*0.002*
Wage-work experience (in years)	0.071**	0.070**
	0.002	*0.002*
Wage-work experience squared	-0.001**	-0.001**
	0.000	*0.000*
Schooling * Wage-work experience	-	0.0001
	-	*0.0001*
Number of observations	338,314	338,314
R^2	0.3241	0.3241

Notes: The dependent variable used is total wage income. All regressions include the following variables as additional controls: Male (dummy), married (dummy), city (dummy), and immigrant (dummy). Managers and individuals with previous self-employment experience have been excluded. All regressions include full sets of industry dummies and birth year dummies. A full set of estimation results can be found in Table A3 in the Appendix. Robust standard errors in italics. ** = significant at 1% level; * = significant at 5% level.

Table A1: Returns to Schooling and Wage-Work Experience for Self-Employed and Managers

	(1)	(2)	(3)	(4)
	Self-employed		Managers	
Schooling (in years)	0.034**	0.011	0.057**	0.004
	0.003	*0.007*	*0.002*	*0.012*
Wage-work experience (in years)	0.079**	0.079**	0.025	-0.021
	0.009	*0.008*	*0.019*	*0.015*
Wage-work experience squared	-0.002**	-0.002**	-0.000	-0.000
	0.000	*0.000*	*0.000*	*0.000*
Schooling * Wage-work experience	-	0.0021**	-	0.0027**
	-	*0.0006*	-	*0.0006*
Self-employment experience (in years)	0.104**	0.103**	-	-
	0.002	*0.002*	-	-
Male (dummy)	0.270**	0.270**	0.270**	0.272**
	0.018	*0.018*	*0.010*	*0.010*
Married (dummy)	0.131**	0.130**	0.053**	0.054**
	0.016	*0.016*	*0.013*	*0.013*
Immigrant (dummy)	0.151**	0.153**	0.084	0.072
	0.031	*0.031*	*0.046*	*0.045*
City (dummy)	0.030*	0.028*	0.131**	0.129**
	0.013	*0.013*	*0.009*	*0.009*
Assisting spouse (dummy)	0.529**	0.529**	-	-
	0.025	*0.025*	-	-
Number of observations	26,116	26,116	10,509	10,509
R^2	0.1740	0.1745	0.2760	0.2785

Notes: The dependent variables used are: Annual surplus (for self-employed) and total wage income (for managers). All regressions include full sets of industry dummies and birth year dummies.Robust standard errors in italics. ** = significant at 1% level; * = significant at 5% level.

Table A2: Returns to Schooling and Potential Experience

	(1)	(2)	(3)	(4)
	Self-employed		Managers	
Schooling (in years)	0.040**	0.019	0.077**	0.142**
	0.004	*0.028*	*0.002*	*0.016*
Potential experience (in years)	0.061**	0.028	0.058**	0.170**
	0.019	*0.046*	*0.009*	*0.029*
Potential experience squared	-0.001*	-0.001	-0.001**	-0.003**
	0.000	*0.001*	*0.000*	*0.000*
Schooling * Potential experience	-	0.0010	-	-0.0035**
	-	*0.0014*	-	*0.0009*
Male (dummy)	0.428**	0.428**	0.280**	0.281**
	0.019	*0.019*	*0.010*	*0.010*
Married (dummy)	0.196**	0.196**	0.056**	0.056**
	0.017	*0.017*	*0.013*	*0.013*
Immigrant (dummy)	-0.552**	-0.551**	-0,049	-0,050
	0.025	*0.025*	*0.038*	*0.037*
City (dummy)	0.013	0.013	0.128**	0.128**
	0.014	*0.014*	*0.009*	*0.009*
Assisting spouse (dummy)	0.627**	0.627**	-	-
	0.025	*0.025*	-	-
Number of observations	26,116	26,116	10,509	10,509
R^2	0.0881	0.0881	0.2694	0.2705

Notes: The dependent variables used are: Annual surplus (for self-employed) and total wage income (for managers). Potential experience is calculated as: Age minus years of schooling minus 6. All regressions include a full set of industry dummies. Robust standard errors in italics. ** = significant at 1% level; * = significant at 5% level.

Table A3: Effects of Schooling and Experience for Wage Workers

	(1)	(2)
	Wage workers	
Schooling (in years)	0.066**	0.065**
	0.000	*0.002*
Work experience (in years)	0.067**	0.070**
	0.000	*0.002*
Work experience squared	-0.001**	-0.001**
	0.000	*0.000*
Schooling * Work experience	-	0.0001
	-	*0.0000*
Male (dummy)	0.232**	0.232**
	0.002	*0.002*
Married (dummy)	0.070**	0.070**
	0.002	*0.002*
Immigrant (dummy)	0.174**	0.174**
	0.006	*0.006*
City (dummy)	0.068**	0.068**
	0.002	*0.002*
Number of observations	338,314	338,314
R^2	0.3241	0.3241

Notes: The dependent variable used is total wage income. Managers and individuals with previous self-employment experience have been excluded. Robust standard errors in italics. ** = significant at 1% level; * = significant at 5% level. All regressions include full sets of industry dummies and birth year dummies.

Figure 1: Earnings as a Function of Wage-Work Experience, Self-Employed and Managers