Hierarchies and Entrepreneurship: Evidence from Swedish Microdata

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We explore whether the tendency for smaller firms to have fewer hierarchical layers explains the well-documented inverse correlation between firm size and entrepreneurship. Our analysis is based on Swedish matched employer-employee data. Conditional on firm size, employees in firms with more layers are less likely to enter entrepreneurship, to become self-employed, and to switch to another employer. However, hierarchies constitute only a partial explanation of the small firm effect. Part of the distinct hierarchy effect we find appears to be due to preference sorting by employees, and part due to employees in firms with fewer layers having a broader range of skills.

***Key words*:** entrepreneurship; employee mobility; hierarchy, rank, small firm effect.

***JEL codes*:** L26, D20, J20, M50.

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1. Introduction

Compared with their counterparts in large firms, workers in small firms are more likely to separate from their employers (Anderson and Meyer, 1994; Lazear and Shaw, 2008) and those that leave small firms are more likely to become entrepreneurs or self-employed than those leaving large firms (Wagner, 2004; Dobrev and Barnett, 2005; Gompers et al., 2005; Elfenbein, Hamilton and Zenger, 2010; Chen, 2012). While higher job separation rates in small firms are in part due to the greater volatility of jobs and job types in small and young firms (Haltiwanger, Jarmin and Miranda, 2011), higher rates of entrepreneurship among movers suggests that employees of small firms are different from their counterparts in large firms. We will follow Elfenbein et al. (2010) and refer to the greater propensity of employees of small firms to establish businesses as *the small firm effect*.

One potential explanation for the small firm effect is the segregation of observable worker types into large and small firms. For example, Frederiksen (2006) shows that women in Denmark are both more likely to separate from their jobs and more likely to be employed in a small firm. Similarly, separation rates are higher for the less educated and educational attainment is on average lower in small firms. Because small firms are younger on average, job tenure is lower and this, too, is associated with higher separation rates. But these readily observable characteristics of employees in small firms do not explain higher rates of entrepreneurship: women are markedly less likely to become entrepreneurs than men, and neither tenure nor education are good predictors of entrepreneurship among movers.

Elfenbein et al. (2010) find evidence of segregation of *unobservable* worker types. First, small firms offer greater autonomy and a greater variety of work experiences, so we might expect that workers with a preference for these work attributes are more likely to be employed by, and to create, small firms. Elfenbein et al. have a direct measure of whether

individuals in their sample have a desire to become entrepreneurs. Individuals who do are overrepresented in small firms, and are more likely to subsequently establish a business. Second, employees in small firms may have skills that are especially valuable for the creation of new businesses. These skills may reflect innate abilities that are better rewarded in small firms so future entrepreneurs select into small firms, or they may be abilities that are gained as a result of employment in small firms. Consistent with this hypothesis, Elfenbein et al. find that entrepreneurs with prior small firm experience have better performance.

Small firms attract individuals with preferences and abilities for entrepreneurship not just because they are smaller, but because they are different. In particular, small firms are less bureaucratic, and bureaucracy stifles the accumulation of skills appropriate for entrepreneurship and repels those with a preference for autonomy and work variety. Sørensen (2007) reviews the prior literature and sociological arguments for the negative effects of bureaucracy on entrepreneurship, and examines their implications using Danish microdata. However, lacking direct measures of the extent of bureaucracy, Sørensen associates greater levels of bureaucracy with older and larger firms. As a result, one cannot infer from his analysis the extent to which varying levels of bureaucracy can explain the small firm effect.

In this paper, we use the number of management layers in a firm as an indicator for the extent of bureaucracy that is independent of firm size, and investigate the extent to which the correlation between firm size and its hierarchical structure can explain the small firm effect. Our sample is drawn from the Swedish matched employer-employee dataset, and consists of more than 100,000 firm-level observations and 7 million individual-level observations over the period 2001–2008. As our discussion of the data in Section 2 will make

clear, our sample is not a true panel although we do have repeated observations on both individuals and firms. Following Caliendo and Rossi-Hansberg (2012) and Caliendo, Monte and Rossi-Hansberg (2012), we identify employees' ranks from their job titles and measure the hierarchal structure of the firm by the number of layers of management it has. Our sample behaves as one would expect from a meaningful measure of hierarchy: upper levels of management contain fewer employees and pay higher wages than lower levels, and employee transitions are most likely to be to an adjacent rank.

In Section 3, we demonstrate that a strong small firm effect exists in Sweden, and that there is a strong correlation between the number of management layers in a firm and its size. We also show that, conditional on size, employees in firms with more management layers are less mobile. This is true regardless of the mover's destination, but the effect of layers on business creation is much greater than its effect on relocation to other incumbent firms. We decompose business creation into self-employment and entrepreneurship, defined by the legal form of business that is created. More layers in a firm suppress both types of business creation. However, despite the magnitude of the effect of layers, the small firm effect persists. Our point estimates suggest that the hierarchical structure of the firm accounts for about one fifth of the small firm effect.

In Section 4, we examine potential explanations for the effect of layers on mobility in general and business creation in particular (the *hierarchy effect*). We first look at evidence for the preference sorting hypothesis. Individuals with a strong preference for entrepreneurship should be more willing to establish businesses that yield low financial returns, and they should also persist in business for longer. We test these implications, and conclude that employees of small firms do behave in ways consistent with preference sorting. We then assess whether there are differences in entrepreneurial ability among employees of

firms with different layers of management. We frame our analysis around Caliendo and Rossi-Hansberg's information-processing model, which relates the number of management layers in a firm to the breadth of problems that employees at different ranks are expected to be able to solve. Although they do not study their model's implications for employee separations, we derive and test two implications. First, employees in firms of a given size but with fewer layers should have a higher propensity to enter entrepreneurship and self-employment and to be more successful when they do. Our evidence on business creation rates are consistent with the information-processing model (but also with preference sorting); our evidence on earnings do not support the model. Second, the propensity for business creation is greater when employees of a given rank have more layers beneath them. We find strong support for this prediction.

Our third investigation is an examination of the career concerns model. Hierarchies offer opportunities for promotion and if the increment to wages that is associated with a rise in rank is large, the opportunity cost of mobility increases and job separation rates will decline. We consider three distinct measures of a firm's wage policy, but find no evidence to support the career concerns hypothesis. Finally, we explore whether the model of job mismatching developed in Åstebro, Chen and Thompson (2011) can explain the effect of layers. In their model, mismatching occurs when employees of differing skills are put to work together. Such mismatching is more likely in the tails of the ability distribution so we see greater mobility from the tails. We hypothesize that layers create a functional separation between agents of high and low ability, and thereby reduces mismatching problems. We find clear evidence that such mismatching is occurring in our sample, but no evidence that this explains the hierarchy effect.

2. The Data

The data are drawn from two distinct sources, one at the firm level and one at the individual level. The firm level dataset comes from the IFN Corporate Database (IFNCDB), which is based on official mandatory accounting data filed to the Swedish Companies Registration Office. The individual level dataset is based on the Statistics Sweden's LISA database drawing on several official registry databases of every person living in Sweden. From the IFNCDB we extract the annual accounts of firms, and from the LISA database we obtain information on occupation codes, firm-worker links, worker's labor income, worker's capital income, and numerous other worker characteristics. We make use of firm- and individual-level data for the period 2001–2008.[1] We drop duplicated firm-year information (multiple annual accounts can be submitted each year) and then merge the firm and individual level data. We drop firms active in the health, education, agriculture and fishing industries, and also firms in the public sector, in order to focus on private sector firms. Given our focus on hierarchies, we restrict attention to firms with more than 5 employees (we lose 76 percent of all firm-year observations since most Swedish firms are small). We also restrict attention to individuals between the ages of 20 and 60.

Because we will construct indicators of employee rank and organizational structure from information on occupational codes assigned by Statistics Sweden, we further restrict our sample to include only firms with sufficient occupation data for its employees. In the sample of firms with more than 5 employees, 63 percent of all individual-level observations have accurate occupation data as the occupation data is based on surveys and does not have complete coverage. Because occupation data is not complete for every year, we drop firm-year observations with fewer than 75 percent of all employees having accurate occupation data. This involves mainly smaller firms that are less likely to be sampled by Statis-

tics Sweden and it reduces the firm-year sample size by another 76 percent. In our final sample, 91 percent of all individual-level observations have accurate occupation data and it covers 48 percent of all individual-year observations in the initial dataset.

In each year, we track whether employees remained with their current firm, switched to another incumbent firm, or created and became primarily occupied in running their own business.[2] We follow the definition used by Statistics Sweden to define entrepreneurs and self-employed. Statistics Sweden defines an individual as being employed in her own firm in a given year if her total income from her own company (labor and capital income) is greater than 62.5 percent of all other labor income.[3] We define an individual as *entering* entrepreneurship in any given year if the following criteria are simultaneously fulfilled:

1. Newly occupied in own business. An individual is classified by Statistics Sweden as working in her own company in the current year, but had not been in the previous year.

2. New place of work. The individual's current firm and establishment identifiers are different from the previous year, and

3. New firm. No individual in our sample had worked for the current firm in the previous year.

Statistics Sweden also separates sole proprietorships from limited liability companies. Because an individual who intends to create a growing company likely will establish a limited liability company, we characterize agents starting limited liability companies as "entrepreneurs", and agents starting sole proprietorships "self-employed".[4]

[Insert Table 1 about here]

Table 1 displays numbers on the sample size of the final dataset. It contains 105,749 firm-

year observations covering 61 percent of value added and 53 percent of employment in the Swedish private sector. Of around 7.5 million employee-level observations, about 14 percent transitions to a new incumbent employer in each year, about 0.36 percent enter self-employment, while just 0.1 percent enters entrepreneurship. The number of firms in the sample varies considerably across years, likely a result of different sampling of occupation codes over time. Moreover, parts of the surveys are targeted to certain sectors in certain years, which probably accounts for the large jumps in the number of observations per year.

2.1 Occupation classifications, rank and management layers

Our data on the hierarchical structure of firms are developed out of occupational classifications obtained from Statistics Sweden's LISA database. The Swedish Standard Classification of Occupations 1996 (SSYK) is a Swedish version of the International Standard Classification of Occupations (ISCO-88). The SSYK data available from the LISA database come mainly from the official wage statistics survey (Lönestrukturstatistiken) and from a supplementary survey of firms not included in the official wage survey. Between the two surveys, at least 40,000 firms are sampled every year. The sampling design is a rolling panel,[5] and all eligible firms are surveyed at least once every five years. Not all firms are included in these surveys. The largest excluded category is of self-employed workers who do not obtain any wage from a limited liability company, but the surveys also exclude owners who receive payment from their companies only in the form of dividends.[6]

[Insert Table 2 about here]

The SSYK assigns workers to one of ten main occupational categories, and one of a large number of subcategories. Statistics Sweden also assigns each of these occupational catego-

ries to one of four skill levels.[7] We use the SSYK codes to assign a rank to each employee (see Table 2). The highest rank, which we label CEOs, consists of directors, chief executives, managers of small enterprises, and certain other senior officials. The next two ranks comprise two levels of managements. The more senior, which we label as "senior staff", contain production and operations managers and certain other specialist managers. The less senior, "supervisors", consists of workers with occupations classified in the SSYK as professionals, technicians and associate professionals. The fourth category, "production workers", comprises clerks, service workers, plant and machine operators, and other non-supervisory positions. As Table 2 shows, our rank classifications broadly coincide with the skill levels attributed to these positions by Statistics Sweden.

[Insert Table 3 about here]

Do our classifications induce patterns consistent with our notions of rank and hierarchies? We look first at earnings by rank. The earnings data we use throughout the paper measure each individual's annual labor income. However, for compactness, we will generally refer to our earnings measure as the "wage". Table 3 displays the wage distribution by rank. Clearly, workers in higher ranks tend to earn more on average than workers in lower ranks. The same ordering persists at each percentile shown in the table, with the notable exception of senior staff that earn more than the CEO rank at the lower percentiles. This reflect in part differences across firms (large firms that pay more on average are more likely to have senior staff) and in part the tendency of senior staff to be highly educated. The table also displays that the within-rank wage distribution is the highest at the top rank and reduces monotonically with lower rank.

[Insert Table 4 about here]

Table 4 plots rank transitions (of course the lowest and highest ranks can only transition in one direction) among workers remaining with the same firm. Transition rates decline with distance between rank pairs, and most employees do not change rank. For example, 93.6 percent of production workers are at the same rank three years later, while 5.4 percent are at the rank of supervisor and less than one percent have attained either of the two highest ranks. Similarly CEOs are most likely to remain as CEOs; among those that do switch rank, moving one rank is almost twice as likely as moving two, and moving two is in turn twice as likely as moving three. Tables 3 and 4 together suggest that our occupational classifications succeed in capturing a form of distance consistent with our notion of ranks and hierarchies.

[Insert Table 5 about here]

Table 5 provides information about within-firm differences in rank populations and in earnings across ranks. Following Caliendo et al. (2012), a firm-year observation with R ranks will be said to have L=R-1 layers of management. Part A of the table documents the mean number of employees in each layer, while part B provides the probabilities that a lower rank contains more employees than the rank immediately above it in the firm. In the large majority of cases, the firm's structure corresponds to our notion of hierarchies as triangular structures, where higher ranks consist of small numbers of people supervising larger groups of workers in lower ranks. For example, in firms with only one layer of management, the lower of the two ranks in the firm has more workers in 88 percent of the firm-year observations, and the mean difference in layer size is 8.3. Panels C and D compares earnings across ranks. It shows that in the great majority of firms, members of the higher rank earn more on average than workers in the rank immediately below them in the firm. For example, in firms with three layers of management, the lowest rank has lower

mean earnings than the next layer in 94 percent of the firm-year observations. These percentages are consistent with the earnings distributions summarized in Table 3.[8]

3. Hierarchies and the Small Firm Effect

In this section we explore the relationship between worker mobility, especially into entrepreneurship and self-employment, and the hierarchical structure of the firm, and we assess whether the hierarchies offer an explanation for the small firm effect. Table 6, which summarize the raw data on management layers, firm size and earnings, reveals patterns consistent with the discussion in section 1. First, firms with more layers of management tend to be larger, whether size is measured by value added or by the number of employees. For example, firms with three layers of management have on average 15 times as many employees as firms with just one layer, and they also produce 38 percent more value added per worker. Table 6 also documents that firms with more layers of management pay higher wages. Finally, firms with more layers of management also have a larger dispersion of wages. If more layers of management, higher wages and higher wage dispersion all suppress entry into entrepreneurship and self-employment, then these positive associations between layers, firm size and wages might well enable hierarchies to explain the firm-size effect.

[Insert Table 6 and 7 about here]

Table 7 reports the main results of this section. We estimate multinomial logit regressions with four possible outcomes in each year: remain with the current employer, enter entrepreneurship, enter self-employment, and switch to another employer. Model A, in columns (1) through (3), includes indicators for firm size, while model B in the remaining columns adds controls for the number of management layers. The key result here is that an in-

crease in the number of layers is negatively associated with mobility of all types, although the effect is much stronger for entry into entrepreneurship and self-employment than it is for moving to another employer. However, the inclusion of controls for layers has only a modest effect on the estimated impact of firm size on entry into entrepreneurship and self-employment.

Before looking at the key results in more detail, we review the results concerning the controls in the regressions. As is the case in most samples, tenure is negatively associated with mobility of all kinds,[9] while the more educated[10] and males are more mobile regardless of destination. Interestingly, individual wages have impacts that differ by destination. Individuals with higher wages are less likely to switch to another incumbent employer and less likely to enter self-employment. However, a higher wage is associated with an *increase* in the propensity to become an entrepreneur. The contrasts between these effects of individual wages are not only statistically significant, they are economically meaningful. For example, a one standard deviation increase in log income is associated with a decline in the odds of switching employers (relative to staying with the current employer) of 15 percent, with a decline in the odds of entering self-employment of 38 percent, but with an increase in the odds of entering entrepreneurship of 4.4 percent. Employee age similarly has disparate effects on mobility by destination. Increasing age raises the probability of entering entrepreneurship and self-employment until a peak hazard is attained at 43 years of age for entrepreneurship and 48 years for self-employment, after which the hazard declines. In contrast, increasing age *reduces* the probability of switching incumbent employers until a minimum hazard is attained at about 47 years of age.

These results for the control variables suggest that mobility is driven by a complex interplay of multiple forces. For examples: the negative effect of tenure on mobility of all kinds

is consistent both with job matching models (e.g., Jovanovic, 1979) and with survivor bias caused by unobserved heterogeneity across individuals in the propensity to move; the initially positive impact of age on business creation might reflect the effect of wealth constraints that are relaxed as an agent ages and saves, or the consequences of on-the-job learning specific to the demands of business creation; and the contrast between the effects of individual wages on entrepreneurship and self-employment recalls the mismatching model of Åstebro, Chen and Thompson (2011), in which business creation is more likely among agents with especially high and especially low ability.

We return now to consideration of the main effects of firm size, rank, and management layers on mobility. Consider first the role of rank. Employees in supervisory positions are much more likely than production workers (the omitted category) to enter entrepreneurship, and the propensity to do so rises with each increase in rank. CEOs, directors and senior staff are almost three times more likely than production workers to found a limited liability company, while supervisors are more than twice as likely to do so (Figure 1 plots the odds ratios). Senior staff and workers with supervisory rank are also more likely to enter self-employment. The effects are smaller than for entrepreneurship, however, and CEOs are no more likely to become self-employed than production workers.[11] Finally, CEOs and Directors are less likely to switch employers than production workers, while Senior Staff and Supervisors are more likely to do so than production workers. In this case, however, the magnitudes of the differences are trivial.

[Insert Figure 1 about here]

Table 7 contains four indicators for size categories, the omitted category being firms with fewer than 50 employees. The point estimates reveal a strong negative effect of increasing firm size on mobility; regardless of destination (see also Figure 2). For example, employ-

ees in the largest firms are only one third as likely as employees in the smallest firms to enter entrepreneurship or self-employment, and they are 44 percent less likely to switch to another employer. The effect of firm size is not limited to a contrast between the largest and smallest firms. As Figure 2 illustrates, each change in firm size class is in almost all cases associated with a similar change in the odds of mobility. Clearly, there is a small firm effect on mobility in general. However, the differential effect of firm size on movements into business creation relative to movement to other firms also demonstrates that there is a strong small firm effect on entrepreneurship and self-employment even conditional on job separation.

[Insert Figure 2 and 3 about here]

Model B in Table 7 includes controls for layers of management and shows that, even though we condition on firm size and employee rank, more layers are associated with less mobility of all kinds (see Figure 3 for the odds ratios). Business creation rates, especially in entrepreneurship, are strongly affected by adding layers of management. For example, moving from zero to one layer of management reduces the likelihood of a transition to entrepreneurship by 22 percent and the likelihood of a transition to self-employment by 18 percent. There is, however, an interesting contrast between the effects of layers on entrepreneurship and self-employment. In the former case, each increment to the number of layers in the firm significantly reduces the odds of entrepreneurship. In the latter case, movement between zero and any other number of layers reduces self-employment, but there is no effect of any increment beyond zero layers. The effect of layers on movement to other incumbent firms, while statistically significant on account of the large sample size, is small: in the largest estimated effect, when moving from zero to two layers of management, the relative odds of job switching decline by less than 8 percent.

[Insert Figure 4 about here]

Although management layers have a profound effect on the likelihood of transitions into entrepreneurship and self-employment, and the number of layers is strongly correlated with firm size, adding layers to the regressions explains only a modest fraction of the small firm effect. All six coefficients for firm size in columns (4) and (5) are smaller than their counterparts in columns (1) and (2), consistent with our conjecture that management layers may explain part of the small firm effect. However, the reductions are rather modest, ranging from 13 to 20 percent for entrepreneurship, 4 to 10 percent for self-employment, and from 2 to 17 percent for job switching (see Figure 4).[12] Thus, although we have found that layers of management have a large effect on the likelihood of a transition to entrepreneurship and to a somewhat lesser extent on the likelihood of a transition to self-employment, that layers and firm size are positively correlated, and that firm size is negatively correlated with mobility, layers explain on average only about 10 percent of the estimated firm size effect.

[Insert Table 8 about here]

Because self-employment and entrepreneurship are likely strong substitutes among those considering separation from their employer, it is useful to verify the robustness of the results in Table 7 by restricting the choice set. We do so by examining the odds of self-employment and entrepreneurship relative to job switching after restricting the sample to movers. Table 8 reports estimates of multinomial logit estimation on this restricted sample; the baseline category is moving to an incumbent firm.[13] The results clearly demonstrate the small firm effect on business creation: among movers, and conditional on rank (model A) and on both rank and layers (model B), the likelihood of business creation instead of job switching declines markedly as firm size increases. Model B shows that, condi-

tional on size and rank, the likelihood of business creation also declines markedly as the number of layers increases. As already noted, the effect of layers is greater for entrepreneurship than for self-employment, and in the latter case much of the effect is due to the contrast in self-employment entry rates between firms with zero layers of management and those with more than zero. Finally, as Figure 5 illustrates, the fraction of the small firm effect that is explained by layers is somewhat larger when the sample is restricted to movers than it is in the full sample: Adding layers to the regression induces an average 22 percent decline in the coefficients on size for entry into entrepreneurship, although the decline remains less than 10 percent for self-employment.

[Insert Figure 5 about here]

4. Explaining the Hierarchy Effect

In the previous section we found that, conditional on firm size, more layers of management are associated with less mobility of all kinds. While the magnitude of the impact on movements to other employers is small, more layers markedly suppress rates of business creation by employees. The contrast between the effects of layers on business creation and job switching indicate that the reduced mobility associated with more layers is not just an artifact of the general correlation between larger firms (with more layers) and turnover in general. In this section, we consider several candidate explanations for the hierarchy effect we document, and provide some evidence concerning each one.

4.1. Bureaucracy and preferences

There is an extensive literature documenting that some individuals declare, often at an early stage in their career, a preference to create and operate their own business, and that

such declarations predict entry into entrepreneurship (Hamilton, 2000; Halaby, 2003; Benz and Frey, 2008; Åstebro and Thompson, 2010). Halaby (2003) and Sørensen (2007) show that the offspring of self-employed parents, who have on average much greater entrepreneurial aspirations than the offspring of wage earners, are more likely to work in smaller and presumably less bureaucratic organizations. Benz and Frey (2008) have documented that both entrepreneurs and employees of smaller firms report greater levels of job satisfaction, and that in both cases satisfaction is associated with having greater autonomy and more rewarding work content. There seems, therefore to be an association between the preferences of people who found businesses and employees of small organizations that might induce a small firm effect.[14]

Elfenbein et al. (2010) claim that, if preference sorting is the only reason we observe a small firm effect, then the size of employers should be unrelated to subsequent performance in entrepreneurship and self-employment. By extension, layers of management should not predict entrepreneurial performance.[15] However, this argument strikes us as incomplete. Agents create and then continue to operate businesses if the total compensation expected from the business exceeds the foregone wage. However, total compensation from entrepreneurship and self-employment includes a non-pecuniary component among those with a preference for entrepreneurship. Because people with such preferences are presumably overrepresented in less-bureaucratic firms, we may anticipate either or both of (i) a positive relationship between the number of management layers and subsequent *monetary* performance in entrepreneurship, and (ii) a negative relationship between the number of management layers and the likelihood of business survival.

Which of these two possible consequences of preferences matters more depends in large part on the ability of agents to forecast business earnings. If forecast errors are large, so

entry into business is predicated mostly on the population mean of business earnings, then there is no mechanism by which agents with a preference for entrepreneurship can choose to accept lower income in exchange for the non-pecuniary payoff that business ownership entails. In this case, monetary business income will not depend upon preferences. However, agents with a preference for entrepreneurship are more likely to continue operating a business that provides poor financial returns, so management layers and business survival will be negatively correlated. If, in contrast, forecast errors are small, agents with a preference for entrepreneurship will elect to create businesses that are known in advance to offer relatively poor financial returns. Selection effects imply that they will earn less on average and, more precisely, that they are more likely to create a business that pays less than they earned in wage employment. However, because they are on average of worse initial quality, businesses created by agents with a preference for entrepreneurship do not necessarily survive longer than those created by agents without such preferences.

[Insert Table 9 about here]

To test the thesis of preference sorting, we regress entrepreneurial and self-employment earnings and survival rates on the size of, and the number of management layers in, the business owner's previous employer. We report the results of these regressions, separately for entrepreneurs and the self-employed, in Table 9. There is a positive relationship between the number of layers in the previous employer and an agent's earnings from entrepreneurship, although this relationship is not apparent for self-employment. Furthermore, businesses created by agents that left a firm with no layers of management have higher survival rates, results that hold for both entrepreneurship and self-employment. There are no clear patterns between performance and firm size. The result provide evidence for the existence of both channels through which preference sorting may affect firm

performance, and these effects are more clearly associated with the hierarchical structure of the firm than they are with firm size.

4.2 Information processing

Caliendo and Rossi-Hansberg (2012) develop a general equilibrium model of management layers in which output is secured by solving problems, and worker knowledge and time are key inputs into the production process. Workers on the shop floor (their context is manufacturing) produce by solving problems that present themselves. If they have the knowledge, they solve the problem themselves, which yields some output. If they do not have the knowledge they pass the problem up to their supervisor, who may either solve the problem or pass it up to the next layer of management. Employees are constrained not only by their knowledge, but also by time. Thus, a supervisor in charge of too many workers, or of workers with too little knowledge, will not be able to address all the problems that come up the line. Caliendo and Rossi-Hansberg examine the optimal number of management layers, and size and composition of each layer, and how these change as a firm experiences an increase in demand.

Firm heterogeneity is an important part of the model, and firms may respond to an increase in demand in either of two ways. First, they may increase the size and change the composition of each layer, while holding the number of layers constant. Alternatively, they may add a layer of management, which in turn induces changes in the size and composition of existing layers. Caliendo and Rossi-Hansberg show that when a firm expands layers, it increases the number of hours worked at each pre-existing layer. The additional layers enable workers to pass more problems up the line. They therefore need less knowledge and the average wage declines. Symmetrically, elimination of layers reduces layer size and raises the average wage within each surviving layer. In contrast, if a firm expands without

increasing layers it must pay higher wages at each level because time constraints on upper management force workers in lower layers to solve more of their own problems. Caliendo, Monte and Rossi-Hansberg (2012) exhaustively examine these predictions of the model using a panel of observations on the large majority of French manufacturing firms, and find no instance in which the evidence contradicts the predictions. Tåg (2013) replicates their study and concludes that the predictions of Caliendo and Rossi-Hansberg (2012) also hold for Swedish manufacturing firms.

The theory predicts that conditional on firm size, firms with fewer layers employ workers with the ability to solve a broader range of problems. Consistent with Lazear's (2005) Jack-of-all-trades theory, such workers are more likely to enter entrepreneurship and self-employment, and they are likely to perform better when they do. However, workers with broader skills are paid a higher wage, which reduces mobility. If we condition on an individual's wage, however, employees in firms of a given size but with fewer layers should have a higher propensity to enter entrepreneurship and self-employment and be more successful when they do. Similarly, employees of larger firms with a given number of layers are predicted to have a boarder range of skills; such employees should, conditional on their wage, be more likely to create a business and be more successful when they do.

The evidence from analyses we have already reported is not especially favorable to these predictions. In Table 8, which estimated business creation rates after controlling for prior earnings, we saw that while more layers reduce business creation, larger firms were associated with less entry. The effect of layers is consistent with the model, but the effect of firm size is not. In the performance regressions of Table 9, we found that more layers are associated with higher entrepreneurial earnings and lower survival rates. Both these associations, we concluded, were consistent with preference sorting; the effect of layers on

business earnings is not what the information processing model would lead us to expect.

Of course, preference sorting and information processing are not mutually exclusive theories, so it is quite possible that evidence for the latter theory is confounded by preference sorting. We can conduct a perhaps sharper test of the information processing story. So far, we have controlled in our multinomial logit regressions for rank, the number of layers and firm size. Of particular note here is the positive effect we found of higher rank on the likelihood of business creation, and especially of entrepreneurship. However, the meaning of a particular rank depends on the hierarchical structure of the firm. The information processing story implies that the more layers there are in a firm the greater the difference between the breadth of knowledge of employees in the highest and lowest ranks. As a result, the likelihood of business creation of any rank relative to the lowest rank in the firm should be greater the more ranks that lie between them.

[Insert Table 10 about here]

Evidence on this prediction is provided in Table 10, which estimates the effect of rank on the likelihood of business creation separately for firms with different numbers of layers. Consistent with the information processing story, we find first that for any given number of layers in a firm the probability of entering entrepreneurship and self-employment is greater the higher the relative position. Moreover, the coefficients for entrepreneurship and self-employment on the top layers are larger the more layers there are in the firm. This is true for employees in the top ranks as we move from one-layer to two-layer and then to three-layer firms; and it is also true for employees in the second highest rank as we move from two to three layers in the firm. These findings hold both for entrepreneurship and for self-employment and they suggest, consistent with Caliendo and Rossi-Hansberg (2012), that the span of knowledge of managers is related to the number of layers beneath

them, rather than the title of their rank.

4.3 Career concerns

A firm may develop a hierarchy to create incentives for employees to exert effort. In particular, tournament theory (e.g., Lazear and Rosen, 1981; Lazear and Shaw, 2007) explains that wages are generally associated with jobs rather than with individuals, and that promotion is the reward for employees whose performance exceeds that of their peers. Conditional on size, a firm with more layers offers greater prospects of promotion, so employees are more likely to remain with the firm. The prospect of promotion also serves as a form of deferred compensation, which adds a further incentive to remain with a firm. Thus, the concerns that individuals have for their career prospects may well lie behind the negative association we have observed between the number of layers and mobility of all kinds.

[Insert Table 11 about here]

Unless employees care about status, the incentives that layers provide to remain with the firm depend on how much pay increases at the time of promotion. We would therefore expect a larger within-firm difference in wages across ranks to increase the incentive to stay in the organization. In model A of Table 11, we test this notion by estimating transition probabilities as a function of, *inter alia*, the standard deviation of wages within the firm. The sample is restricted to firms with at least one layer of management. The regression also controls for an agent's own wage and the average wage in the firm, the latter because we already know that it is correlated with the number of layers. The results are not what the career concerns model would lead us to expect: the greater the wage dispersion the *higher* the probability of exit to entrepreneurship, self-employment and other firms. Our results for mobility are the same as those reported by Lazear and Shaw (2008) across

eight countries.

The standard deviation of wages reflects not only the increments to the wage that are secured by promotion to a higher rank but also within-rank dispersion. Although this has been the usual way in which a firm's wage policy has been measured, it might be a poor measure for tests of the career concerns model. In Model B of Table 11 we replace the standard deviation with the firm's average between-rank change of wage, estimated through a linear regression of wage on rank across all employees within the firm. This measure might more adequately reflect the incentive effects of promotion. However we continue to find no support for the career concerns model. Although the coefficient on this wage slope variable has the expected sign for entrepreneurship, it continues to have the wrong sign for self-employment and job switching.

Perhaps we are using the wrong measure of wage dispersion to proxy incentives to stay and work. The appropriate measure of dispersion as an incentive for an agent to stay with his current employer may be one that is calculated relative to the dispersion that is found at other firms that might employ the agent. We explore this possibility next. We use our measure of the wage slope across ranks, but now we compare it with the slopes of firms operating in the same industry and year.[16] The results, shown as Model C of Table 11, again fail to offer support for the career concerns.

4.4 Stars and Misfits

Throughout much of our analysis so far, we have seen different results for entry into self-employment and entrepreneurship. This is particularly so with the various measures of earnings that we have included: the agent's own wage is positively associated with entry into entrepreneurship but negatively with self-employment (Tables 7 and 8); the firm's

mean wage and between-rank wage slope also have effects of opposite signs (although not always statistically significant) on entrepreneurship and self-employment (Table 11); and the number of layers in the firm is positively related to subsequent entrepreneurial earnings but not to self-employment earnings (Table 9). These contrasting impacts suggest that entrepreneurship and self-employment may be chosen by qualitatively different employees.

In a recent paper, Åstebro, Chen and Thompson (2011) developed and tested a model in which workers vary in the degree to which they are well matched to their job. Those that are poorly matched earn less than they might expect in business creation, and so they leave. Although workers are treated symmetrically in their model, Åstebro et al. show that mismatches are more common in the tails of the ability and earnings distributions. In the lower tail, "misfits" with low ability are more likely to enter self-employment, while in the upper tail, high-ability "stars" are more likely to become entrepreneurs. If one is willing to suppose that low-ability workers creating a business are likely to become self-employed while their high-ability counterparts are likely to establish limited liability companies, the mismatching model readily accounts for the contrasting effects of own wage on business creation. Among the set of agents at the lower end of the distribution a lower wage is associated on average with less ability and a greater likelihood of suffering a job mismatch. Thus, own wage is negatively correlated with entry into self-employment. In contrast, a higher wage among agents at the top of the earnings distribution is associated on average with greater ability, and an increased chance of a mismatch, so own wage is positively correlated with entrepreneurship.

It is less apparent that the mismatching model can explain the effects of management layers on mobility. One possible mechanism, however, is that layers create a hierarchy that

induces a functional separation between agents of high and low ability, and thereby reduces mismatching problems.[17] However, our view is that the main impact of stars and misfits is to insert some anomalies in our empirical tests of preference sorting, information processing, and career concerns as potential explanations for the effects of layers.

[Insert Table 12 about here]

To see whether mismatching might be influencing our results, we examine where in the wage distribution the probability of exit is the greatest. To do so we create a dummy for each decile of the wage distribution and examine the effects of these dummies on exit probabilities, leaving the 40th to the 60th percentile of the wage distribution as the omitted category. We include each employee's own wage in the regression to absorb effects on wage that are not related to within-firm relative ability. The results, which are reported in Table 12 are quite striking. The probability of remaining in the firm is clearly highest among those with middling wages while the probability of exit is remarkably higher among those in the bottom and top quintiles of the earnings distribution. The bottom quintile is much more likely than those with middling earnings to enter self-employment or to join another firm, and they are also somewhat more likely to become entrepreneurs. In contrast, the top earners are much more likely to become entrepreneurs, more likely to switch jobs, but less likely to become self-employed. These patterns exhibit a noteworthy consistency with the mismatching model. However, they appear to provide no explanation for the effect of layers, the coefficients on which are all but identical to those obtained in our previous regressions.

5. Conclusions

In this paper, we asked whether small firms are more frequent incubators of entrepre-

neurs because they tend to be less hierarchical. We found that hierarchy, at least as we have measured it in terms of the number of layers of management, is indeed less prevalent in small firms and is associated with more frequent transitions of employees into self-employment and entrepreneurship. However, we also found that hierarchy explains no more than a fifth of the observed small firm effect. The contribution of hierarchy to the small firm effect is comparable in magnitude to the contribution of other mechanisms identified by Elfenbein, Hamilton and Zenger (2010).

We then examined four potential mechanisms for the impact of hierarchy on business creation rates (the hierarchy effect). First, individuals with a preference for entrepreneurship choose to seek employment in firms with fewer management layers (preference sorting). Second, employees in firms with fewer layers have a broader range of skills, and this makes them more fit for entrepreneurship (ability breadth). Third, multiple layers of management offer promotion opportunities that do not exist in firms without a hierarchy, thereby suppressing mobility (career concerns). Finally, skill mismatching is less problematic in firms with a more hierarchical structure. We found evidence for preference sorting, ability breadth and skill mismatching, but none for career concerns. However, there remained throughout a substantial unexplained component of the effect of management layers on business creation rates. An appealing avenue for future theoretical and empirical work is studying more in detail the mechanisms behind this hierarchy effect.

Our analysis is based on the Swedish matched employer-employee dataset. Conventional wisdom has it that, along with other Scandinavian countries, Sweden's labor market is atypical. This conventional wisdom is now dated, [18] and most employment data reveal that Sweden is comparable to other OECD countries. While labor mobility remains lower than average, its wage structure is now much like other high-income countries. In fact, Lazear

and Shaw (2008), show that across several measures such as wage dispersion within firms, the variance of wage growth rates within firms, and even overall wage dispersion, Sweden is not remarkably different from seven other countries they study, including the U.S.A. The environment for new firm formation in Sweden is further not markedly different from other countries such as the U.S.A., Brazil or Denmark (Andersson and Klepper, 2013). We thus see no reason why results found in this paper would not be replicated elsewhere.

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Tables

Table 1

Sample size

Year	Firms	Workers	To other firm	To self employment	To entrepreneurship
2001	20,364	1,042,267	155,063	3,061	465
2002	19,051	1,155,587	156,242	3,451	434
2003	13,535	1,079,013	139,370	4,103	1,125
2004	11,831	1,048,657	137,992	4,249	1,103
2005	12,426	1,059,188	140,544	4,329	1,042
2006	13,026	1,060,428	146,305	3,763	1,268
2007	15,516	1,107,941	152,545	4,050	1,537
Total	105,749	7,553,081	1,028,061	27,006	6,974

Table 2

Occupational classifications, skill levels, and rank

SYYK Occupational Classification	Skill Level	Rank
1. Legislators, senior officials & managers	NA	**3. CEOs:** SSYK 121 (Directors and chief executives), 131 (Managers of small enterprises), 111 (legislators and senior government officials), 112 (senior officials of special-interest organizations) **2. Senior staff:** SSYK 122 (Production and operations managers), 123 (Other specialist managers)
2. Professionals	4	**1. Supervisors:** SSYK 200-399 (Professionals, technicians and associate professionals)
3. Technicians & associate professionals	3	
4. Clerks	2	**0. Production workers:** SSYK 400-999 (Clerks, service workers and shop sales workers, skilled agricultural and fishery workers, craft and related trades workers, plant and machine operators and assemblers, and elementary occupations).
5. Service workers & shop sales workers	2	
6. Skilled agricultural & fishery workers	2	
7. Craft & related trades workers	2	
8. Plant & machine operators & assemblers	2	
9. Elementary occupations	1	
0. Armed forces	NA	Omitted

Table 3

Wage distribution across broad occupation classes based on SSYK

Rank	Mean	Percentiles					Wage Dispersion
		10th	25th	50th	75th	90th	
3. CEOs and directors	600	232	300	417	669	1,086	1,324
2. Senior staff	540	292	363	469	620	833	775
1. Supervisors	358	201	260	330	421	534	475
0. Production workers	239	127	192	241	288	336	277
Mean	302	151	215	272	348	462	388

Data are in units of 1,000 SEK in 2005 prices.

Table 4

Rates of within-company rank transitions

	To production worker	To supervisor	To senior staff	To CEO
Production worker	**93.61**	5.44	0.71	0.24
Supervisors	7.63	**87.32**	4.34	0.71
Senior Staff	4.54	25.55	**63.24**	7.67
CEO or director	7.10	13.59	22.20	**57.11**

Transition rates over a three-year period if available; otherwise two years, otherwise one year. Transition rates are very similar if we include employees that switched firms.

Table 5

Size and wage by layers of management

Layers of management	A Mean Size of Layer				C Mean Wage in Layer			
	Layer 0	Layer 1	Layer 2	Layer 3	Layer 0	Layer 1	Layer 2	Layer 3
0	10.7				238.2			
1	12.0	3.7			230.9	344.8		
2	31.3	18.7	3.3		238.2	323.8	491.5	
3	127.2	85.2	12.1	3.1	241.6	334.2	505.9	946.9
Total	**38.9**	**28.3**	**6.9**	**3.1**	**236.4**	**335.1**	**497.4**	**946.9**

Layers of management	B Fraction of firms with more employees in lower rank than in next higher rank.			D Fraction of firms with lower mean wage in lower rank than in next rank up.		
	0>1	1>2	2>3	0<1	1<2	2<3
1	0.88			0.87		
2	0.72	0.90		0.87	0.86	
3	0.61	0.92	0.93	0.94	0.92	0.87

The layer numbers do not necessarily correspond to the rank numbers used in Table 2. For example, a firm with one CEO and several blue-collar workers will have one layer of management and consist of workers in ranks 3 and 0. Such firms will appear in the same c ells as firms with consisting only of, for example, ranks 3 and 2.

Table 6

Descriptive statistics of sample by layers of management in firm

Layers of management	*N*	Means				Median Wage
		Value Added per worker	Employees	Wage	Wage Dispersion	
0	21,627	477	13	235	317	225
1	35,245	594	18	253	383	237
2	28,773	717	62	288	457	268
3	20,104	817	268	319	468	295
Total	105,749	646	77	271	406	254

N is the number of firm-year observations. Value added per worker, annual wages and wage dispersion are in unit of 1,000 SEK at 2005 prices

Table 7

Worker Transitions. Multinomial Logit Estimation

	Model A			**Model B**		
	Entrepre-neurship	Self-employment	Other firm	Entrepre-neurship	Self-employment	Other firm
	(1)	(2)	(3)	(4)	(5)	(6)
CEOs and Directors	1.054***	0.010	-0.034***	1.124***	0.046	-0.030**
	(0.067)	(0.060)	(0.012)	(0.068)	(0.060)	(0.012)
Senior staff	0.994***	0.400***	0.278***	1.048***	0.419***	0.282***
	(0.054)	(0.036)	(0.007)	(0.054)	(0.037)	(0.007)
Supervisors	0.748***	0.259***	0.031***	0.776***	0.269***	0.033***
	(0.039)	(0.020)	(0.003)	(0.039)	(0.020)	(0.003)
Firm layers: 1				-0.250***	-0.200***	-0.042***
				(0.061)	(0.032)	(0.007)
Firm layers: 2				-0.336***	-0.243***	-0.078***
				(0.060)	(0.032)	(0.007)
Firm layers: 3				-0.461***	-0.215***	-0.055***
				(0.063)	(0.034)	(0.007)
Size 50-100	-0.470***	-0.388***	-0.063***	-0.379***	-0.350***	-0.052***
	(0.047)	(0.026)	(0.005)	(0.049)	(0.027)	(0.005)
Size 100-500	-0.770***	-0.661***	-0.136***	-0.645***	-0.616***	-0.123***
	(0.038)	(0.021)	(0.004)	(0.042)	(0.024)	(0.004)
Size 500-1500	-0.831***	-0.851***	-0.255***	-0.684***	-0.808***	-0.243***
	(0.044)	(0.025)	(0.004)	(0.049)	(0.029)	(0.005)
Size >1500	-1.281***	-1.172***	-0.579***	-1.120***	-1.123***	-0.567***
	(0.043)	(0.023)	(0.004)	(0.050)	(0.028)	(0.005)
Age (years)	0.152***	0.107***	-0.080***	0.152***	0.107***	-0.080***
	(0.012)	(0.006)	(0.001)	(0.012)	(0.006)	(0.001)
Age squared	-0.002***	-0.001***	0.001***	-0.002***	-0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female	-0.855***	-0.653***	-0.094***	-0.850***	-0.650***	-0.093***
	(0.039)	(0.019)	(0.003)	(0.039)	(0.019)	(0.003)
Education	0.046***	0.095***	0.105***	0.046***	0.095***	0.105***
	(0.015)	(0.008)	(0.001)	(0.015)	(0.008)	(0.001)
Log(wage)	0.496***	-0.768***	-0.531***	0.499***	-0.766***	-0.530***
	(0.035)	(0.011)	(0.002)	(0.035)	(0.011)	(0.002)
Tenure (years)	-0.086***	-0.134***	-0.156***	-0.085***	-0.134***	-0.156***
	(0.010)	(0.006)	(0.001)	(0.010)	(0.006)	(0.001)
Tenure squared	0.001*	0.004***	0.005***	0.001*	0.004***	0.005***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Constant	-12.876***	-3.024***	3.253***	-12.624***	-2.862***	3.295***
	(0.298)	(0.128)	(0.021)	(0.301)	(0.130)	(0.022)
N	6,865,026	6,865,026	6,865,026	6,865,026	6,865,026	6,865,026

Standard errors in parentheses. . *** p<0.01, ** p<0.05, * p<0.1. Size classes are for number of employees. Regressions include 43 industry dummies, 21 county dummies, and year dummies.

Table 8

Transitions among movers. Multinomial logit estimation

	Model A		**Model B**	
	Entrepreneurship	Self-employment	Entrepreneurship	Self-employment
CEOs and Directors	1.220***	0.244***	1.293***	0.267***
	(0.071)	(0.062)	(0.072)	(0.062)
Senior staff	0.846***	0.154***	0.895***	0.168***
	(0.055)	(0.037)	(0.055)	(0.038)
Supervisors	0.734***	0.220***	0.762***	0.228***
	(0.039)	(0.020)	(0.039)	(0.020)
Firm layers: 1			-0.174***	-0.164***
			(0.061)	(0.033)
Firm layers: 2			-0.285***	-0.191***
			(0.061)	(0.033)
Firm layers: 3			-0.426***	-0.176***
			(0.064)	(0.034)
Size 50-100	-0.487***	-0.329***	-0.394***	-0.298***
	(0.048)	(0.027)	(0.050)	(0.028)
Size 100-500	-0.741***	-0.531***	-0.610***	-0.495***
	(0.038)	(0.021)	(0.043)	(0.024)
Size 500-1500	-0.664***	-0.589***	-0.512***	-0.552***
	(0.044)	(0.026)	(0.049)	(0.029)
Size >1500	-0.746***	-0.567***	-0.579***	-0.527***
	(0.043)	(0.023)	(0.050)	(0.028)
Age (years)	0.204***	0.176***	0.204***	0.176***
	(0.012)	(0.006)	(0.012)	(0.006)
Age squared	-0.002***	-0.002***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Female = 1	-0.826***	-0.545***	-0.822***	-0.543***
	(0.039)	(0.019)	(0.039)	(0.019)
Education	-0.027*	0.006	-0.027*	0.006
	(0.015)	(0.008)	(0.015)	(0.008)
Log(wage)	0.676***	-0.262***	0.680***	-0.261***
	(0.031)	(0.011)	(0.031)	(0.011)
Tenure (years)	0.057***	0.031***	0.058***	0.031***
	(0.010)	(0.006)	(0.010)	(0.006)
Tenure squared	-0.002***	-0.002***	-0.002***	-0.002***
	(0.001)	(0.000)	(0.001)	(0.000)
Constant	-13.766***	-6.001***	-13.565***	-5.867***
	(0.288)	(0.128)	(0.291)	(0.130)
N	828,683	828,683	828,683	828,683

Standard errors in parentheses. . *** p<0.01, ** p<0.05, * p<0.1. Size classes are for number of employees. Regressions include industry dummies, county dummies, and year dummies.

Table 9

Performance of entrepreneurs, two years after business creation

	OLS Regressions			
	Log(Total income)		Survival	
	Entrepreneurs	Self-employed	Entrepreneurs	Self-employed
	(1)	(2)	(3)	(4)
CEOs and Directors	0.032	-0.013	-0.030*	-0.069***
	(0.026)	(0.027)	(0.018)	(0.026)
Managers	-0.003	-0.032*	-0.019	-0.060***
	(0.021)	(0.016)	(0.014)	(0.016)
Supervisors	0.010	-0.014	0.008	-0.022**
	(0.015)	(0.009)	(0.011)	(0.009)
Firm layers: 1	0.043*	0.004	-0.042**	-0.029**
	(0.024)	(0.014)	(0.017)	(0.014)
Firm layers: 2	0.074***	-0.008	-0.049***	-0.036***
	(0.024)	(0.014)	(0.017)	(0.014)
Firm layers: 3	0.069***	-0.002	-0.047***	-0.038***
	(0.025)	(0.015)	(0.018)	(0.014)
Size 50-100	-0.018	-0.001	0.016	-0.008
	(0.020)	(0.012)	(0.014)	(0.012)
Size 100-500	-0.026	0.011	0.021*	0.010
	(0.017)	(0.011)	(0.012)	(0.010)
Size 500-1500	-0.006	0.018	0.031**	-0.010
	(0.020)	(0.013)	(0.014)	(0.012)
Size 1500>	-0.008	0.020	0.020	-0.033***
	(0.019)	(0.012)	(0.014)	(0.012)
Log(wage)	-0.019***	-0.025***	0.007**	-0.002
	(0.005)	(0.002)	(0.003)	(0.002)
Tenure (years)	0.000***	0.000***	-0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Tenure squared	-0.005	-0.025***	-0.018	-0.021***
	(0.016)	(0.008)	(0.011)	(0.008)
Observations	5,769	19,276	5,769	19,276
R squared	0.72	0.76	0.71	0.25

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Regressions include a constant term, and controls for age, age squared, gender, education, industry, county, and year. Total income is the sum of capital and labor income accruing to the individual two years after business creation. Success is equal to one if a business created in year *t* is active, in the sense that it has more than one employee (including the founder), two years after business creation.

Table 10

Worker Transitions, Multinomial Logit estimations

	THREE LAYERS			TWO LAYERS			ONE LAYER		
	Entrepreneurship	Self-employment	Other firm	Entrepreneurship	Self-employment	Other firm	Entrepreneurship	Self-employment	Other firm
Top	1.460***	0.534***	0.300***	0.747***	0.314***	0.187***	0.516***	-0.017	-0.233***
	(0.099)	(0.081)	(0.014)	(0.090)	(0.064)	(0.012)	(0.081)	(0.052)	(0.011)
Second	1.153***	0.426***	0.293***	0.565***	0.255***	0.068***			
	(0.074)	(0.046)	(0.008)	(0.065)	(0.037)	(0.007)			
Third	0.865***	0.249***	0.035***						
	(0.055)	(0.027)	(0.004)						
Size 50-100	-0.311***	-0.192***	-0.035***	-0.394***	-0.343***	-0.055***	-0.555***	-0.469***	-0.086***
	(0.081)	(0.048)	(0.009)	(0.079)	(0.046)	(0.008)	(0.122)	(0.065)	(0.012)
Size 100-500	-0.641***	-0.514***	-0.097***	-0.624***	-0.575***	-0.182***	-0.909***	-0.764***	-0.040***
	(0.067)	(0.041)	(0.008)	(0.065)	(0.039)	(0.007)	(0.163)	(0.083)	(0.013)
Size 500-1500	-0.667***	-0.708***	-0.248***	-0.792***	-0.754***	-0.222***	-1.275***	-1.136***	-0.219***
	(0.071)	(0.043)	(0.008)	(0.090)	(0.054)	(0.009)	(0.257)	(0.166)	(0.022)
Size 1500>	-1.243***	-1.024***	-0.513***	-1.074***	-1.107***	-0.675***	-0.708***	-1.191***	-0.753***
	(0.074)	(0.042)	(0.008)	(0.091)	(0.056)	(0.010)	(0.191)	(0.129)	(0.022)
Log(wage)	0.467***	-0.784***	-0.527***	0.589***	-0.738***	-0.497***	0.514***	-0.760***	-0.575***
	(0.049)	(0.014)	(0.003)	(0.066)	(0.023)	(0.005)	(0.091)	(0.028)	(0.008)
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)
Constant	-12.625***	-2.989***	3.428***	-13.137***	-3.345***	2.765***	-13.776***	-4.065***	2.917***
	(0.425)	(0.179)	(0.027)	(0.573)	(0.263)	(0.044)	(0.864)	(0.366)	(0.068)
Observations	4,561,415	4,561,415	4,561,415	1,525,459	1,525,459	1,525,459	548,383	548,383	548,383

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Regressions include controls for age, age squared, female, education, tenure, tenure squared, industry, year and county, and a constant.

Table 11

Worker Transitions. Multinomial Logit Estimation

	Model A			Model B			Model C		
VARIABLES	Entrepre-neurship	Self-employment	Other firm	Entrepre-neurship	Self-employment	Other firm	Entrepre-neurship	Self-employment	Other firm
CEOs and directors	1.278***	0.445***	0.295***	1.254***	0.454***	0.306***	1.257***	0.453***	0.306***
	(0.097)	(0.086)	(0.014)	(0.097)	(0.086)	(0.014)	(0.097)	(0.086)	(0.014)
Senior staff	1.053***	0.415***	0.304***	1.041***	0.424***	0.309***	1.042***	0.424***	0.309***
	(0.063)	(0.041)	(0.007)	(0.063)	(0.041)	(0.007)	(0.063)	(0.041)	(0.007)
Supervisors	0.821***	0.205***	0.058***	0.820***	0.212***	0.062***	0.821***	0.212***	0.061***
	(0.047)	(0.024)	(0.004)	(0.047)	(0.024)	(0.004)	(0.047)	(0.024)	(0.004)
Firm layers: 2	-0.040	0.033	-0.059***	-0.044	0.052	-0.034***	-0.040	0.052	-0.031***
	(0.073)	(0.041)	(0.007)	(0.074)	(0.042)	(0.007)	(0.074)	(0.042)	(0.007)
Firm layers: 3	-0.138*	0.059	-0.035***	-0.135*	0.087**	-0.005	-0.131*	0.086**	-0.003
	(0.072)	(0.041)	(0.007)	(0.073)	(0.041)	(0.007)	(0.073)	(0.041)	(0.007)
Log(wage)	0.569***	-0.768***	-0.510***	0.608***	-0.770***	-0.509***	0.607***	-0.770***	-0.509***
	(0.045)	(0.013)	(0.003)	(0.045)	(0.013)	(0.003)	(0.045)	(0.013)	(0.003)
Firm mean log(wage)	-0.097	0.254***	-0.081***	-0.190**	0.136***	-0.152***	-0.193**	0.136***	-0.149***
	(0.093)	(0.051)	(0.008)	(0.091)	(0.048)	(0.008)	(0.091)	(0.048)	(0.008)
Firm log(wage) standard deviation	0.514***	0.565***	0.347***						
	(0.139)	(0.081)	(0.014)						
Wage slope				-0.188*	0.067	0.137***			
				(0.100)	(0.058)	(0.009)			
Relative wage slope							-0.059	0.026	0.066***
							(0.039)	(0.022)	(0.004)
Observations	5,952,282	5,952,282	5,952,282	5,952,282	5,952,282	5,952,282	5,952,282	5,952,282	5,952,282

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Regressions include four firm size dummies, age, age squared, female, education, tenure, tenure squared, industry, year and county, and a constant.

Table 12

Worker Transitions. Multinomial Logit Estimation

	Entrepreneurship	Self-employment	Other firm
CEOs and Directors	1.007***	0.011	-0.187***
	(0.068)	(0.061)	(0.012)
Senior staff	0.867***	0.370***	0.084***
	(0.056)	(0.039)	(0.007)
Supervisors	0.693***	0.334***	0.009**
	(0.042)	(0.021)	(0.004)
Log(wage)	0.183***	-0.367***	-0.285***
	(0.063)	(0.021)	(0.005)
Firm layers: 1	-0.239***	-0.185***	-0.029***
	(0.061)	(0.032)	(0.007)
Firm layers: 2	-0.325***	-0.215***	-0.057***
	(0.061)	(0.032)	(0.007)
Firm layers: 3	-0.448***	-0.185***	-0.034***
	(0.063)	(0.034)	(0.007)
0-10th percentile	0.351***	1.001***	0.696***
	(0.106)	(0.038)	(0.007)
10-20th percentile	0.013	0.692***	0.363***
	(0.077)	(0.027)	(0.005)
20-30th percentile	-0.099	0.285***	0.120***
	(0.071)	(0.028)	(0.005)
60-70th percentile	0.005	-0.030	0.019***
	(0.056)	(0.029)	(0.005)
70-80th percentile	0.264***	-0.143***	0.082***
	(0.053)	(0.031)	(0.005)
80-90th percentile	0.426***	-0.097***	0.179***
	(0.055)	(0.032)	(0.006)
+90th percentile	0.757***	0.040	0.341***
	(0.071)	(0.037)	(0.007)
N	6,865,026	6,865,026	6,865,026

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Regressions include four firm size dummies, age, age squared, female, education, tenure, tenure squared, industry, year and county dummies, and a constant.

Figures

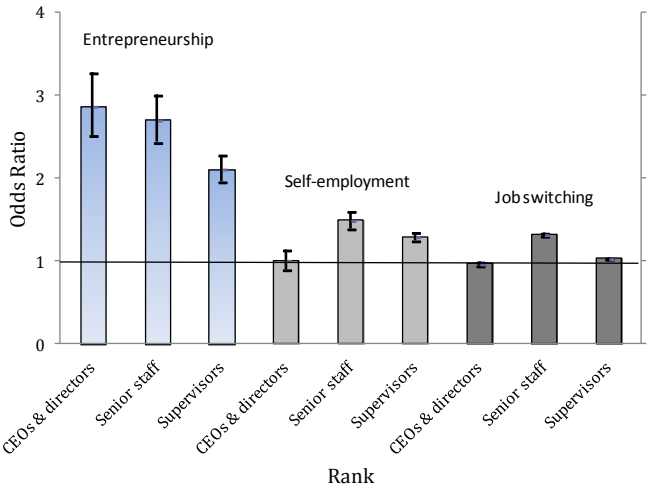

Figure 1. *Odds Ratios of Mobility, by destination and rank, with 95% confidence intervals. From model A of Table 7.*

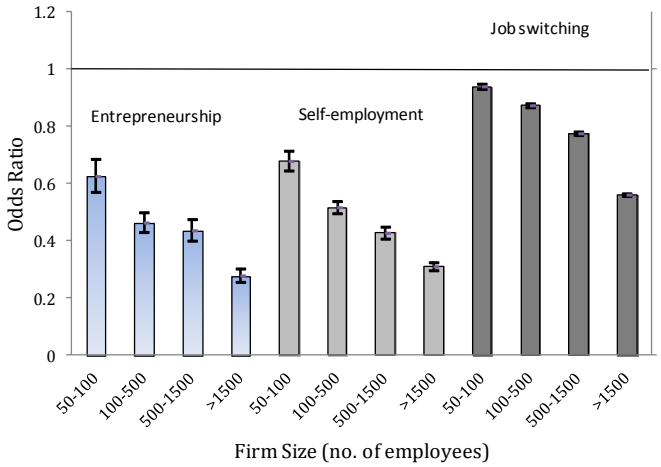

Figure 2. *Odds Ratios of Mobility, by destination and firm size, with 95% confidence intervals. From model A of Table 7.*

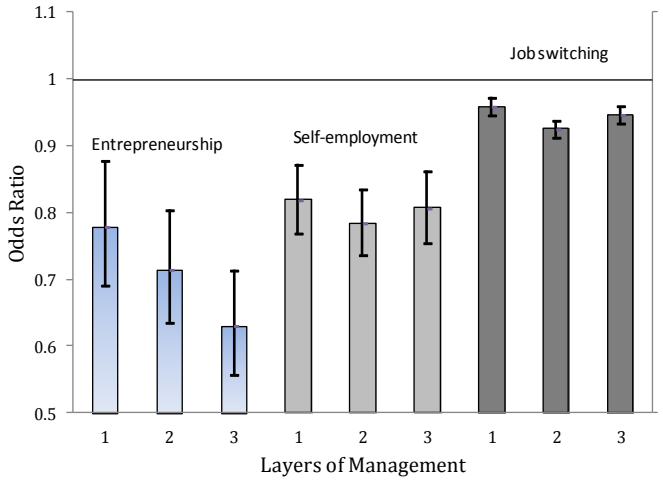

Figure 3. *Odds Ratios of Mobility, by destination and number of layers in employee's firm, with 95% confidence intervals. From model B of Table 7*

Figure 4. *Percentage reduction in regression coefficients on firm size obtained upon adding controls for layers of management.*

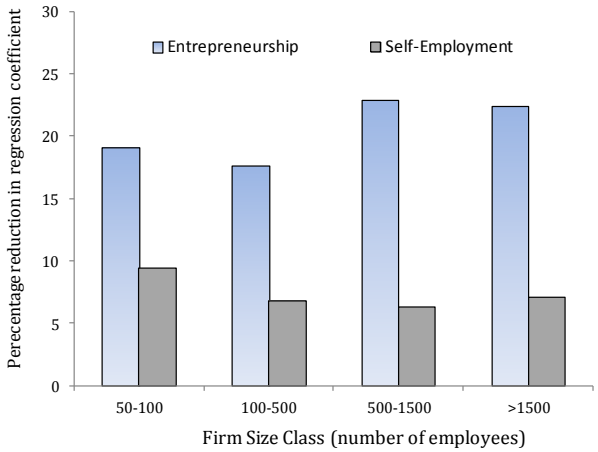

Figure 5. *Percentage reduction in regression coefficients on firm size obtained upon adding controls for layers of management. Movers only.*

Endnotes

[1] Accurate occupation data is only available from 2001 and onwards.

[2] Employee exits to unemployment are ignored: they are treated the same as employees remaining with their current employer.

[3] Statistics Sweden treats self-employment as the primary occupation even though it may generate less income than other activities, because self-employment typically generates lower hourly wages.

[4] The mean size of a limited liability company two years after creation is 5.3 employees with a standard deviation of 8.3, while the mean size of a sole proprietorship is 1.2 employees with a standard deviation of 0.9. Henrekson and Sanandaji (2013) survey the literature on entrepreneurship and self-employment and demonstrate the importance of separating between entrepreneurs and the self-employed using data on billionaire entrepreneurs.

[5] Except that firms with at least 500 employees are always included.

[6] There have been some attempts since 2004 to survey partnerships and sole proprietorships but the coverage is extremely limited.

[7] Statistics Sweden notes that, although these skill levels have been made operational in terms of the educational categories of the International Standard Classification of Education, they do not imply that the skills necessary to perform the tasks and duties of a given job can be acquired only through formal education.

[8] The identified number of management layers is inevitably somewhat crude. In particular, zero-layer firms will generally have someone engaged in managerial and supervisory functions. However, they are not identifiable when, for example, supervisory functions are only

a fraction of their activities and their main work is similar to those of other employees in the firm.

[9] The positive coefficients on the quadratic terms indicate a non-monotonic effect of tenure. For entry into entrepreneurship and self-employment the minima are attained at 39 and 18 years of tenure; for movements to another incumbent employer the minimum is at 15 years. However, the predicted effect of tenure is greater than these minima and extrapolates outside most of our sample observations.

[10] Education is on a scale from 1–6 corresponding to: 6. Postgraduate education; 5. Post-secondary education, two years or longer; 4. Post-secondary education, less than two years; 3. Upper secondary education; 2. Primary and lower secondary education; 9 or 10 years; and 1. Primary and lower secondary education, less than 9 years.

[11] Supervisors are about 25 percent more likely than production workers to become self-employed. Senior staff is 50 percent and CEOs are less than ten percent more likely to do so.

[12] The largest reduction in coefficient size for job switching is based on a small initial effect: the odds ratio of switching to an incumbent employer for employees in size class 50–100 (relative to less than 50 employees) increases from 0.938 to 0.949 after the addition of controls for layers.

[13] If we were to rerun Table 7 using moving to another firm as the baseline, it would of course be possible to formally test the IIA assumption using the Hausman-McFadden (1984) test. If the results in Table 7 are robust, we should find that the *difference* between any coefficient on entrepreneurship or self-employment and the corresponding coefficient on self-employment in Table 7 is similar to the corresponding coefficient on entrepreneur-

ship or self-employment in Table 8. The results meet this expectation.

[14] Offsetting this, however, is the likelihood that small firm employment is a substitute for entrepreneurship among certain types of individuals.

[15] Elfenbein et al. report that entrepreneurs previously employed in small firms earn less than those employed by the largest firms, but attribute this to the lower opportunity cost of entrepreneurship among the former group. Once they control for prior wages, they find a 23 percent premium to entrepreneurial earnings among those that left the smallest firms relative to those that left the largest. However, the effect is non-monotonic, with the largest premium occurring among entrepreneurs previously employed in medium-sized firms.

[16] The wage slope is based on a regression of labor income on the management layer in a firm and is normalized such that it is relative to the industry-year mean slope. It is positive if the wage slope is higher than industry-year mean and negative otherwise. Because the slope is meaningless in firms with zero layers of management, we drop these firms. We also restrict attention to firms with more than 30 employees to have large enough samples for estimating the wage-rank slope for each firm individually.

[17] In Åstebro et al. mismatching arises because agents of differing ability may become co-workers and the production function exhibits complementarity in worker abilities.

[18] For the majority of the 20th century, annual average wage increases were set by "collective bargaining" between the three major labor unions and the three major employers, respectively. However, between 1970 and 1990 centralized control over wages was progressively dismantled, and it was abandoned entirely in 1997. Further deregulations of the Swedish labor market in the early 1990s gave rise to a dual labor market consisting of temporary and permanently employed workers. These changes induced an increase in the

Gini coefficient for income from 0.199 in 1981 to 0.332 in 2007 (http://www.scb.se/Pages/TableAndChart___163550.aspx). The 2007 figure places Sweden at the OECD average (*The Economist*, 2013). The percentage of temporary employees in the private sector rose from 8.8 percent in 1997 to 13.1 percent in 2008 (Sveriges Officiella Statistik, 2001; 2012).