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IZA DP No. 15337

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ABSTRACT

"Since You're So Rich, You Must Be Really Smart": Talent, Rent Sharing, and the Finance Wage Premium*

Financial sector wages have increased extraordinarily over the last decades. We address two potential explanations for this increase: (1) rising demand for talent and (2) firms sharing rents with their employees. Matching administrative data of Swedish workers, which include unique measures of individual talent, with financial information on their employers, we find no evidence that talent in finance improved, neither on average nor at the top. The increase in relative finance wages is present across talent and education levels, which together can explain at most 20% of it. In contrast, rising financial sector profits that are shared with employees account for up to half of the relative wage increase. The limited labor supply response may partly be explained by the importance of early-career entry and social connections in finance. Our findings alleviate concerns about "brain drain" into finance but suggest that finance workers have captured rising rents over time.

JEL Classification: J24, J31, G20

Keywords: industry wage premia, talent allocation, rent sharing, earnings inequality, compensation in financial sector

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1 Introduction

Wages in the financial industry have increased dramatically since the 1980s (e.g., Philippon and Reshef, 2012; Bell and Van Reenen, 2014; Boustanifar et al., 2018). The increase has been remarkably similar across developed countries: both in the U.S. and in Sweden, for example, relative earnings of finance employees rose from 110% in the mid-1980s to 170% in 2014 compared to other private-sector workers. Several studies have shown that rising wages in finance account for a significant part of the growth in top incomes for many countries (e.g., Kaplan and Rauh, 2010; Guvenen et al., 2014; Bell and Van Reenen, 2014; Lemieux and Riddell, 2015), implying that finance has contributed to the global rise in income inequality over the last thirty years (Atkinson et al., 2011).

There is still no consensus on what explains the rising finance wage premium, however. In a competitive labor market, wages rise when the marginal productivity of workers increases. A natural explanation for the surge in finance pay would then be that skilled workers in finance have become increasingly productive compared to those in other sectors. Consistent with this explanation, Philippon and Reshef (2012) show that deregulation of financial markets in the 1980's—which they argue raised the demand for skill—was followed by simultaneous increases in the GDP share, relative wages, relative education, and job complexity in the financial sector.[1]

A second (and not necessarily mutually exclusive) explanation is that rents have increased faster in financial firms compared to the rest of the economy, and that these rents have been shared with workers, causing relative wages to increase. A growing literature in labor economics has documented that more profitable firms pay higher wages to their employees, resulting in substantial dispersion of wages across firms (see Card et al., 2018). While these studies focus on non-financial firms, the increase in relative finance wages over the last four decades has indeed been accompanied by a significant growth of financial sector profits relative to the rest of the economy (see Philippon and Reshef, 2013; Greenwood and Scharfstein, 2013). Philippon (2015) shows the unit cost of producing financial services did not decrease

[1] Along similar lines, Kaplan and Rauh (2010) argue that the combination of new technology and globalized financial markets has allowed the most talented finance workers to apply their skills to a significantly larger pool of assets, in turn increasing their productivity and relative compensation (as in Gabaix and Landier 2008). Other supporting evidence come from Goldin and Katz (2008), Oyer (2008), Shu (2016), and Célérier and Vallée (2019), who document that an increasing fraction of graduates from elite universities have been taking up jobs in the financial sector over the recent decades. Focusing on French engineering graduates, Célérier and Vallée show that the increase in relative pay has been particularly pronounced for finance workers who have graduated from the very top engineering programs. In contrast, Lindley and Macintosh (2017) analyze a sample of U.K. workers and argue that the finance wage premium can only partly be explained by skills, education, or cognitive ability.

over this period, suggesting that the finance sector did not really become more productive.

Disentangling rents from competitive wages is challenging as more productive workers tend to work at more productive firms. Since most datasets only have limited information on worker human capital, it is difficult to account for such selection effects. Regardless of the explanation, however, rising relative wages have led to a concern about "brain drain" into finance. To the extent that the most talented and skilled workers are drawn into the finance industry, productivity in the non-financial sector may suffer, with potentially negative consequences for economic growth (see Baumol, 1990; Murphy et al., 1991).[2]

In this paper, we use administrative records from Sweden to examine the relation between wages, skills, and rents in the financial industry. Our data contain uncensored information on individual earnings, as well as a several unique measures of talent, for the entire population of workers in Sweden during 1990–2017. We match this to financial information for the universe of Swedish firms over this period, including new hand-collected data on financial firms.

Our talent measures include estimates of cognitive and non-cognitive abilities from military aptitude tests, which are available for the majority of Swedish men for the period we study. Although the exact determinants of worker productivity are not directly observable, our talent measures are likely to capture an individual's ability to acquire productive skills and are strongly related to future labor market outcomes (e.g., Lindqvist and Vestman, 2011; Fredriksson et al., 2018; Edin et al., 2022). We construct corresponding measures for women using high-school grades. These talent measures are largely pre-determined before an individual chooses their sector of employment. The measures' distribution is constant in the population, which makes results comparable over time, and sufficiently granular to distinguish the most talented individuals. We also consider education as an alternative skill measure, although changes in educational attainment make it harder to compare over time (Lemieux 2006).

If the increase in finance wages is caused by a higher demand for productive workers, talent in finance relative to other sectors should have increased over time (given a constant employment share, which is the case for the time period we study). While finance workers are indeed more talented *on average*, we show that talent levels in finance *did not improve* over the period 1990–2017, neither in absolute nor relative terms. In sectoral choice regressions, where we control for other skill determinants such as education and experience, there is no

[2] For examples voicing this concern, see e.g., Krugman (2009), Terkel (2011), and Shiller (2013). Hsieh et al. (2019) estimate the quantitative effect of misallocation of talent across sectors on U.S. economic growth.

sign of talent becoming more important for explaining worker entry into the finance industry over time. Thus, we do not observe any increased "brain drain" of talented workers into the financial sector, despite the rise in relative wages.

These results are robust to a large number of alternative specifications and tests that include restricting the sample to the right tails of the talent or earnings distribution, focusing on recent entrants into the labor market, comparing finance to other high-skilled sectors, controlling for worker migration, accounting for compensating differentials[3], or using top university graduates as an alternative talent measure. Across all our specifications, we find a large increase in relative pay, but no corresponding increase in the relative talent of finance workers over time.

We then analyze the relation between skill and pay in detail. First, we argue that compositional changes based on other, unobserved dimensions of (specific) skill are unlikely to explain the rising relative wages. Since we can control for cognitive and non-cognitive talent as well as for detailed fixed effects, such dimensions would have to be uncorrelated with talent measures and not absorbed by individual(–sector) specific fixed effects. Whereas talent is positively and significantly related to wages *on average* for both finance and non-finance workers, *changes* in the return to talent or experience cannot explain the rise of the finance wage premium.

While fundamental talent did not change, we find that relative college attainment of finance workers has increased over time. This should have raised their relative productivity (although trends in other attainment levels were more heterogeneous). We find that changes in educational composition and returns explain less than 20% of the rising finance premium for men and none of it for women. Moreover, relative finance wages did not increase monotonically with talent or education, which would be expected if the growth in finance pay was driven by an increased demand for skill. When we examine the 30 most common occupations in finance, relative wages have increased for almost all of them, including jobs that are unlikely to require very high or specific skills (e.g., secretaries or doorkeepers).[4]

Given the limited role for rising skills, we then examine the extent to which rent sharing can explain relative finance wages. To do this, we combine financial performance data for real economy firms with newly collected measures for financial institutions. We first confirm that the finance sector's share of aggregate value added grew significantly over our sample

[3]Using data from labor force surveys, we find that whereas a subset of finance jobs work long days, working hours have not increased over time. Full-time equivalent monthly wages have also trended broadly similarly to annual labor earnings. Thus, while our main analyses are based on the latter, we mostly use the term "wages".

[4]The rise in finance pay has thus been an industry rather than an occupational phenomenon. Patterns are similar in U.S. data we analyze, suggesting that our results are not due to factors unique to the Swedish labor market.

period, and that there is a strong co-movement between value added and wages in the time-series. We then run regressions of individuals' log wages on log value added per worker in the firms where they are employed, controlling for skills and firm fixed effects. The resulting rent-sharing elasticities for the real economy are substantial and comparable to those found in previous studies. In addition, we find that rent-sharing elasticities for financial firms are highly significant with point estimates at least as high as those of the real economy. Given the relative increase of value added in finance, these estimates imply that rent sharing can account for as much as 50% of the relative finance wage increase in our sample.

These findings raise the question of why the increase in relative pay did not attract more talented workers into the financial sector (as predicted by Murphy et al., 1991, and others) and why labor market competition did not drive down the finance wage premium. We explore two labor market frictions that might help explain this puzzle. First, we show that workers enter finance at relatively young ages, which raises the possibility that the finance premium over the life-cycle and its increase are lower in net present value terms. Yet, studying workers' careers longitudinally, we find that unemployment and earnings risk are not higher in finance and that relative time-discounted earnings also strongly increased. Second, we use data on parents and the municipalities where individuals grew up to construct measures of social networks. We obtain suggestive evidence that family ties and local connections may be particularly important for landing a job in finance, which could act as a barrier to entry into the sector.[5]

Our paper contributes to the recent and growing literature on the causes and consequences of finance wages. Apart from the empirical studies cited above, contributions include theoretical work by Axelson and Bond (2015), Glode and Lowery (2016), and Bolton et al. (2016). Our results suggest that the increase in relative finance wages over the last three decades cannot be explained by higher competition for talent, and that it is unlikely to have caused an increased brain-drain of skilled workers into finance at the expense of other sectors. A more important driver seems to be that the finance sector has generated increasing rents, which have been shared with workers, e.g., because of moral hazard reasons (Axelson and Bond, 2015; Biais and Landier, 2020), fairness concerns, (Akerlof and Yellen, 1990) and/or poor corporate governance (Bebchuk et al., 2010; Bivens and Mishel, 2013).[6]

These results have ramifications for the broader debate on the underlying causes of rising

[5]Consistent with this argument, Chuprinin and Sosyura (2018) provide evidence that family connections are important to land a job in the U.S. mutual fund industry.

[6]Potential explanations for the growth of financial market rents include Gennaioli et al. (2014); Philippon (2015).

inequality. One long-standing view has been that increases in wage inequality largely stem from shifting productivity of skill, due to skill- or task-biased technological change (e.g., Katz and Murphy, 1992; Acemoglu and Autor, 2011), international trade and offshoring (Autor et al., 2013; Hummels et al., 2018), or rising superstar economies (Gabaix and Landier, 2008). At the same time, a more recent literature has emphasized the role of imperfect competition and wage premia at the firm level (summarized in Card et al., 2018). We document that rent sharing can have an important role in raising the long-run wage premium for a whole industry. This also suggests that rising financial sector rents have contributed to a non-negligable part of the increase in overall inequality experienced in recent decades.

Our results finally have bearing on the literature on labor market sorting, e.g., recently analyzed at the firm level by Card et al. (2013, studying Germany), Song et al. (2018, U.S.), and Bonhomme et al. (2019, Sweden). In particular, our findings raise some doubts on the effectiveness of the price mechanism to allocate talent, at least between finance and other sectors.

In the following section we describe the Swedish and U.S. financial sectors and the overall patterns of finance wages. Section 3 outlines the "Talent-Competition Hypothesis" for explaining the finance wage premium, and discusses its testable predictions. We test these implications for the talent selection into finance (Section 4) and study their contribution to the evolution of relative finance wages (Section 5). We then turn to the alternative "Rent-Sharing Hypothesis". Section 6 analyzes firms' rent sharing and its contribution to the rise of finance wages, and Section 7 provides evidence on labor market frictions that may prevent more talented workers from entering finance. The last section concludes. In a separate appendix we provide a more detailed description of the data, robustness tests, additional comparisons to the United States, and a theoretical model deriving our testable predictions more formally.

2 The Growth of Finance and the Evolution of Wages

2.1 The Growth of Finance

Several papers have documented a significant increase in the GDP share of the financial sector for both the U.S. (e.g., Greenwood and Scharfstein, 2013; Philippon, 2015) and other developed economies (e.g., Philippon and Reshef, 2013; Pagano et al., 2014; Godechot, 2016), which accelerated after 1980. A number of factors have been proposed to explain this trend. Philippon (2015) relates the growth of finance to contemporaneous growth in intermediated assets (equity issuance, household and corporate credit, and liquidity services). He also estimates that the cost charged by the financial sector for intermediation services has been fairly constant over time at 1.5–2% of assets. To explain these facts, Gennaioli et al. (2014) propose a model where financial intermediaries provide "wealth preservation services" to households, which implies that the rise of the finance share is the result of an increase in household wealth relative to GDP. In their model, financial intermediaries compete by setting fees, but as some intermediaries are especially trusted by clients, they can capture excess profits in equilibrium.

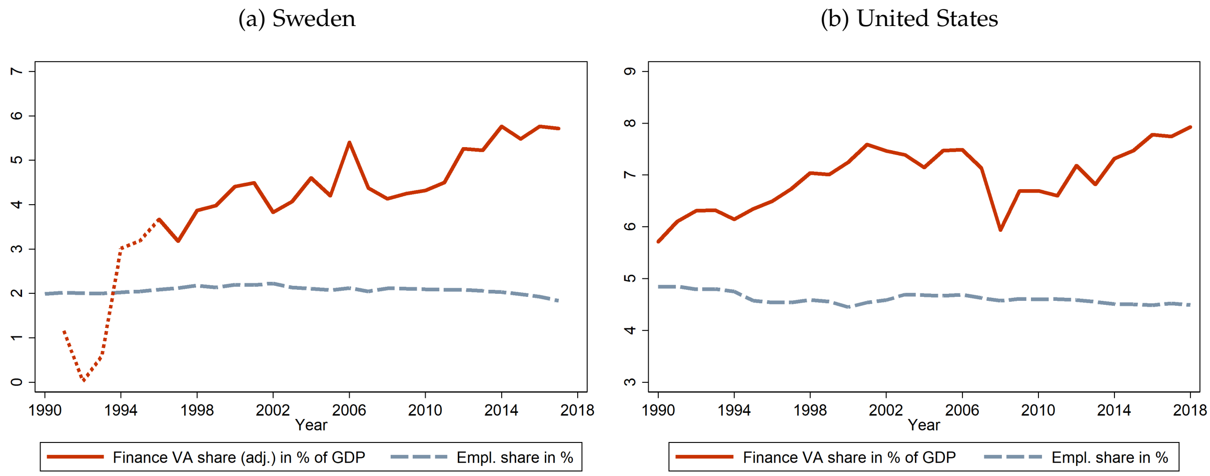
Another potential source of rents stems from the high level of regulation in finance. Since banks are prone to runs and systemic failures (Diamond and Dybvig, 1983), governments provide explicit and implicit guarantees of bank liabilities, such as deposit insurance and crisis bailouts. These guarantees incentivizes banks to increase leverage and risk-taking, which in turn necessitates regulation such as capital requirements, supervision, and licenses to operate. Such regulation acts as a barrier to entry that weakens competition and makes it possible to earn above-competitive profits. Indeed, regulators have frequently argued in favor of reducing the amount of competition in the financial industry in order to preserve the stability of the financial system (see Hellwig, 2018).

On the other hand, the growth of the financial industry accelerated in a number of countries after markets started deregulating in the 1980s and 1990s (Pagano et al., 2014; Philippon, 2015). While deregulation might increase competition and entry, it can also enable incumbent players to enter new markets and product segments in order to increase their profits, and/or to more freely acquire smaller competitors. The latter effect seems to have dominated on average, as evidenced by an increased consolidation of the financial industry in both the U.S. (Berger et al., 1999) and Europe (Pagano et al., 2014) following deregulation.

2.2 The Financial Sector in Sweden and the U.S.

Our analysis focuses on the Swedish financial sector, where we have detailed data on earnings and talent of individuals. Although this raises the issue of external validity, the Swedish financial sector is in many ways similar to that of the U.S. and the U.K. All three countries experienced significant financial market deregulation in the early 1980s (see Englund, 2015), setting off a substantial expansion of financial activity and a surge in relative wages. Throughout the analysis, we will show that our main results for Sweden look similar to the U.S. whenever we have data available to calculate corresponding numbers.

Figure 1. Value added and employment share of the financial sector



Notes: The figure describes the evolution of the finance and insurance sector's value added as a percentage of GDP and of its employment share as a percentage of overall employment. The value-added share for Sweden has been adjusted using the methodology of Bazot (2017). Since the Swedish banking sector's operating profits are not separately reported before 1996, the Bazot (2017) correction can only be approximated (dotted red line). Employment is total headcounts for Sweden and in full-time equivalent employees for the U.S. Sources: National industry accounts from Statistics Sweden and Bureau of Economic Analysis (BEA) for the U.S.

Figure 1 depicts the evolution of the financial sector in terms of employment share and value added as percent of GDP for Sweden and the U.S.[7] While the finance sector accounts for a smaller share of the economy in Sweden, the evolution is quite similar over most of our sample period. In both countries, the employment share in finance has been relatively stable whereas the GDP share has been increasing from the mid-1990s and onward.[8] In terms of subsectors, both Sweden and the U.S. have experienced a decreasing share of workers in banking and insurance, and an increasing share of workers in asset management over the sample period (see Table B.1 in the appendix for different subsectors of finance in Sweden and the U.S.).

Sweden had a somewhat different financial crisis experience compared to the U.S. and the U.K., however. Following the post-financial deregulation boom, Sweden was hit by a severe

[7] Appendix B provides comparisons of equity market growth as well as employment shares by gender.

[8] We use the method of Bazot (2017) to adjust financial sector value added from Statistics Sweden. The standard treatment of banks in national accounts uses FISIM (*Financial Intermediation Services Indirectly Measured*) as a measure of value added, which is an estimate of the difference between the bank's interest income and interest expense using a reference rate (see Eurostat, 2010). As pointed out by Stauffer (2004) this measure excludes capital gains and losses, which have historically accounted for a significant fraction of bank profits, especially in Europe which is dominated by large universal banks providing both lending and investment banking services. Bazot (2017) proposes a correction where bank value added is replaced by operating profits, which we follow. As *Statistics Sweden* only provides aggregate bank income statements from 1996 and onwards, we use our hand-collected microdata for 1991–95, which is indicated by the dotted red line in Figure 1. Notice also that compared to earlier versions of our paper, financial sector value added has been revised in U.S. national statistics. This led to a more modest increase of its GDP share over time, as also noted by Philippon (2015, p1411).

banking crisis in the early 1990s. This led to a fall in GDP by almost 4% between 1990 and 1993, and finance value added dropped dramatically as banks suffered large credit losses. The crisis and its aftermath also affected the Swedish labor market, with unemployment peaking at more than 8% during the mid-1990s, and then falling back to 4% in 2001. The transition to this new equilibrium was reached by the cleanup of the financial system, which aided the macroeconomic recovery, and labor market reforms, such as a liberalization of fixed-term contracts (Skans et al., 2009). In contrast, the Swedish banks had a relatively mild crisis experience in 2008–2009, when the value added share and relative wages exhibited a more protracted drop in the U.S. compared to Sweden (as seen in Figure 1, and in Figure 2, below).[9]

2.3 Evolution of Finance Wages

Our main data source for worker information is the *Longitudinal Integration Database for Health Insurance and Labor Market Studies* (LISA), provided by Statistics Sweden. LISA contains employment information (employment status, employer identity, and occupation), tax records (including labor and capital income) and demographic information (such as age, education, and family composition) for all individuals 16 years of age and older, domiciled in Sweden, starting in 1990. The sector where an individual works is reported according to the Swedish Standard Industrial Classification (SNI) code for the establishment at which they are employed.

To make our results comparable to previous research, we exclude individuals with yearly labor income below the threshold that qualifies a worker for public pensions (44,500 SEK or approximately 5,300 USD in 2015), as well as farming sector, public sector, and self-employed workers. We have confirmed, however, that including these observations does not significantly change our results. We also exclude observations with incomplete data on gender, age, or sector of employment. This results in a sample of about 93.4 million individual-year observations.

We define the relative finance wage as the ratio of average labor income of finance workers to that of workers in the non-financial, non-farming private sector. Our main classification

[9] The early 1990s crisis, which also severely hit Norway and Finland, was the result of a series of events that included a rise in international interest rates (following the fall of the USSR and German reunification), a 1990 tax reform that significantly increased the after-tax borrowing costs for individuals, a large decrease in real estate prices starting in 1990, and the European-wide currency (ERM) crisis, which eventually led to Sweden abandoning its fixed exchange rate regime in November 1992. The crisis culminated in government bailouts of three of the five major Swedish banks in 1991 and 1992. In contrast, none of the major Swedish banks failed during 2008–2009, although the government did take significant measures to stabilize the banking sector following the Lehman bankruptcy, including guarantees for bank borrowing and doubling the deposit insurance limit. Also, the largest independent Swedish investment bank, Carnegie Investment Bank, was taken over by the government in November 2008.

of a finance worker is an indicator for whether the SNI code of the individual's working establishment is in the "Financial Intermediation" group (SNI2002 codes 65000–67000), which includes banks, finance and leasing companies, insurance companies, security broking, fund management, and pension funds.[10]

For labor income we use reported annual earnings before tax. Importantly, this information is not censored or top-coded, and includes bonus payments, which are a substantial part of compensation for many finance jobs. In robustness tests, we also analyze alternative income measures such as labor plus capital income, after-tax disposable income, and full-time equivalent monthly wages surveyed from a sample of employers. While we focus on labor income, all of our results hold with these alternative income measures. We use the term "relative wages" when referring to relative pay in the financial sector compared to the private, non-financial sector, and refer to the "finance premium" as the remaining wage differential once we have accounted for differences in skill and other demographic information. Appendix A contains a more detailed description of our data and sample construction. We also extend the relative wage time-series back to 1978 for a representative sample covering between 3% and 4% of the working population, using the *LINDA* data base (see Edin and Fredriksson, 2000), to capture the time of the deregulation of the Swedish finance industry.

Panel (a) of Figure 2 shows the extraordinary growth of relative finance wages in Sweden and the U.S. over the last three decades. In the early 1980s, before deregulation, annual earnings in finance were about 5–10% higher than in the rest of the economy. Finance wages began to rise in 1983, the year when financial deregulation first set off, and steadily increased from this point.[11] By 1990, relative finance wages had risen to 120%, and continued to grow to about 170% in 2014. The relative wage increase is remarkably similar in magnitude for both countries.

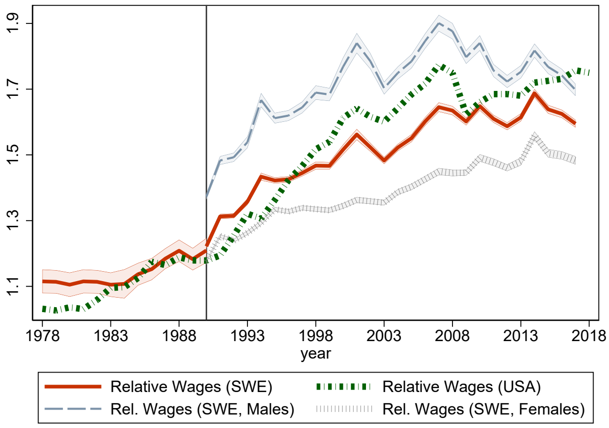
While finance wages are more cyclical than those in the rest of the economy, financial downturns seem to only have a temporary effect on relative earnings. Panel (a) of Figure 2 shows a rapid increase of relative earnings after the 1990–92 banking crisis. The effect of the dotcom crash in 2000–01 was somewhat stronger in Sweden while the 2008-09 crisis was more severe in the U.S. By 2014, however, relative finance wages in both countries were again around an all-time high. Although for women relative earnings in finance are substantially lower and

[10]As an alternative, we have hand-classified firms into the financial industry based on the *Serrano* data base of Swedish corporations, combined with membership lists from various financial associations. While this gives very similar results, we focus on the more easily replicable SNI-based definition in our analysis.

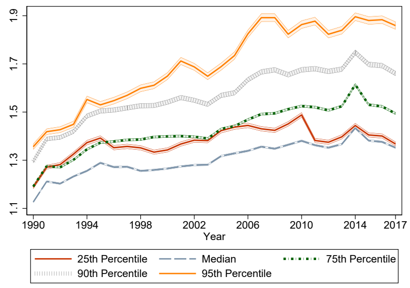
[11]Philippon and Reshef (2012, 2013); Boustanifar et al. (2018) also relate the beginning of the finance wage increase to financial deregulation for a large number of countries, including the U.K. and other European countries.

Figure 2. Relative wages in the financial sector

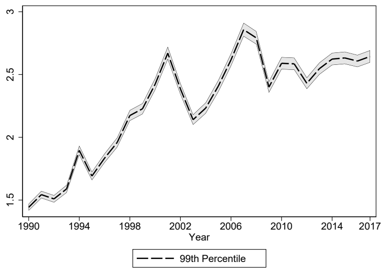
(a) Relative wages, Sweden and U.S.



(b) Percentiles, Sweden



(c) 99th percentile, Sweden



Notes: The figures show relative wages in finance, defined as the ratio of wages in finance to wages in the non-financial, non-farming private sector. Panel (a) are relative average wages during 1978–2017. The period between 1978 and 1989 uses a representative administrative sample of 3–4% of the Swedish population (LINDA). The period between 1990–2017 uses the full Swedish population data (LISA). We follow Philippon and Reshef (2012) to extend their relative wage series for the U.S. to 2007–2018 using compensation of full-time equivalent employees reported by the BEA's Current Industry Analysis Division. Panels (b) and (c) depict the relative quantiles of the wage distribution in the Swedish financial sector, i.e., the ratio between the percentile in finance and the respective percentile in the non-financial, non-farming private sector. Sources: Swedish population data LISA and 3–4% sample LINDA, U.S. Bureau of Economic Analysis. Shades are 95 percent confidence intervals.

increased more smoothly over time, both genders have experienced a similar increase overall.[12]

With our detailed administrative data, we can precisely estimate the complete distribution of relative wages for Sweden. Bottom panels (b) and (c) of Figure 2 plot relative wage percentiles, defined as the earnings at a particular percentile of the finance distribution divided by the earnings at the same percentile of the non-finance distribution. Kaplan and Rauh (2010) and Bell and Van Reenen (2013) show that in the U.S. and U.K., the increase in relative finance

[12]While male relative finance wages rose most strongly during the 1990s, there is still a rise in the 2000s (a time when overall male wage inequality in Sweden had ceased to increase, see Edin et al., 2022).

wages was particularly dramatic at the top of the income distribution. Again, the Swedish evidence is similar: as the median relative wage increased from around 110% to 130%, the 99th percentile rose from 150% to above 250%. While these results imply that the wage distribution within finance widened compared to non-finance, there is still a significant increase in relative finance pay across the whole distribution.[13]

We provide additional analyses in the appendix to show that these patterns are robust. Appendix B shows that the results are similar across different wage measures and that they are not simply due to rising living costs in Stockholm (the largest financial center). Relative wages is seen to have increased across all subsectors of finance in Table B.1. Since the finance sector is known for high working hours, there may be a concern that the rise in relative wages reflects an increase in the number of hours worked and possibly an increasing compensating wage differential. Figure B.3 however suggests that the working hours in finance for full-time workers (40 hours or more) have not increased relative to the rest of the economy over our sample period, neither for Sweden nor for the U.S.[14] Overall, it seems that increasing working hours would not substantially account for the rising relative wages in finance. Finally, Appendix D shows that finance pay has still increased when restricting the comparison to other high-skilled sectors, such as law, consulting, and accounting (LCA) and information technology (IT), with a substantial finance wage premium relative to these sectors as well.

In sum, our results show that wages in the Swedish finance industry have risen dramatically compared to the real economy since the mid-1980s. Trends are very similar to what has been documented for the U.S. and the U.K. Although the relative wage increase is most pronounced among top earners, it is present across the income distribution and across the different segments of the finance industry.

3 Talent and Finance Wages: Theory and Predictions

A vast literature has documented that the wages of skilled workers (typically classified by having higher education) have increased relative to unskilled workers over the last several

[13]The rise in top finance wages can also be illustrated by considering the representation of finance workers in the highest percentiles of the income distribution (see Kaplan and Rauh, 2010, 2013; Bakija et al., 2012; Bell and Van Reenen, 2014; Lemieux and Riddell, 2015). For Sweden, the share of finance workers among the 0.1 percent highest earners rose from 14.7% to 31.1% during the 1990–2014 period. This compares to an increase from about 17% to 31% between 1981–1985 and 2008–2012 for the US.

[14]For these analyses we make use of Swedish Labour Force Survey (SE-LFS) and U.S. CPS data. The figures look very similar when we condition on workers who work at least 30 hours or 32 hours per week.

decades in many countries. Since educational attainment has also increased over this period, this suggests that the relative demand for skilled labor in the economy has risen. A leading explanation for this trend is that new technology has disproportionately raised the productivity of skilled workers compared to unskilled workers, so-called *skill-biased technological change (SBTC)*. As Acemoglu and Autor (2011) explain, the canonical SBTC model can account for many observed patterns in the wage distribution, such as changes in returns to schooling over the last 100 years (see Goldin and Katz, 2008).[15]

Philippon and Reshef (2012) suggest that increasing returns to skill or talent can also help to explain the surge in relative finance wages in the U.S. since 1980. They argue that finance jobs have become more complex following deregulation, which would imply that the relative productivity of skilled workers in finance has increased. Along similar lines, Kaplan and Rauh (2010) argue that new technology has enabled the most productive finance workers to apply their talents to a larger capital base, giving rise to superstar effects (Rosen, 1981) and particularly high wage increases at the top of the talent distribution (similar to Gabaix and Landier (2008)'s explanation for the rise in CEO compensation). A faster productivity increase of talented workers in finance compared to other sectors should raise the relative demand for talent in finance. This increased demand would in turn drive up relative wages for more talented finance workers, both compared to less talented workers in finance and to similarly talented workers in other sectors. The first part of our paper examines the importance of this Talent-Competition Hypothesis in the data.

Most of the previous literature use education as a measure of skill. In contrast, our main focus will be on cognitive and non-cognitive test scores, which we refer to as *talent*. An advantage of using talent is that it is determined before the individual decides on a career path and makes investments in sector- or firm-specific human capital. This circumvents the problem of education being endogenous to career choice, and allows us to better quantify the extent of "brain drain" of talented individuals into finance at the expense of other sectors (as in Baumol, 1990; Murphy et al., 1991). Educational attainment also changes in the population over time, making it more difficult to draw conclusions about trends (see Lemieux, 2006). That said, education is an important way for individuals to acquire productivity-enhancing skills. We will also examine the composition and returns to education in finance over our sample period,

[15] Acemoglu and Autor (2011) also argue, however, that the canonical model needs to be extended by adding endogenous assignment of skills to tasks, in order to explain other salient patterns, such as job polarization.

keeping these caveats in mind.

Apart from talent and education, there could of course be other traits that affect the productivity of finance workers. Moreover, some of the skills that are important for finance jobs might only be acquired or discovered on the job (as in Gibbons et al., 2005; Terviö, 2009). Nonetheless, it seems plausible that talent is at least positively correlated with such skills, and/or makes it easier to acquire them over time, in which case talent demand should also increase as other relevant skills become more productive. Hence, we believe that our talent measures are relevant for addressing the demand for skilled workers more broadly.

Appendix C contains a simple two-sector model of talent selection under competitive and frictionless labor markets, which we use to formally derive testable predictions from the Talent-Competition Hypothesis. The predictions can be summarized as follows:

Prediction 1. *If (a) the relative productivity of talent increases faster in the financial sector compared to the rest of the economy between time* $t = 0$ *and* $t = 1$*, and (b) the employment share of the financial sector in the economy is not increasing, then the average talent level of finance workers will increase between* $t = 0$ *and* $t = 1$ *relative to other sectors.*

If the productivity of more talented workers (compared to those less talented) is increasing faster in finance, the demand for talent increases more in finance than in other sectors, and the finance sector ends up hiring more talented workers. If the finance sector employment share remains the same, this leads to a replacement of less talented workers with more talented workers, and average talent should increase. If the finance sector were to grow at the same time, there might not be any improvement in average talent, however, since firms may have to move down the talent supply curve in order to fill an increased number of positions. As we showed in Section 2, the employment share in finance has been roughly constant over the period we study (both in Sweden and the U.S.).[16] The Talent-Competition Hypothesis thus predicts that average talent should have increased in finance relative to other sectors.

We can also formulate this prediction in terms of employment choice probabilities.

Prediction 2. *If the relative productivity of talent increases faster in the financial sector compared to the rest of the economy between time* $t = 0$ *and* $t = 1$*, then the likelihood of a more talented worker entering finance will increase more between* $t = 0$ *and* $t = 1$ *compared to a less talented worker.*

[16] In general, the Talent-Competition Hypothesis does not imply whether employment in finance should grow or decline (see also the formal model in Appendix C).

We test these two predictions in Section 4.

If the Talent-Competition Hypothesis is true, the increase in relative finance wages documented in Section 2 results from a combination of more talented (and thus more highly paid) workers entering the finance sector, and an increase in the relative wage of more talented workers. This has two implications (formally in Appendix C.2).

Prediction 3. *If the relative productivity of talent increases faster in the financial sector compared to the rest of the economy between time $t = 0$ and $t = 1$, and the average talent level of finance workers therefore increases as in Prediction 1, then part of the increase in relative finance wages will be due to that improved talent selection.*

We will test this prediction using wage regressions in Section 5.

Finally, if the Talent-Competition Hypothesis is true, the average finance wage premium (i.e., the relative wage differences that remain after controlling for talent and skill) should be driven by wage increases among the most talented finance workers.

Prediction 4. *If the relative productivity of talent increases faster in the financial sector compared to the rest of the economy between time $t = 0$ and $t = 1$, then the relative wage of talented workers in finance will increase between $t = 0$ and $t = 1$, and this relative wage change will be increasing in the talent level.*

This prediction is essentially what Célérier and Vallée (2019) tested for a sample of French engineers, using the entry exam score needed for acceptance at a given engineering program as a measure of talent. In Section 5, we analyze this relationship using unique measures of cognitive and non-cognitive abilities available for a large fraction of the Swedish population. We also study the finance premium by level of education and for differently skilled occupations.

Note that these predictions are only necessary but not sufficient conditions for relative finance wages to have risen due to talent-competition. For example, even if relative productivity of talented workers in finance is not increasing, but the potential to earn rents in the sector is, we might still expect that the most talented workers are drawn to the sector to capture these rents, along the lines of Murphy et al. (1991). Hence, while failing to support these predictions leads to a rejection of the Talent-Competition Hypothesis (and theories with similar implications), a confirmation of the predictions would not necessarily rule out such other explanations.

4 Has the Finance Industry Become More Talented Over Time?

In this section, we examine the evolution of talent in finance over time, both relative to the private sector as a whole as well as to other high-skilled sectors.

4.1 Data on Talent

Our main source of talent data are military enlistment tests, which were mandatory for Swedish male citizens before 2007. They were typically taken at the age of 18 or 19 with the purpose of evaluating an individual's potential for military service based on medical, physical, cognitive, and psychological traits. Lindqvist and Vestman (2011), Fredriksson et al. (2018), and Edin et al. (2022) provide further details on this data.

Our first talent measure is an individual's cognitive ability score (similar to IQ). Cognitive ability was assessed through subtests covering logic, verbal, spatial, and technical comprehension. The four test results were aggregated into an overall integer score ranging from 1 (lowest) to 9 (highest), according to a Stanine (standard nine) scale that approximates a normal distribution with a mean of 5 and standard deviation of 2.[17] The second talent measure, the non-cognitive ability score, was assessed through a 25-minute semi-structured interview by a certified psychologist. The subject was graded on his willingness to assume responsibility, independence, outgoing character, persistence, emotional stability, and power of initiative. The psychologist would weigh these components together and assign an overall non-cognitive score on a 1 to 9 Stanine scale. Individuals who scored sufficiently high on the cognitive test would also be evaluated for leadership ability, again on a 1 to 9 Stanine scale. The leadership score is meant to capture the suitability to become an officer. Since leadership was only assessed for a subset of individuals, we focus on cognitive and non-cognitive ability in our analysis.[18]

As military enlistment scores are only consistently available for men, much of our analysis focuses on male workers. To make comparisons across gender, however, we also construct an alternative talent measure based on high-school grades. Since high school programs vary in length and difficulty, we regress, for each high-school graduation year separately, the cognitive score of males on a third order polynomial of high-school grades interacted with high-school

[17] A score of 5 is for the middle 20 percentiles of the test taker population. Scores of 6, 7, and 8, are given to the next 17, 12, and 7 percentiles, and the score of 9 to the top 4 percent of individuals (scoring below 5 is symmetric).

[18] Non-cognitive ability and leadership ability are also highly correlated (Lindqvist and Vestman, 2011); in our data the correlation is 0.856, while the correlation of cognitive and non-cognitive is 0.357. Cognitive ability in turn is more strongly correlated with education (see Edin et al., 2022, and also Footnote 38).

track and age at graduation. The predicted score has a correlation of 0.644 with the actual cognitive score. We use these estimates to calculate predicted cognitive ability for both genders. We standardize this to percentiles (1 to 100) within each graduation year and for each gender, to account for possible grade inflation and the fact that females have higher grades on average.

Appendix A provides summary statistics of all the talent measures as well as the other main variables used in the analysis. Military test scores are consistently available for almost 90 percent of males across most birth cohorts in our sample. Availability of high-school grades increases for more recent cohorts and reaches 80 percent for individuals born after the early 1970s.[19] The appendix explains why deliberate underperformance on the military tests is unlikely a major concern for our study. It also shows that the relationship between the military test scores and high-school grades is strong and largely stable across birth cohorts.[20]

While cognitive and non-cognitive talent at the individual level may be influenced by human capital investments (e.g., Heckman et al., 2006; Carlsson et al., 2015), a key strength is that the distribution in the population is stable over time. Results based on cognitive and non-cognitive test scores are thus robust to compositional changes.[21] Talent is also largely exogenous and predetermined to career choices, since it is measured before individuals enter post-secondary training or the labor market, and it is sufficiently granular to study the tails of the ability distribution. These are critical advantages over alternative measures such as education. Importantly, the talent scores have been shown to significantly predict future labor market outcomes, such as wages and unemployment, in previous research (e.g., Lindqvist and Vestman, 2011; Edin et al., 2022). We verify that cognitive, non-cognitive, and predicted cognitive ability are significant predictors of wages in our sample (Appendix Table A.3).[22]

[19]This is partly because individuals with only lower secondary education, who often hail from older cohorts and completed the "Folkskola" (people's schools) that existed until 1972, do not have high-school grades by definition. In 1990, 29% of males and 25% of females in our sample had this lowest level of education, while in 2017 this was down to 11% and 6% respectively (Figure D.6). Because of the missing high-school grades, we cannot include females with only lower secondary education in our analyses that condition on talent (e.g., the wage regressions), which is another reason we focus on males and military enlistment scores.

[20]The availability of test scores gradually declines from the 1980s cohorts due to Sweden phasing out mandatory military service, but these cohorts are too young to affect our main results. See discussion in Appendix A.2.

[21]Appendix Figure A.1 shows that the distribution of talent measures is stable over the sample. This allows us to select a specific talent percentile of interest and compare it over time. The stability of the military test scores is ensured by standardization within cohort by the enlistment authority. In addition, the underlying distribution of cognitive ability may be quite stable over time as well. While Flynn (2000) reports improvements in intelligence during the mid-20th century, these gains are likely to have petered out for most of the individuals in our sample: Sundet et al. (2004) find that 18-year-old Norwegian male conscripts born after the mid-1950s had rapidly decreasing gain rates with a complete cessation of the Flynn effect for birth cohorts after the mid-1970s. Similar findings exist for Danish conscripts and for Swedish 13 year olds born 1947-1977 including girls.

[22]Edin et al. (2022) show that the wage return to non-cognitive talent has increased over time while the return to cognitive talent has declined since the turn of the century, similar to the U.S. (e.g., Deming, 2017). Aghion

4.2 Evolution of Average Talent in Finance

We start by examining the evolution of relative talent, defined as the difference in average talent between finance and non-finance workers. Figure 3 plots relative talent in finance for workers of all ages. We observe that relative talent is positive across all years and talent measures, showing that finance workers are more talented than other private-sector workers on average. The difference, ranging from 0.66 for leadership to 0.85 for cognitive ability, corresponds to above a third of a standard deviation. Although this implies that finance is a high-talent profession, Appendix D.1 shows that workers in the law, consulting, and accounting (LCA) and information technology (IT) sectors have even higher cognitive ability.

The main prediction of the Talent-Competition Hypothesis is concerned with the evolution of talent over time, however. First, according to Prediction 1, if the rise in relative finance wages were driven by an increase in the relative productivity of talented workers, relative talent of finance workers should have risen concurrently. As seen in Figure 3, this prediction is not supported by the data. For males, relative talent is flat or decreasing over our sample period for cognitive, non-cognitive, and leadership ability. For females, using grade-based predicted cognitive ability, we do not find any evidence of an increase in talent either.

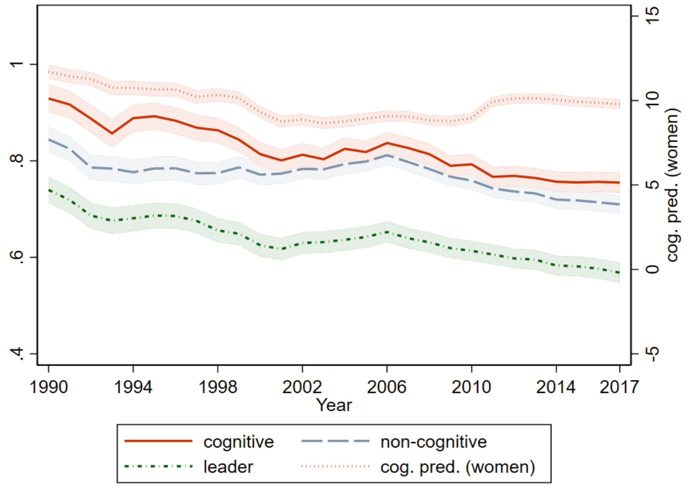
In Appendix D.1, we show the corresponding results for 30 year old males, since a change in relative demand for talent should be the easiest to detect in this subsample of recent entrants.[23] We find that relative talent was actually higher in 1990 than in 2017 for all three measures, opposite to the prediction of the Talent-Competition Hypothesis. The appendix further shows that finance talent has not increased relative to the high-talent LCA sector either, despite finance wages having increased significantly relative to this sector. Relative to workers in the IT sector, there is only a minor catch-up of talent in finance, despite a tripling of employment in IT during the 1990s (while the employment share in finance remained constant).

Second, to test Prediction 2, we run regressions analyzing the choice of a male worker entering the financial sector. We focus on the subsample of 30-year olds in order to capture recent entrants and to ensure that every individual enters the sample only once. Table D.1 in the appendix displays the regression results. While an individual's choice to enter the finance sector is positively related to both cognitive and non-cognitive talent, the effect is if anything

et al. (2017) further show that cognitive military test scores similar to ours strongly predict whether an individual becomes an inventor in Finland, a different indicator of productivity.

[23] As we report in Section 7, the majority of finance workers have entered the sector by age 30.

Figure 3. Relative talent in the financial sector



Notes: The figure shows the evolution of relative talent in finance, i.e., average talent in finance minus the corresponding average in the rest of the economy, during 1990–2017. The left y-axis displays the relative talent for cognitive, non-cognitive, and leadership ability for men, while the right y-axis displays predicted cognitive ability for women. Sources: Swedish population data LISA, Swedish Military Archives and Defence Recruitment Agency, Swedish High-School Register. 95 percent confidence intervals are shaded.

decreasing over time. When including years of schooling, cognitive ability no longer predicts entry into finance, showing that finance workers are not more cognitively talented than others given their level of education (in contrast with LCA and IT sector workers).

Hence, we do not find support for the entry prediction of the Talent-Competition Hypothesis either: while the impact of relative education for entering finance seem to have risen (which we return to below), we do not find that more talented workers have entered the sector over time despite the rise in relative wages. Appendix Table D.2 shows corresponding patterns for women, using predicted cognitive talent based on high-school grades. Similar to males, female workers entering finance are more talented on average compared to other sectors, but this difference has decreased over time even though relative wages have increased.

Robustness: Migration of talented finance workers. Major financial centers, such as London or New York, attract a significant number of foreign workers. Boustanifar et al. (2018) show that the wage gap in finance between two countries predicts emigration of financial workers from the lower- to the higher-wage country, and that this is particularly strong for skilled (defined as university-educated) workers. Our analysis might thus not detect an increase in talent intensity if the most talented Swedish finance workers increasingly migrated abroad. In

Appendix D.4 we make use of Statistics Sweden's Migration Register to identify emigrants and add them back to our sample for the years they stay abroad. Figure D.8 reveals that the relative talent distribution in finance remains essentially unchanged, and there is still no increase in the representation of individuals with high cognitive and/or non-cognitive talent. The group of finance emigrants is relatively small and thus only has a minor effect on the overall talent distribution. In addition, while finance emigrants tend to be more talented, the relative finance versus non-finance share emigrating from each talent level has been fairly constant over time.

4.3 Evolution of Top Talent in Finance

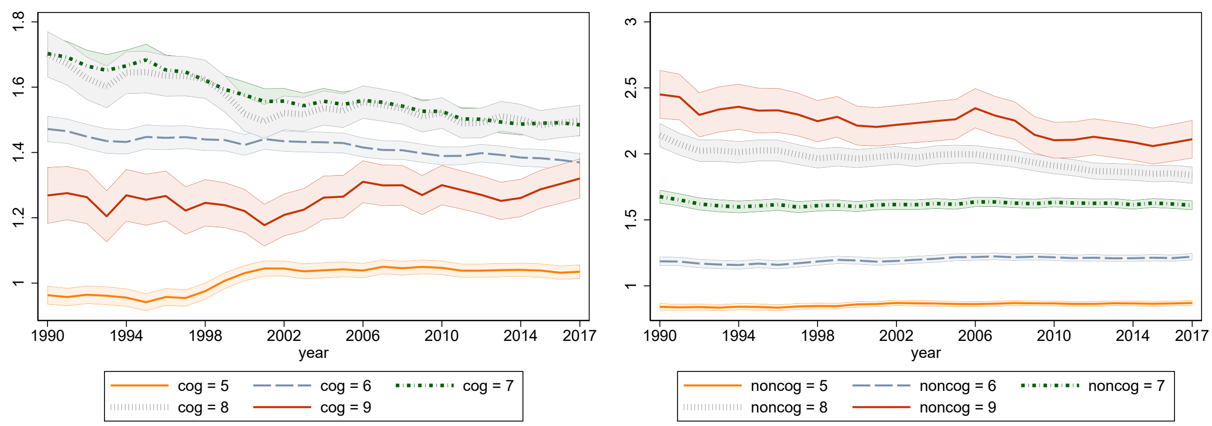
Kaplan and Rauh (2010) argue that technical change has particularly benefitted the productivity of "superstars" (Rosen, 1981) and attribute much of the increase in relative wages for finance workers (as well as CEOs, lawyers, and athletes) to rising compensation levels among the exclusive group of top talents. An increase in top talent might not necessarily lead to an increase in average talent if there is a concurrent increase in the fraction of lower-talent workers. Previous research on job polarization suggests that this might indeed be the case (see Acemoglu and Autor, 2011). As shown by Autor et al. (2008) and others, the replacement of workers involved in routine tasks by computers has coincided with an increase in the demand for both abstract tasks (which require relatively high-skilled labor) and service tasks (which only require relatively low-skilled labor).[24] This suggests that the rise of finance wages might be driven by an increased demand for superstars who can perform abstract tasks, with average talent still remaining constant due to an offsetting decrease in the demand for mid-talent workers performing routine tasks.

In Figure 4 we plot the relative share of each talent group in the financial sector compared to the rest of the economy for male workers with median talent scores and above. Top cognitive talent, i.e., with score 9, represent roughly five percent of finance workers, as opposed to four percent of the working population overall, resulting in a ratio of 1.2. While this shows that top cognitive talent is overrepresented in finance, the ratio has remained more or less constant over our sample period (except for a slight uptick during 2015–2017, when the finance wage premium was actually declining). The cognitive talent groups that are the most overrepresented are the 7s and 8s, but the relative representation of these groups in finance has fallen over

[24]Several papers, including Böhm (2020), have shown that cognitive ability is higher among workers performing abstract tasks, while non-cognitives correlate positively with both abstract and service tasks.

Figure 4. Relative distribution of talent in the financial sector

(a) Cognitives (b) Non-cognitives



Notes: The figure shows the evolution of relative shares of medium and high talent levels in the financial sector during 1990–2017. Relative shares are calculated as the share of individuals with a specific talent level in finance divided by the corresponding share in the rest of the economy. Panel (a) employs cognitive ability as a talent measure, while Panel (b) uses non-cognitive ability. Sources: Swedish population data LISA, Swedish Military Archives and Defence Recruitment Agency, High-School Register. 95 percent confidence intervals are shaded.

time. In contrast, the talent group whose representation has increased the most is the median cognitive talent (5s), speaking against the superstar hypothesis.

Turning to non-cognitive ability, top talent (9) comprise a much higher fraction of male workers in finance (around 5% in 1990) compared to the rest of the workforce (2% in 1990). The concentration of top non-cognitive talent in finance has decreased over time, however, from a ratio of 2.5 in 1990 to just above 2.0 in 2017. There is also a modest decrease in the relative share of 8s, the second most talented group.

Appendix Table D.1 reports linear probability choice regressions predicting entry into finance for 30-year old male workers using dummies for bottom (omitted), upper middle (scores 5–8), and top (9) talent groups, interacted with the time period. The regression results confirm the patterns in Figure 4, showing no indication that the coefficient on top talent is increasing over time, despite a large increase in the finance premium during this period. Results for females in Appendix Table D.2 are similar. All in all, we find no support for the hypothesis that top talent has increased in the financial sector compared to other sectors, inconsistent with an increased demand of "superstar" workers driving the rising relative wages in finance.[25]

[25] In Appendix Figure D.4 we show another test that could potentially uncover superstar effects, namely the evolution of average talent among the very top earners in finance. Although the average cognitive, non-cognitive, and leadership talent of top 5% and 1% earners in the finance sector is high (about a standard deviation above the mean of the population), it is not increasing over time. In terms of *relative* talent, we find that finance workers are

4.4 Education as an Alternative Measure of Skills

Most studies on wage premia have used education as a proxy for worker skill, rather than the talent measures we use. Philippon and Reshef (2012) show that the increase of the finance premium in the U.S. has coincided with an increase in the education level of finance workers relative to the rest of the economy. Boustanifar et al. (2018) find that this relationship is present in a broader sample of developed countries. The choice regressions in Appendix Table D.1 indicated a rising role for years of schooling to predict finance entry also in our Swedish data.

Figure D.6 provides a more detailed analysis of the relative shares of different education levels (lower secondary education, high-school graduate, some college, university graduate, and doctorate studies) in finance over time. It shows that the fraction of male finance workers with a university degree went from ten percentage points higher in 1990 to 24 percentage points in 2017, relative to the rest of the economy. Correspondingly, the relative fraction of university among females in finance increased from minus five to plus four percentage points. The increase in relative education was not monotonic, however, as the relative fraction of lower secondary among males in finance actually increased from -18 to -8 percentage points.[26]

Although these results seem consistent with education upgrading in finance, the evidence is at best suggestive. Relative education is difficult to compare over time, since the fraction of individuals with a university degree has increased significantly in many countries, including the U.S. In addition, the level of education is partly endogenous to an individual's sector choice. Many finance jobs that in the past were dominated by workers with only a high-school degree increasingly require some college training or a completed university degree. Figure D.6 shows that during 1990–2017, university attainment in Sweden rose from 10% to 21% for males and from 12% to 32% for females. The general education upgrading was accompanied by declining ability within each of the attainment levels. For university graduates, (predicted) cognitive ability declined by around a third of a standard deviation among both men and women.

Carneiro and Lee (2011) as well as Bowlus et al. (2017) present related composition effects for the U.S., showing that higher college attainment leads to a decline in the average quality of graduates. Hence, the fact that relative education is rising is not necessarily a sign that actual

significantly more talented than top earners in the economy as a whole, but less cognitively talented than if we restrict the comparison to the LCA and IT sectors.

[26]Since there was a secular decline of these least educated workers (who were mostly from older cohorts), and few of them worked in finance to begin with, at least part of this decline is mechanical. This points to the general problem of interpreting changes in relative education when the underlying distribution of education is changing for the overall population.

relative ability (e.g., measured as cognitive talent) has been increasing in the finance sector.[27] In Section 5.3, we instead control for direct compensation of education in our wage regressions.

Robustness: Top university graduates. As an alternative measure of top talent, a number of papers have considered graduates from highly selective "elite" universities. Goldin and Katz (2008), Oyer (2008), and Célérier and Vallée (2019), respectively, find that a higher fraction of Harvard undergraduates, Stanford MBAs, and French engineering graduates went into finance over time. To relate to these findings, we examine whether there was a similar increase in the fraction of top graduates entering finance. By restricting attention to top graduates in each cohort, this analysis might also be less sensitive to the overall trends in educational attainment.

Due to the structure of Swedish higher education, elite universities are not as easily identified as in the U.S. or France in our data. In Appendix D.4 we therefore define top graduates as university graduates with a top cognitive score of 9. The most common university major for finance workers is business, where 20% of top graduates enter finance after graduation. We find no clear evidence that this share increased together with the finance wage premium over time. Similar to Célérier and Vallée (2019), we observe a steady rise in the fraction of top engineering graduates entering finance, from around 1% in 1990 to 3% in 2014. Although this is large in relative terms, the economic magnitude is fairly modest.[28] Appendix Figure D.9 also finds a significant decline in average non-cognitive and leadership ability for the sample of university graduates with top cognitive scores. This shows that even when restricting attention to top graduates, it is still somewhat difficult to draw definite conclusions about skill upgrading due to the change of educational attainment in the underlying population.

5 Talent and Wages in the Financial Sector

Even though we do not observe that worker talent has increased in finance, it does not rule out the possibility that the rise in finance wages is driven by increased worker productivity. This could happen if, for example, the supply of talented labor was not very responsive to changes in relative wages across sectors. To identify whether relative wage changes are due to changing

[27] In Appendix D.3 we focus on U.S. males born during 1950–1969, since there was no increase in overall educational attainment for these birth cohorts and thus likely no changing composition effects. Restricting the sample to these cohorts, there is no rise of relative education in U.S. finance over time while relative wages strongly increased.

[28] To put this in perspective, the fraction of top engineering talent going to the IT sector increased from less than 10% in the early 1990s to about 20% in 2014, while the fraction entering manufacturing decreased from 30% to about 15% over the same period.

productivity of talent is challenging, however, due to the likely self-selection of workers based on unobservable characteristics. In Appendix C.2 we show that the relative finance wage can be decomposed into parts due to observable and unobservable selection, the overall return to talent, a finance-specific return to talent, and a residual wage premium. We also measure the contribution of rising education levels in finance. To disentangle these parts, we split our empirical analysis into separate steps.

We begin by regressing wages on our talent measures controlling for gender and work experience (Prediction 3 of the Talent-Competition Hypothesis). We also allow for economy-wide changes in the return to talent or experience. We then include person and person–job fixed effects to control for time-invariant and sector-specific unobservable components of skills. The next step allows for time-varying finance-specific returns to talent (Prediction 4). Finally, we examine the additional explanatory power of increasing relative education in finance. In addition to these analyses, we compare the evolution of relative wages across different occupations in finance that are likely to differ in their finance-specific skill requirements.

5.1 Wage Regressions with Talent and Fixed Effects

Figure 5 plots the finance premium that remains after controlling for talent and other characteristics in wage regressions for the subsample of male workers (Prediction 3). Appendix Figure E.1 shows corresponding (and similar) results for the subsample of female workers.

Panel (a) of Figure 5 plots three versions of the remaining relative finance wage ($\exp(\hat{\tilde{a}}_t)$) after accounting for control variables in the following wage regression:

$$\log(w_{it}) = a_t + \tilde{a}_t F_{it} + b'\theta_i + \boldsymbol{c}'\boldsymbol{X}_{it} + v_{it}, \tag{1}$$

where $\log(w_{it})$ is the log wage of individual i at time t, F_{it} is an indicator for whether individual i works in the finance industry at time t, θ_i is observable talent for individual i, $\boldsymbol{X}_{it}$ is a vector of control variables, and a_t is a time fixed effect. $\tilde{a}_t$ captures the part of relative finance wages that is not explained by talent and other control variables. The solid red line shows the relative wage among males with non-missing test scores, controlling for a quadratic in potential experience (defined as age minus years of education minus 6). Over our sample period, this premium increased from slightly above 20 to more than 50 percent.[29] The dashed blue line plots the

[29]Conditioning on having data on talent and other controls reduces the sample of male workers from 49 million

relative finance wage after controlling for a linear in cognitive and non-cognitive talent θ_i in addition to potential experience. Talent explains roughly 10 percentage points of the premium for men, but the increase in the relative wage does not disappear despite finance workers being more talented on average.

We then include time-varying (but not sector-specific) returns to observed talent, i.e., b_t and c_t are allowed to vary with t (year dummies). Previous research has established that the returns to skill have increased in most Western countries over the last couple of decades, motivating the skill-biased technical change hypothesis (Katz and Murphy, 1992; Acemoglu and Autor, 2011). Since we have shown that finance attracts relatively high-talented individuals, rising returns to talent in the overall economy should account for at least part of the increase in relative finance wages. The dotted green line in Figure 5a plots $\exp(\hat{\hat{a}}_t)$ with these time-varying coefficients for talent and experience. While the line becomes a little less steep, time-varying returns to talent explain only a fraction of the overall increase in relative finance wages[30]

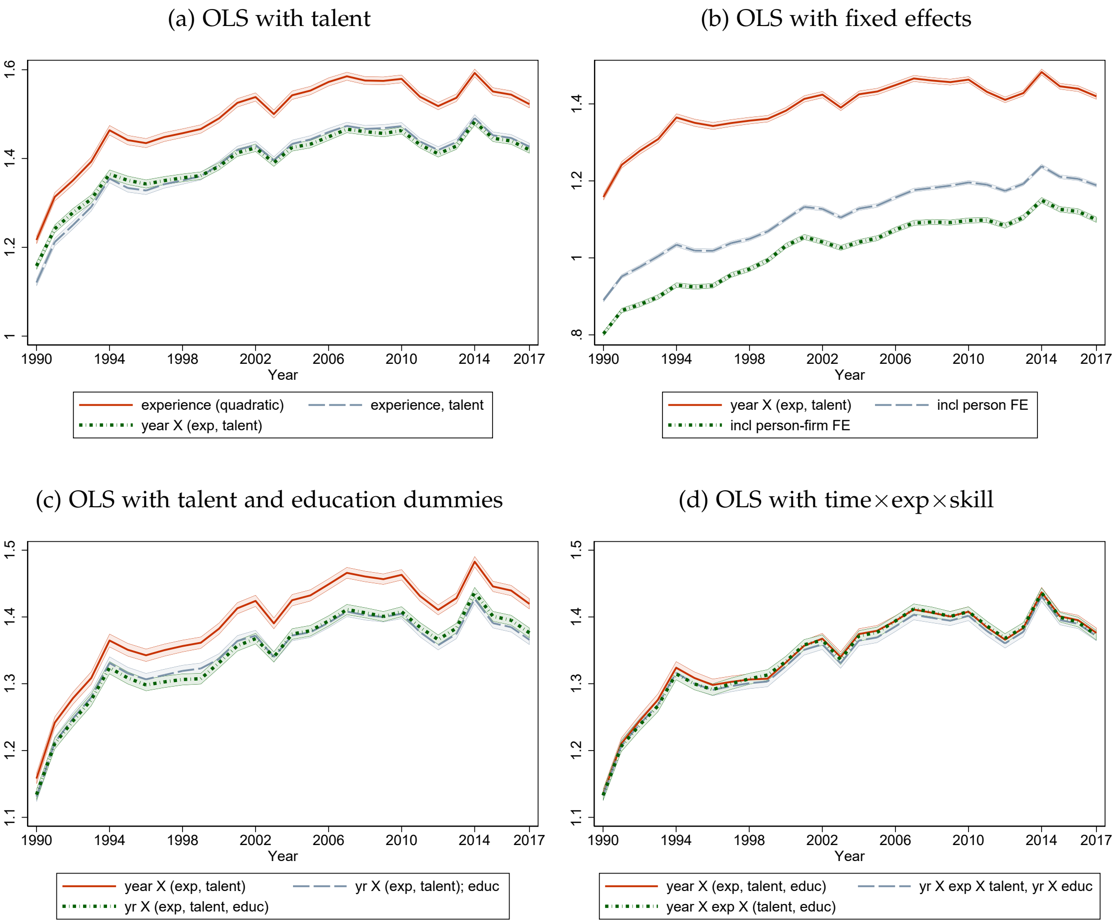
Next, we add person, person–sector, and person–firm fixed effects (λ_i, λ_{ik}, and λ_{im}, with m indicating a worker's firm) to the specification in (1). Person fixed effects account for all time-invariant components of worker skills that affect wages, even unobserved ones that are uncorrelated with our talent measures. We also employ person–sector fixed effects to control for workers' specific skills. This specification identifies the changing finance premium from differential wage growth of stayers in finance and non-finance over time, consistent with a recent literature that uses stayers' wage growth to estimate changes of industry- or occupation-specific wage premia (e.g, McLaughlin and Bils, 2001; Cortes, 2016; Cavaglia and Etheridge, 2020; Böhm et al., 2021). Finally, our employer–employee data also permits including person–firm fixed effects, which can account for time-invariant employer-specific skills or job-match effects.[31] Identification in this specification derives from differential wage growth of stayers

to 28 million individual-year observations, primarily due to missing data for older cohorts (see also Table A.1). Nonetheless, the increase in relative finance wages remains very pronounced, as seen from Figure 5.

[30]Section D.1 in the appendix corroborates this result by showing that finance wages strongly increased compared to LCA as well as IT; sectors which attract workers who are equally or more talented than finance.

[31]To identify firms, we use organization numbers from the Swedish organization registry. Since sectors are determined by the establishments where an individual works, and establishments are sub-units of organizations, person–sector and person–firm fixed effects capture somewhat different notions of specific skills and yield slightly different results. In particular, there can be workers in finance and non-finance in the same firm at a given point in time if they are in establishments with different activities. This does not happen often but a level of the finance premium is therefore (mechanically) identified when we use person–firm fixed effects. Regardless, neither finance-specific nor firm-specific skills can account for the rising relative wages in this sector (see Table 1). While they give the same results, we focus on firm- rather than establishment-specific fixed effects here because rent sharing in Section 6 will need to be analyzed at the firm level.

Figure 5. Relative finance wages after regression controls (males)



Notes: The figure in Panel (a) shows the relative finance wage ($\exp(\hat{a}_t)$) that remains after controlling for observed and unobserved skills and other variables in linear regressions. Results are shown for three different models: (i) controlling for (quadratic in potential) experience, (ii) controlling for experience and linear in cognitive and non-cognitive talent, and (iii) interacting those with time (year dummies). The sample consists of male workers for whom talent scores are available. Panel (b) adds individual fixed effects and person–firm fixed effects to (iii). Panel (c) adds dummies for detailed education levels and then also interacts them with time. Panel (d) allows for the fully flexible interaction of time, experience, and talent as well as education. Sources: Swedish population data LISA, Swedish Military Archives and Defence Recruitment Agency. 95 percent confidence intervals are shaded.

within finance versus non-finance firms. A general limitation of these specifications is that they assume switches to be exogenous to changes in workers' unobserved skills (or employers learning about such skills) over time. Nonetheless, the results are informative about the importance of individuals' general and finance-specific skills for the trends in relative wages.

Panel (b) of Figure 5 takes the richest specification from the top panel (controlling for time-varying talent and experience), and then adds the person and person–firm fixed effects (the person–sector fixed effects are in Table 1). The residual relative wage is below one at the start of the sample period, suggesting that finance has a positive selection of workers both in terms of observable talent and unobservable characteristics. The increase in the finance premium over time is still present, however, and even somewhat steeper than before, indicating that time-invariant unobservables cannot account for the rise in relative finance wages either.

The four left columns of Table 1 summarize the results from regressions combining time-varying returns and fixed effects (for males, females, and both genders), i.e.,

$$\log(w_{it}) = a_t + \tilde{a}_t F_{it} + b_t' \theta_i + \boldsymbol{c}_t' \boldsymbol{X}_{it} + \lambda_{im} + v_{it}. \tag{2}$$

To make the table more readable, we split our sample into five-year periods, and we interact all regressors with these period dummies. In column (1), we see that the finance premium, controlling for talent, experience, and education, increased from 16–24 log points in 1990–1994 to about 26–36 log points towards the end of the sample. As noted before, men's increase in the 1990s was fast, especially during the initial period 1990–1994, whereas women's finance premium rose rather smoothly up until 2010–2014.[32] Controlling for person, person–sector, or person–firm fixed effects diminishes the level of the premium, but the increase remains and for male workers it becomes even steeper. This confirms the results from Figure 5 that Prediction 3 of the Talent-Competition Hypothesis is not borne out in the data.

5.2 Evidence on Sector-Specific Returns to Talent over Time

Even if a rising return to talent in the overall economy cannot explain the increase in relative finance wages, it could still be that the talent premium has been increasing more in finance compared to other sectors. This version of the Talent-Competition Hypothesis leads to Prediction 4, which posits that the increase in the relative wage should be higher for more talented (compared to less talented) finance workers. Testing this prediction is complicated due to selection on unobservables. Assuming that unobserved selection is constant over time, however, we can compare the change of relative finance wages across workers with different observed talent. This assumption is supported by our earlier finding that observable talent has remained

[32] Note that 36.2 log points premium for males in Table 1, column (1), in the last period fits with the respective values during 2015–2017 in Figure 5a (i.e., $e^{0.362} = 1.43$). The rise over time in the table only looks smaller than in the figure because using joint periods obscures some of the fast rising finance wage premium during 1990–94.

Table 1. Finance premium overall and by talent group (all ages)

Overall	(1)	(2)	(3)	(4)
Finance (log pts; male)	**24.0***	**−0.9**	—	**−11.8***
diff in 1995–99	6.2*	6.9*	7.2*	7.1*
diff in 2000–04	10.2*	15.0*	14.7*	15.3*
diff in 2005–09	13.6*	19.6*	18.4*	19.2*
diff in 2010–14	12.9*	21.9*	19.5*	21.2*
diff in 2015–17	12.1*	21.7*	19.0*	21.6*
Finance (log pts; female)	**15.5***	**0.7**	—	**−5.8***
diff in 1995–99	3.0*	2.7*	3.1*	4.2*
diff in 2000–04	6.4*	7.0*	6.7*	8.3*
diff in 2005–09	9.9*	10.2*	8.6*	10.9*
diff in 2010–14	10.8	11.6*	8.4*	11.9*
diff in 2015–17	10.5*	10.8*	5.5*	10.3*
Finance (log pts; both)	**17.7***	**−0.5**	—	**−8.4***
diff in 1995–99	4.0*	4.0*	4.3*	5.0*
diff in 2000–04	7.9*	10.3*	10.1*	11.2*
diff in 2005–09	11.4*	14.4*	13.2*	14.7*
diff in 2010–14	11.1*	16.6*	14.0*	16.3*
diff in 2015–17	10.7*	16.8*	12.6*	16.0*
Fixed effects	No	Person	Per–Sec	Per–Firm
Obs (million; male)	28.1	28.1	28.0	25.0
Obs (million; female)	21.6	21.6	21.6	19.0
Obs (million; both)	45.6	45.6	45.4	40.1

By talent group (males only)	(5)	(6)
Finance (log pts)	**22.5***	—
diff in 1995-99	2.2*	7.9*
diff in 2000-04	2.2	13.5*
diff in 2005-09	7.1*	16.9*
diff in 2010-14	9.9*	21.2*
diff in 2015-17	9.8*	20.8*
Fin × Mid cog (5–8)	**2.5***	—
diff in 1995-99	1.7	−1.2
diff in 2000-04	4.5*	−1.2
diff in 2005-09	2.7*	−2.9*
diff in 2010-14	1.1	−4.8*
diff in 2015-17	1.1	−4.9*
Fin × High cog (9)	**4.3***	—
diff in 1995-99	−1.0	−7.3*
diff in 2000-04	3.9	−8.3*
diff in 2005-09	0.7	−12.1*
diff in 2010-14	−5.4*	−18.3*
diff in 2015-17	−5.7*	−18.8*
Fin × Mid non-cog (5–8)	**0.4**	—
diff in 1995–99	3.9*	1.9*
diff in 2000–04	6.1*	5.1*
diff in 2005–09	6.4*	7.6*
diff in 2010–14	4.1*	6.3*
diff in 2015–17	3.3*	6.4*
Fin × High non-cog (9)	**10.2***	—
diff in 1995–99	3.9	0.4
diff in 2000–04	3.0	−2.2
diff in 2005–09	1.3	−2.5
diff in 2010–14	−0.1	−5.8
diff in 2015–17	−2.8	−6.5
Fixed effects	No	Per–Sec
Obs (million; male)	28.1	28.1

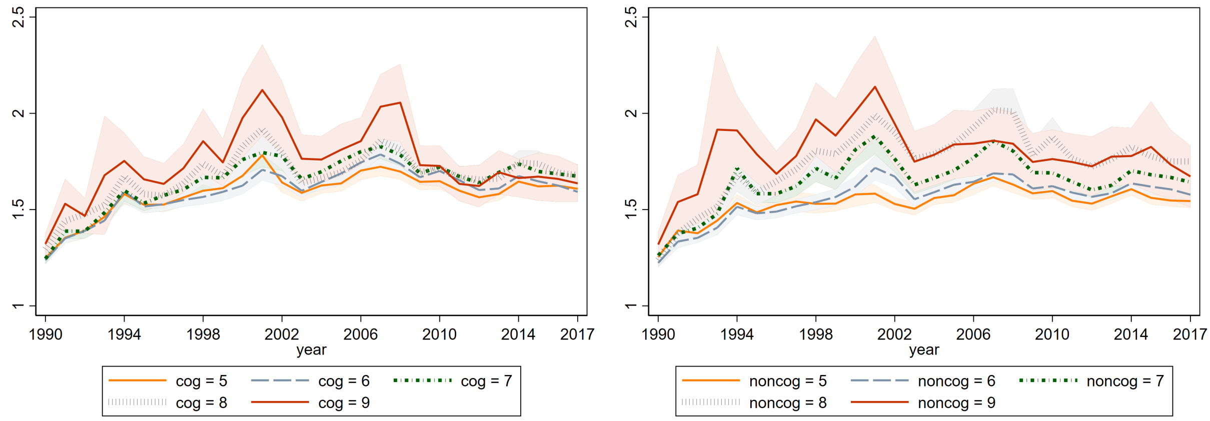
Notes: The table shows regressions of log earnings (multiplied by 100) on a finance dummy interacted with period dummies ("the finance premium in log points") for individuals of all ages. Always included as regressors are a quadratic in potential experience interacted with period dummies. The left panel uses as controls linear cognitive and non-cognitive talent (or predicted cognitive ability plus gender dummy as appropriate) interacted with period. It then adds individual (column 2), individual interacted with sector (column 3), and individual interacted with firm (column 4) fixed effects. The right panel computes the premium interacted with low (1–4; base group), (upper-)middle (5–8), and high (9) cognitive and non-cognitive talent groups for males. "—" indicates that this coefficient is absorbed. Robust standard errors clustered at the person level (not reported for brevity). * $p < 0.01$.

roughly constant in finance. We can then run a regression of the form

$$\log(w_{it}) = a_t + \tilde{a}_t F_{it} + b_t' \theta_i + \tilde{b}_t' (\theta_i \times F_{it}) + \boldsymbol{c}_t' \boldsymbol{X}_{it} + v_{it} \qquad (3)$$

Figure 6. Relative wages in the financial sector by talent group

(a) Cognitive ability (males) (b) Non-cognitive ability (males)



Notes: The figure shows relative finance wages by cognitive and non-cognitive talent group for medium and high talent males during 1990–2017. Relative finance wages are defined as the average wages in finance of the respective talent score divided by the average wages outside finance of the same talent score. Panel (a) shows results for cognitive ability and Panel (b) for non-cognitive ability. Sources: Swedish population data LISA, Swedish Military Archives and Defence Recruitment Agency. 95 percent confidence intervals are shaded.

and estimate the *changes* in the finance-specific return to talent and the residual wage premium from the differences in the coefficients, $\tilde{b}_t - \tilde{b}_0$ and $\tilde{a}_t - \tilde{a}_0$ (see Appendix C.2 for details).

We start non-parametrically. Figure 6 plots relative finance earnings for males by talent level from median talent and above (Stanine score 5 through 9), that is, $\tilde{b}_t^j = \mathrm{E}(w_{it} \mid F_{it} = 1, \theta_i = j) \ / \ \mathrm{E}(w_{it} \mid F_{it} = 0, \theta_i = j)$, for $j \in \{5, 6, 7, 8, 9\}$. If the return to talent has risen faster in finance than in the rest of the economy, we expect the differences across the talent levels to be increasing over time (i.e., the lines for the different groups should "fan out" to the right). Panel (a) shows results for cognitive talent. Relative finance wages for males line up roughly by cognitive talent, and the differences widen during market peaks (around 2000/01 and 2007/08), especially for the top cognitive talent group. The finance premium increases significantly over time across all talent groups. However, there is little indication that relative finance wages have increased faster for the more talented compared to mid-talented groups over the long run. These results are similar for non-cognitive talent (Panel b) and for females using predicted cognitive talent (Figure E.2 in the appendix).

Columns (5) and (6) of Table 1 present regression estimates of Equation (3) for males, controlling for a quadratic in experience interacted with the time-period dummies.[33] To account

[33]Controlling for age instead of experience yields virtually the same results throughout this section.

for potential selection on unobserved characteristics, the last column includes person–sector fixed effects. We again split workers into bottom (omitted), upper middle (scores 5–8 or percentile 41–95), and high (score 9 or percentile >95) talent. Column (5) shows that the finance premium for the bottom talent group rises by 9.8 percentage points over the sample. As seen in Figure 6, the difference in the finance premium for middle and high talent workers peaks in 2000–2004, but over the whole sample the premium does not rise significantly more for high-talent workers. When we include person–sector fixed effects in column (6), the finance premium relative to the bottom talent group decreases, except for middle non-cognitive talent, and the wage increase for the high cognitive talent group almost disappears. The results for females (Table E.1) are similar.[34] Overall, we find no evidence that returns to talent have risen more in the finance sector compared to the rest of the economy over the long run, inconsistent with Prediction 4 of the Talent-Competition Hypothesis.

5.3 Education and the Finance Premium

As was mentioned in Section 4.4, relative education levels in finance have increased in both the U.S. and Sweden. While our previous analyses indicate that changes in talent or unobservable skills cannot explain the rise in finance wages, it is still possible that the increase in education has raised productivity of finance workers (e.g., Card, 1999), leading to higher compensation levels. In this section, we therefore assess the extent to which changing relative education can explain the observed increase in the finance premium.

We first return to our graphical evidence from Figure 5 for males. As a baseline, the solid red line in Panel (c) shows the finance wage premium after controlling for time-varying returns to talent and experience. We then add controls for different education levels. This results in a downward shift in the premium (the dashed blue line) because finance workers are relatively more educated (also conditional on talent). While education accounts for a nontrivial share of the finance premium *level*, most of its *increase* remains. Allowing for time-varying returns to education does not have any additional effect on the finance premium (dotted green line).[35]

[34] We also constructed Figure 6 for Stanine scores 1 through 5 (not shown for brevity), finding again comparable and strong relative wage increases across talent levels. One illustrative fact from this was that finance wages of the least talented workers (cognitive score 1) are higher than average wages in the real economy in 2017.

[35] Appendix Table E.2 shows the detailed numbers underlying Figure 5. In the first step, *economy-wide* changes in talent returns can explain three log points of the finance wage premium's increase during 1990–2017. Adding education level dummies in Figure 5c further lowers the remaining increase of 20 log points to 19. Allowing the returns to vary over time explains no further share. Results for female workers (Figure E.1 and Table E.3) are similar.

Table 2. Finance premium by level of education

	Men		Women		Both	
	Baseline 1990–94	*Change 2015–17 vs. 1990–94*	**Baseline 1990–94**	*Change 2015–17 vs. 1990–94*	**Baseline 1990–94**	*Change 2015–17 vs. 1990–94*
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
(A) Full sample						
Controlling for talent × period	24.0*	*12.1**	15.5*	*10.5**	17.7*	*10.7**
Incl. years of school squared	20.5*	*11.4**	17.2*	*11.5**	18.3*	*10.5**
Incl. years of school squared × period	20.9*	*11.8**	17.3*	*11.1**	18.7*	*10.0**
Incl. education dummies	21.4*	*10.4**	16.4*	*11.8**	17.7*	*10.7**
Incl. education dummies × period	21.2*	*11.4**	17.5*	*10.5**	18.5*	*9.9**
(B) Each education level separately						
Lower secondary education	21.2*	*7.7**	—	—	—	—
High-school graduate	20.5*	*13.1**	18.1*	*12.7**	18.1*	*12.2**
Some college	15.8*	*10.3**	13.7*	*13.1**	15.5*	*9.5**
University graduate	28.9*	*7.1**	19.1*	*9.1**	25.6*	*6.1**
(C) Only versus specific sectors						
Control. for talent × period (relative to IT)	−3.6*	*18.1**	−11.0*	*10.3**	−6.9*	*15.9**
Incl. education dummies × period	−1.3*	*14.8**	−7.9*	*8.3**	−4.0*	*12.8**
Control. for talent × period (relative to LCA)	5.3*	*15.6**	0.7	*10.5**	1.9*	*12.0**
Incl. education dummies × period	14.1*	*8.9**	4.2*	*8.2**	8.2*	*7.3**

Notes: The table shows finance wage premia in 1990–94 and their changes to 2015–17 for males, females, and both genders together. These result from regressing log earnings (multiplied by 100) on a finance dummy interacted with 1990–94, 1995–99, 2000–04, 2005–09, 2010–14, and 2015–17 period dummies ("the finance premium in log points") for individuals of all ages. Always included as regressors are a linear in talent (cognitive and non-cognitive for males; predicted cognitive for females and both genders) and a quadratic in potential experience interacted with the period dummies. Panel (A) first includes education dummies (or quadratic in years of schooling) and then interacts them with period. Panel (B) conditions on separate education levels. Since final grades from high-school are not available for individuals with a lower secondary education (see Footnote 19) we cannot calculate the predicted cognitive score for this group and exclude them from specifications (3) through (6). Panel (C) repeats the richest top specifications but only keeps IT and LCA workers outside finance. Total sample sizes as in column (1) of Table 1. Robust standard errors clustered at the person level (not reported for brevity). * $p < 0.01$.

Panel (d), finally, shows the effect on the finance premium when we also allow the time-varying returns to talent and education to differ over a worker's life cycle. The baseline (solid red) is the richest specification from panel (c), with time-varying returns to talent and education. We then add the additional interaction of experience with talent only (dashed blue line), and with both talent and education (dotted green line). Panel (d) shows that the remaining finance premium is more or less unaffected when we allow for such life-cycle effects.

Table 2 summarizes and extends these results. The top panel shows the initial finance wage premium in log points and its change during our sample for males, females, and both genders together. The estimation specification is parallel to Table 1 (we only display 1990–1994 and 2015–2017 to save space). The top row repeats the baseline results from Table 1 when we controlled for time-varying returns to experience and talent, where the remaining increase in the finance premium amounted to 12.1 log points for males, 10.5 for females, and 10.7 for both genders pooled. In rows two and four, we control for education by including either a quadratic in years of schooling or education level dummies to the wage regression.[36] For males, education accounts for up to 1.7 log points of the increase in the finance premium, but has a minimal effect on females (or on the pooled estimates for both genders).[37] Allowing the returns to education to vary over time (specifications in rows three and five of Table 2), increases the explanatory power of education somewhat for females, but reduces it for males.[38] According to these estimates, then, education can explain at most 14% of the increase in the relative earnings of male finance workers after controlling for talent (from the specification in row four; a decline of $1 - \frac{10.4}{12.1} = 14\%$).

It could still be the case, however, that increasing returns to education in finance is present only for the most educated workers. Panel (B) of Table 2 shows that the finance premium increases strongly for workers with high-school education and some college education. For men with lower secondary education, the relative finance wage increase is smaller but also strongly statistically significant. While these patterns are consistent with increasing returns to education in finance, the finance premium for university graduates has increased less compared to workers with high-school or some college education. Hence, the increase has not been monotonic in the level of education, which would have been expected if rising productivity of more educated workers had been a main driver of the surge in relative finance wages.

Finally, we have discussed in Section 4.2 the talent comparison with the information technology (IT) and law, consulting, and accounting (LCA) sectors. Panel (C) of Table 2 shows that

[36]For precision, we pool university and doctorate degrees into one education level here. This is conservative in the sense that, with doctorate separately, the remaining finance premium increase would be 0.2 log points *higher*. The initially high finance premium among doctorates actually declines, though this change is not significant (and unreported) due to the few underlying observations. Using a quadratic in years of schooling is flexible and also conservative here (i.e., the unreported linear explains essentially none of the rising finance premium for males).

[37]Unconditionally, females' relative education in finance rises over time, but the correlation between education (especially the university dummy) and predicted cognitive ability rises as well. Therefore, conditional on talent, the relative education of female finance workers actually declines slightly over time. On the other hand, Appendix Figure E.1 and Table E.3 show that rising returns to talent can account for more of the relative finance wage increase for women than for men (although most of the increase still remains).

[38] This is due to the fact that, conditional on talent, males' measured return to education declines over time. Unconditionally, males' return to education is about unchanged over the sample period. Edin et al. (2022) have documented that, especially among males, returns to cognitive skill have declined in Sweden since the turn of the century. Beaudry et al. (2016) and Deming (2017) show related evidence for the U.S. Trends in our data are very much consistent with Edin et al. (2022); e.g., we find that cognitive talent and education are closely related and, when conditioning, the former's return change over time increases while the latter's decreases. Non-cognitive talent is less related to education and its return increases robustly over time. As we emphasized before, interpreting trends in education and its returns is made difficult by the strongly changing attainment/selection over time.

the finance premium rises strongly also compared to these other high-skilled sectors, and for males the wage increase is even larger than when we compared to the real economy as a whole in Panel (A). Differences in educational composition over time across sectors can account for part of this increase, especially for males (i.e., reducing the premium from 18.1 log points to 14.8 relative to IT and from 15.6 to 8.9 relative to LCA). Nevertheless, the unexplained rise in the finance premium is still substantial and of a similar magnitude as in Panel (A).

Overall, the estimates in Table 2 imply that changing education can account for 14% of the increase of relative finance wages for males, and none of the increase for females. In Tables E.2–E.3 we provide the year-by-year estimates displayed in Figure 5. Using these more granular estimates, changes in composition and return to talent and education together account for less than 20% of the finance premium increase between 1990–2017.[39]

5.4 Evolution of the Finance Wage Premium by Occupation

An alternative approach to address the Talent-Competition Hypothesis, which also speaks to the role of skills more generally, is to consider the evolution of talent and wages across different occupations in finance. If the increased finance premium was driven by a changing demand for skilled workers, the increase in relative pay should have been concentrated in professions that require a high level of talent and more specialized skills.

Table 3 reports relative wages, employment shares, and talent for the 30 largest occupations in the Swedish financial sector. Table E.4 in the appendix shows corresponding results for the U.S. (except for talent). In both countries, these occupations make up about 90 percent of finance employment in our sample. We focus on the years 1990 and 2010 for this analysis.[40]

In the first column of Table 3, occupations are ordered by their finance premium in 2010 compared to the average wage in the rest of the economy. Most of the top 30 finance occupations are also present outside of the financial sector, the exceptions being "Banking associate

[39] In Table E.2, relative finance wages for males increase by 23 log points between 1990 and 2017. Accounting for economy-wide changes in talent returns reduces the increase by three log points, adding education level dummies by another log point. Hence, the combination of talent and education can account for $1 - \frac{19}{23} = 17.4\%$ of the total increase of the male finance premium. Allowing the education returns to vary over time explains no further share. For females, the corresponding number is $1 - \frac{15}{17} = 11.8\%$ using the estimates in Table E.3.

[40] We employ 4-digit Swedish Standard Classification of Occupations (SSYK) codes, of which there are 354 unique codes. The reasons for focusing on these two years is that Swedish occupation codes are missing for the period 1991–2000, and that the classification of occupations changes in 2014. The choice of 2010 as ending year is arbitrary, but results are not sensitive to using any ending years between 2005 and 2013. We pool both genders in this analysis and therefore use predicted cognitive ability. Columns (11)–(15) also show cognitive and non-cognitive correlations, and overall results are similar for the subsample of males using actual rather than predicted talent scores.

professionals", "Insurance representatives", and "Securities and finance dealers and brokers". The three finance-only occupations do however constitute 46% of finance employment (28% in the U.S.). Again, we observe a widespread finance premium, with 25 out of the 30 professions in finance earning more in 2010 than the average worker in the rest of the economy.

The wage ranking of column (1) lines up fairly well with the (predicted) cognitive ability in the profession. While several high-skill occupations are prevalent in finance, many medium-skilled (e.g., bookkeepers) and low-skilled (e.g., doorkeepers) occupations are common as well. In 27 out of the 30 occupations, Swedish finance workers have a predicted cognitive score higher than the population average (i.e., above 50). Comparing finance to non-finance workers *within* occupations, however, finance workers seem to be about as talented as their counterparts in the real economy (column 9), bar a few exceptions. Column (3) of Table 3 shows that finance sector workers earn more than non-finance workers having the equivalent job for 25 out of 27 occupations (24 out of 25 for the U.S.; see Table E.4). Hence, the finance premium does not seem related to the composition of occupations or tasks in finance compared to the real economy.

To address the rise in relative finance wages, we focus on changes rather than levels. In column (2), wages across finance jobs relative to non-finance workers across all occupations increased for 25 out of the 30 occupations (26 out of 30 for the U.S.). The exceptions are less-skilled occupations whose relative wages have generally declined. The overall premium also increases more strongly for high-skill occupations than for middle- and low-skill occupations. Both of these trends are consistent with rising inequality and skill (or task) biased technical change in the whole economy. In contrast, there is no visible trend in talent, which increases for half of these occupations and decreases for the other half over this period (column 8).

Column (4) of Table 3 reports the change in the within-occupation finance premium. Remarkably, relative wages in finance have increased within all occupations but one (same for the U.S. in Table E.4).[41] There is no consistent relation between required talent of the occupation (column 7) and the rise in relative finance pay over time. There also seems to be no systematic relationship with the likely finance-specificity of the occupation. For example, in 1990, a doorkeeper working for a Swedish finance firm earned 7% more than a doorkeeper in a non-finance firm (12% in the U.S.). This wage difference grew dramatically over the next two decades, and

[41] The one occupation where this is not the case in Sweden, "Directors, CEOs and managers in small business services enterprises", is a quite heterogenous group, since it contains both directors and chief executives of large corporations, as well as managers of small business services enterprises (including many tiny firms with fewer than five employees). For this reason, Statistics Sweden started separating these two groups in 2010, but for consistency over time, we merge them back together.

Table 3. Occupational employment, talent, and the finance wage premium in Sweden (30 largest 4-digit occupations in finance)

	Rel. pay (/ all workers)		Rel. pay (/ same occ.)		Fin. empl. share (%)		Pred. cognitive score		Rel. pred. cog. (/ same occ.)	
	2010 (1)	2010 vs. 1990 (2)	2010 (3)	2010 vs. 1990 (4)	2010 (5)	2010 vs. 1990 (6)	2010 (7)	2010 vs. 1990 (8)	2010 (9)	2010 vs. 1990 (10)
Securities and finance dealers and brokers	4.12	2.64	N/A	N/A	2.04	1.86	72.4	9.0	N/A	N/A
Directors, CEOs, or managers of business services enterprises	3.44	0.68	1.17	−0.09	3.66	−0.11	68.9	0.9	1.01	−0.12
Sales and marketing managers	3.29	1.04	1.36	0.20	0.60	0.41	68.4	4.1	1.03	−0.01
Finance and administration managers	3.14	0.87	1.39	0.13	0.67	−0.03	73.6	1.2	1.05	−0.01
Business professionals not elsewhere classified	2.96	1.28	1.82	0.60	4.41	1.81	74.1	1.1	1.04	−0.03
Corporate legal officers	2.44	0.71	1.29	0.40	0.99	−0.04	79.8	2.5	1.01	0.01
Organisational analysts	1.91	0.12	1.10	0.03	0.80	0.66	72.2	9.4	0.97	0.08
Market research analysts and related professionals	1.85	0.03	1.23	0.10	1.56	0.95	67.1	−3.2	0.99	−0.05
Technical and commercial sales representatives	1.84	0.53	1.33	0.32	2.04	1.61	59.6	−2.6	1.15	0.03
Computing professionals not elsewhere classified	1.83	−0.01	1.22	0.09	3.51	2.93	70.8	1.6	1.07	0.13
Accountants	1.83	0.30	1.28	0.21	1.91	1.28	68.7	−5.9	1.00	−0.02
Personnel and careers professionals	1.79	0.34	1.48	0.24	0.66	0.27	66.3	−0.8	1.12	−0.01
Computer systems designers, analysts and programmers	1.66	0.08	1.13	0.05	3.23	0.88	68.9	−2.9	0.95	0.01
Authors, journalists and related professionals	1.57	0.08	1.35	0.18	0.60	0.32	67.9	−2.4	0.99	0.00
Finance and sales associate professionals	1.54	0.37	1.28	0.23	0.56	0.29	61.4	−3.5	1.20	0.10
Insurance representatives	1.47	0.12	N/A	N/A	11.71	−1.39	54.9	−3.7	N/A	N/A
Computer assistants	1.46	−0.06	1.22	0.14	1.89	1.54	55.5	−9.2	1.02	0.10
Bookkeepers	1.43	0.46	1.32	0.31	1.34	1.05	66.1	−0.9	1.12	−0.01
Computer equipment operators	1.42	0.26	1.22	0.13	0.66	−0.21	60.9	8.6	1.14	0.16
Banking associate professionals	1.34	0.30	N/A	N/A	32.23	−12.69	61.5	−1.0	N/A	N/A
Office secretaries	1.28	0.27	1.57	0.40	0.84	−1.53	54.0	1.4	1.28	0.17
Administrative secretaries and related associate professionals	1.26	0.06	1.26	0.15	2.10	0.78	57.7	−0.7	1.05	0.03
Appraisers, valuers and auctioneers	1.23	−0.02	1.17	0.16	5.18	2.20	52.5	−6.5	0.94	−0.04
Public service administrative professionals	1.07	0.00	0.94	0.00	0.91	0.67	58.3	5.1	0.91	0.07
Numerical clerks	1.06	0.04	1.20	0.08	1.23	−0.26	53.9	−3.7	1.11	0.07
Doorkeepers and related workers	0.99	0.12	1.43	0.36	0.52	−0.15	42.1	−3.5	0.97	−0.12
Other office clerks	0.93	0.09	1.13	0.09	2.30	−4.26	54.7	6.4	1.14	0.05
Telephone switchboard operators	0.75	−0.03	1.12	0.07	0.72	−0.08	47.8	4.7	1.11	0.08
Tellers and other counter clerks	0.64	−0.11	1.15	0.26	1.76	−0.75	58.6	1.6	0.98	−0.13
Helpers and cleaners in offices, hotels, etc	0.52	−0.03	0.87	0.00	0.21	−0.64	43.8	0.5	1.40	0.05

	Correlation of relative pay and relative talent in 2010		Correlation of changes in relative pay and changes in relative talent 2010 vs. 1990		
Talent measure	**Wage relative to all non-fin. workers (11)**	**Fin. wage premium within occupation (12)**	**Relative to all non-fin. workers (13)**	**All excl. "dealers and brokers" (14)**	**Within occupations (15)**
Cognitive	0.622	−0.046	0.102	0.055	0.092
	(0.000)	(0.820)	(0.592)	(0.778)	(0.648)
Non-cognitive	0.807	−0.088	−0.089	−0.093	−0.098
	(0.000)	(0.663)	(0.638)	(0.631)	(0.628)
Predicted cognitive	0.742	0.009	0.378	0.166	−0.124
	(0.000)	(0.966)	(0.039)	(0.390)	(0.534)

Notes: This table shows employment, talent, and earnings of the 30 largest (4-digit SSYK96 codes, 354 in total) occupations in finance, constituting 90.65 percent of finance employment on average between 1990 and 2010. Each occupation's share of finance employment, average and relative predicted cognitive ability, relative pay versus all workers and workers in the same occupation outside finance, as well as their changes between 1990 and 2010, are reported. Source: Swedish census and population data LISA from Statistic Sweden. The bottom columns (11)–(15) show pairwise correlations, with p-values in parentheses.

by 2010, the finance-employed doorkeeper made on average 43% more than their non-finance peer (33% in the U.S.). Similarly, other low-paid and non-specific occupations, such as teller clerks in Sweden or receptionists in the U.S., experienced a positive and increasing finance premium between 1990 and 2010. The similarity between Sweden and the U.S. suggests that the patterns of within-occupation premia are not due to country-specific wage bargaining institutions (e.g., union representation primarily at the national sector level in Sweden but at the firm level in the U.S.).

Column (11) of Table 3 shows there is a positive and significant correlation between relative wages and talent (cognitive, non-cognitive, and predicted cognitive) across occupations. I.e., as expected, higher-paying jobs have more talented workers on average, consistent with talent being predictive of future labor market outcomes. At the same time, however, the within-occupation correlation is about zero and insignificant (column 12). That is, the finance premium does not seem to be due to finance workers being more talented than non-finance workers within the same occupation. Columns (13) and (14) report that the correlation between the change in talent and wages relative to the rest of the economy is generally small and insignificant. Most importantly, column (15) shows that the within-occupation changes in relative wages and talent are uncorrelated.[42] Another indication that the evolution of finance pay is not driven by changes in relative demand across different occupations (e.g., via job polarization) is that the changes in employment shares and occupational finance premia are not very correlated: 0.13 for the wage growth relative to non-finance workers across all occupations, 0.10 relative to non-finance workers in the same occupation (both statistically insignificant).[43]

To summarize, the increase in relative finance wages is not just present in the highest-paid skilled finance professions that employ the most talented workers. Rising wages are not related to talent or employment increases within finance occupations. Rather, finance wages have increased broadly across occupations regardless of skill intensity, required talent, or likely finance sector-specificity.

[42]One caveat to the results in columns (12) and (15), compared to (13) and (14), is that they are based on the subset of occupations that exist in both sectors and thus miss a substantial share of finance employment.

[43]The increase in finance occupations' relative wages is also not significantly related to their abstract task content. More generally, overall trends in employment structure documented in previous literature, such as occupations with high routine and offshorable task content declining over time, are similar in finance as in the rest of the economy (and compared to other high-skilled sectors such as LCA and IT). These results are available upon request.

6 Rent Sharing as Alternative Explanation for Rising Finance Wages

In previous sections, we examined whether a competitive model of the labor market, where workers are paid their marginal product and freely choose the sector in which they work, would be consistent with the evolution of finance wages. Despite having access to a rich set of skill measures, we found that Talent-Competition at best can account for a minor part of the observed trends in finance wages and employment.

In contrast, the Rent-Sharing Hypothesis posits that firms share a fraction of their excess profits (or rents) with employees; a phenomenon that has been documented for non-financial firms in several studies (see Card et al., 2018, for a review). In this section, we consider the extent to which rent-sharing can account for the increase in relative finance wages.

In Section 2.1, we showed that the financial sector seems to have generated increasing rents over time and summarized the various explanations that have been proposed for this phenomenon. To generate rent-sharing, however, increasing profits in the product-market are not sufficient; there also need to be frictions in the labor market that enable firm insiders to capture part of these rents and prevent the entry of outside workers driving down wages to competitive levels. The fact that we do not observe much of a response in relative employment and talent to the increase in relative finance wages is an indication that such frictions might be present. In Section 7, we examine two specific labor-market frictions, delayed compensation and personal networks, that might be particularly important for the finance sector.

6.1 Data on Firm Performance

In order to analyze rent sharing we need to relate individual wages to the rents generated by the firms in which they are employed. We therefore construct a new data set containing accounting information for both financial and real-economy firms.

For firms in the real economy, we obtain financial information from the "Serrano" database (provided by Bisnode AB). Firms have to send yearly reports with financial statements to the Swedish company registry office, which are then collected and cleaned in Serrano (e.g., harmonizing fiscal years and calculating consistent key ratios). In addition to operating profits, value added, and other performance measures, Serrano has information on employment and wages. Since Serrano is only available from 1998 onward, we use a similar (but less cleaned and comprehensive) data source from the credit bureau Upplysningscentralen AB ("UC") for the preceding years. While we do our best to replicate Serrano's procedure when processing the UC data, it is still likely that the financial performance variables used in the analysis are subject to more measurement error for the pre-1998 period.

The UC and Serrano data bases do not include information for most finance sector firms, including banks and insurance companies. Instead, we obtain annual accounting data from the Swedish financial supervisory authority ("Finanspektionen") for the period 1996–2017, and hand-collect data from Statistics Sweden yearbooks for earlier years.[44] To confirm the quality of the data, we also cross-check the information for publicly-listed banks with hand-collected annual reports. Starting in the mid-1990s, Swedish banks increased their international expansion (primarily to the Baltics and rest of the Nordic countries). In most cases, we can verify that our financial information refers to the Swedish operations of the business groups. While we cannot exclude that some fraction of our estimated rents are generated from the banks' foreign operations (which might inflate rent-sharing estimates since our sample only contains Swedish workers), we confirm that aggregate trends in the firm-level data set are broadly consistent with national industry accounts shown in Figure 1.

Our main measure of rents is value added, which for non-financial firms is defined as profits plus payments to capital and labor. Serrano implements this concept as operating profits plus personnel expenses (wages and social security contributions) and depreciation/amortization of capital, and we calculate corresponding numbers in the UC data.[45] Value added for banks has to be calculated differently because, in contrast to non-financial firms, interest expenses constitute a main operating cost for a bank. For banks and similar financial institutions we therefore employ a notion of gross income, where value added is calculated as net interest income plus dividends received, commission income, other operating income, and net capital gains, minus credit losses (in line with the Bazot, 2017, approach for national statistics applied in Figure 1).[46] To check robustness, we also use operating profits as an alternative measure of

[44] Up to 1995, Statistics Sweden published financial statistics in their yearbooks "Finansiella Företag".

[45] Note that there is no mechanical relation between the rent and wage measures, since value added or operating profits are calculated from firms' financial statements while wages of individuals are calculated in LISA. As explained in Footnote 31, the industry code is determined by the main activity of the worker's establishment, and a given firm can therefore have employees from multiple sectors. Since rents are reported at the firm level, we compute sector affiliation at the firm level by assigning all workers the mode of the sector codes in the firm's employment. For the firms we classify as being in finance, less than five percent of employees work in establishments with a non-finance industry code.

[46] Personnel costs and depreciation are not deducted from gross income and therefore do not need to be separately added. In contrast, in the real economy definition these items have been deducted to obtain operating profits and need to be added back. A minor item that is missing in our definition, and which cannot be found on banks' balance sheets, are other costs except personnel expenses and depreciation, such as administrative costs. A small subset of

rents. Because value added, profits, and assets are difficult to compare between finance and real economy firms, we include a finance sector dummy throughout all regressions and focus on within-industry relative changes (rather than levels) in our figures. We divide the value-added measure by the number of employees in LISA to obtain value added per worker, the main explanatory variable in our rent-sharing analysis.

A strength of the Swedish setting is that all limited liability corporations—including non-listed firms—have publicly available financial statements. While the majority of private sector firms are incorporated as limited liability corporations, financials are still unavailable for a number of firms, representing about 24% of real-economy and 13% of finance employee-level observations in LISA.[47] Since coverage in 1990 is poor, we use 1991 as the starting year for our analysis. We also drop all insurance firms, as their accounting numbers exhibit unreasonably large year-to-year swings (with negative value added for the whole insurance sector for multiple years), resulting in a loss of about 25% of the finance-sector observations.[48]

Similar to Section 5, we focus on the subsample of males for whom talent measures are available but in Appendix F.6 we confirm that the key results are very similar for females. Table F.1 in the appendix shows that the rent-sharing sample closely resembles the full sample in terms of key variables. Appendix Figure F.1 shows that the finance sector's relative performance using value added, operating profits, or assets strongly increased over time in the rent-sharing sample, while relative employment remained roughly constant .

6.2 Rent Sharing in the Financial Sector

Following Card et al. (2018), we estimate rent-sharing elasticities by regressing the yearly log wages of each individual on the log value added per worker of the firm where the person was employed that year. We allow for differing rent-sharing elasticities across financial and non-financial sectors throughout. Control variables are years of schooling, cognitive and non-

observations (4,800 or 0.15%, mainly other finance companies but including a few banks) have information from both Finansinspektionen and UC/Serrano. Financials are highly consistent; in particular, value added is computed differently and levels are different in the two sources, but the correlation (both when weighing by employment and not) is 0.99. We use the Finansinspektionen financials in this small subset of observations.

[47]The difference in missing rates is mainly due to the education, health/social work, and personal services sectors, where financial data is missing for at least half of observations. Missing rates are somewhat higher in the pre-Serrano years for both real economy and finance firms.

[48]One reason for this is that a majority of the Swedish insurance companies are not-for-profits or mutuals whose objective is to return their surplus to policyholders, which in turn influences their accounting practices. We also find that insurance companies frequently engage in substantial earnings management, resulting in zero reported profits for years at a time.

Table 4. Estimated rent-sharing elasticities for males

	1991–1997 (1)	1998–2008 (2)	2009–2017 (3)	1998–2017 (4)
Log VA per worker	0.036***	0.082***	0.092***	0.086***
	(0.010)	(0.006)	(0.007)	(0.005)
Log VA per worker × finance	0.006	0.030	0.017	0.023
	(0.029)	(0.035)	(0.019)	(0.024)
Finance main effect	Yes	Yes	Yes	Yes × Period
Fixed effects	Firm	Firm	Firm	Firm × Period
IV: Log assets per worker	Yes	Yes	Yes	Yes
Observations (million)	4.0	9.6	8.4	18.0

Notes: The table shows rent-sharing elasticities for males estimated from regressing log wages onto log value added per worker (all employees) in the firm. Control variables are finance sector dummy, year dummies, years of schooling, quadratic in potential experience, cognitive and non-cognitive talent, and firm fixed effects. Effect on interaction with finance dummy is reported as × finance. Log value added per worker is instrumented by the firm's log assets per worker in both real economy and finance. Estimates for sample sub-periods 1991–1997, 1998–2008, 2009–2017, and for joint 1998–2017. In the latter, finance and firm effects are interacted with the sub-period dummy for 2009–2017. Standard errors in parentheses are clustered at firm. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

cognitive talent, and a quadratic in potential experience. Our talent measures capture worker skill components that are typically unobserved in previous work on rent sharing. We also include firm fixed effects to remove all firm-level permanent differences (e.g., in productivity) and identify rent sharing from within-firm variation over time. As previous work (e.g., Guiso et al., 2005; Card et al., 2018) has found transitory fluctuations and measurement errors in firm financial data to be a pervasive problem, we instrument value added with total assets.[49]

Table 4 presents our benchmark rent-sharing estimates. The full OLS, first-stage (which are strong), and reduced-form estimates are reported in Appendix Table F.2. We provide estimates for three different sub-periods: 1991–1997 when Serrano and Finansinspektionen data are not yet available and we rely on a combination of UC and hand-collected data; 1998–2008 before the Great Financial Crisis; and 2009–2017 including the financial crisis and the period after. For the latter two periods, rent sharing is around 8–11 log points wage increase per unit increase in log value added, both for the financial sector and the real economy (columns 2 and 3).

For the initial period of 1991–1997 we estimate a substantially smaller rent-sharing elasticity in column (1) of Table 4. We believe that this is at least partly due to lower data quality

[49] We use assets rather than sales as an instrument, since the latter is hard to compare between financial and non-financial firms. (For financial firms, reported revenues include financial income minus financial expenses.) We have verified, however, that using sales as an instrument yields similar results.

during this period, which biases our rent-sharing estimates downward. First, we have to rely on imputations of personnel costs in the early data, and when we replace true personnel costs with imputations in the later periods as well, estimated elasticities decline significantly and are closer to the 1991–1997 estimates.[50] Second, as we discuss below, the low rent-sharing elasticities in the 1991–97 sample seem to a large part driven by firms that are not consistently reporting yearly financials.[51] In addition, during the Swedish banking crisis in 1991–92 corporate profits dropped dramatically, and then recovered over the next few years. Downward stickiness in wages may therefore have had a particularly large impact in the early period, potentially leading to lower estimated elasticities (see, e.g., Babecky et al. 2010).

For these reasons we have more confidence in the post-1997 estimates. Our benchmark rent-sharing elasticity estimated for the period 1998–2017 is 0.086 in the real economy and 0.109 in finance (column 4 of Table 4). Overall, Table 4 shows that rent sharing is rather substantial and, if anything, somewhat stronger in the financial sector than the real economy. Although differences across sectors are not statistically significant, all estimated elasticities in finance are significantly different from zero at the 1% level (not shown). Appendix F further reports that these results are robust to using operating profits as rents, including female workers in the sample, using the full period 1991–2017, and including additional dimensions of fixed effects.

In Table F.4 of the Appendix we allow rent-sharing elasticities to vary by levels of talent and education. Rent sharing is stronger for more talented workers, which is consistent with talented workers being more likely to hold jobs where performance pay is a larger share of compensation and where there is more control over wage-setting. Yet, while relative wages of talented workers co-moved strongly with financial booms and busts, they increased for all talent levels or job categories over the long run, as previously shown in Section 5. Consistent with this, rent sharing is significant also for mid and low talent individuals, particularly in finance. Rent sharing in finance is also remarkably strong across the education distribution, with no clear gradient of elasticities with respect to the level of education.

[50] Personnel costs are an important component of value added but not explicitly reported in the raw UC data. We therefore have to approximate them from wages during the 1991–1997 period.

[51] Appendix Table F.5 reports higher rent-sharing elasticities from the subsample of firm-years where lagged value added and assets are non-missing, with a particularly large increase for the 1991–1997 period.

6.3 Rent Sharing's Contribution to the Growth of Finance Wages

Figure 7 juxtaposes relative wages with relative value added per worker over time, using male workers in the rent-sharing sample. The evolution of wages is consistent with the patterns shown in Figure 2 for the full sample. Relative finance wages rise from about 1.4 in 1990 to peak at almost 2 in 2007, after which they decline somewhat but still remain at a high level.

Relative value added per worker in finance also rises strongly over this period, although there are significant cyclical fluctuations. From 1991 to 2006 the relative value added increases from about 2 to more than 7. It then falls following the Great Financial Crisis to bottom out at around 4 in 2011, after which it again reverts to surpass its pre-crisis level by 2017. While magnitudes may seem large, they are broadly consistent with trends from Swedish industry-level accounts shown in Figure 1.[52] Figure 7 shows that wages and value added per worker are closely related to each other, both in terms of the overall trend and the cyclical fluctuations. For the later part of the sample period, wages tend to lag value added by a year.

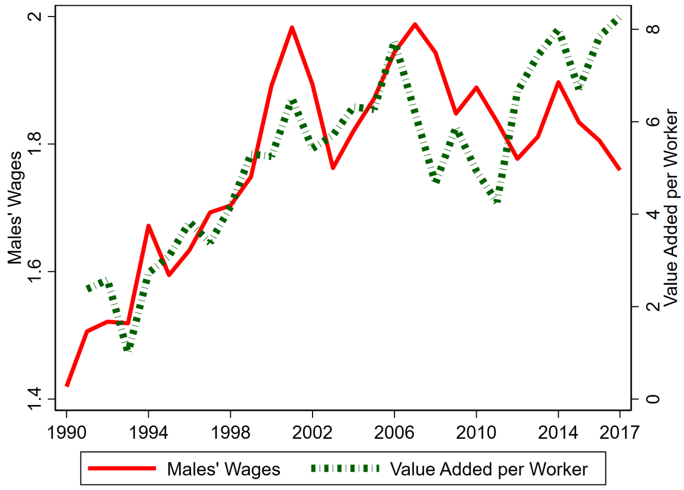
In order to quantify this relationship more formally, we use our regression estimates to calibrate the contribution of rent-sharing to the increase in finance wages up to the financial crisis. The predicted log wage increase due to rent sharing in sector $k \in \{R, F\}$ is $\Delta \log(w_k) = \eta_k \Delta \log(\mathrm{VA}_k)$, where VA stands for the sector's value added per worker and η_k is the estimated rent-sharing elasticity. Since we controlled for worker skills and firm fixed effects in the rent-sharing regressions, we do not condition on additional variables in this calibration. We calculate the increase of relative finance wages predicted by rent-sharing as

$$\Delta \log\left(\frac{w_F}{w_R}\right) = \eta_F \Delta \log(\mathrm{VA}_F) - \eta_R \Delta \log(\mathrm{VA}_R). \tag{4}$$

Table 5 shows the calibration results for different values of η_k. Since rents peak in 2006 and wages in 2007, we use the average of the values over the two years for the endpoint. The results suggest that rent sharing explains a substantial fraction of the rise in relative finance wages.

[52]In Figure 1a, finance's value added share of Swedish GDP rises by 47 percent from 1996 (the first year that all information are available in national industry accounts) to 2006. This is comparable to the increase of relative value added in the rent-sharing sample (see Figure F.1). Value added *per worker* increases somewhat more in Figure 7 due to a decline of finance's relative employment in the rent-sharing sample during 1996–2006. The drop after 2007 and the subsequent rebound are similar in Figures 1 and 7. Even the extraordinary increase up to 1996, which was largely due to the recovery after the 1990–92 banking crisis, is broadly consistent across the figures. As explained previously, the levels in Figures 1 and 7 are not directly comparable because finance rents are defined somewhat differently in the micro data used for computing the latter figure, while the former figure is based on national industry accounts and the procedure from Bazot (2017) to estimate the level of finance's value added share as accurately as possible.

Figure 7. Relative wages of males and relative value added per worker in finance



Notes: The figure shows relative average wages of males and relative value added per worker (all employees) of finance in the rent-sharing sample. Sources: LISA, UC/Serrano, Finansiella Företag/Finansinspektionen.

Between 1991 and 2006/7 the actual increase was 27 log points, i.e., $\Delta \log(\frac{w_F}{w_R}) = \log(1.97) - \log(1.51) = 0.267$. In column (2), using $\eta_R = 0.086$ and $\eta_F = 0.109$ from specification (4) in Table 4, 13 log points is attributed to rent sharing, or close to one half of the total increase. Employing our period-specific estimates of elasticities, which takes into account the lower estimated elasticities in the early period, rent sharing predicts an increase of 9.8 log points or 36% of the total. These results are subject to substantial sampling variation, however, due to the finance-specific elasticity estimates being imprecisely estimated. If we instead the finance interaction term and only use the (smaller) 0.086 estimate for the real economy in Table 4, rent sharing still accounts for 9.2 log points (or 34%) of the total increase in relative finance wages, with a 95% confidence interval of $[0.075, 0.110]$.

The bottom row of Table 5 considers the 1998–2006/7 period in which we consistently have high-quality data available for both financial and non-financial firms, and removes the fast relative wage rises of the early 1990s. This calibration attributes between 31% and 42% of the increase in relative wages over 1998–2006/7 period to rent sharing. Overall, our calibration exercise indicates that firms' sharing of rents with their workers is substantial, roughly accounting for between one third to one half of the relative finance wage increase over time.

We believe this estimate is conservative, since the rent-sharing estimates in Table 4 may be understated for a couple of reasons. First, the fixed-effects specification identifies elasticities from within-firm variation across years, which will yield lower estimates to the extent firms in-

Table 5. Rent sharing's contribution to the relative finance wage increase (males)

	Data (1)	$\eta_R = 0.086$, $\eta_F = 0.109$ (2)	Period-specific (3)	$\eta_R = \eta_F =$ 0.086 (4)
$\Delta \log(w_F/w_R)$				
Period 1991 to 2006/7	0.267	0.126	0.098	0.092
(Standard error)		(0.034)	(0.029)	(0.009)
Period 1998 to 2006/7	0.144	0.058	0.060	0.044
(Standard error)		(0.014)	(0.021)	(0.003)

Notes: The table reports the actual increase of relative log finance wages between 1991 or 1998 to 2006/7 together with different increases predicted by rent sharing. These are calibrated according to Equation (4) using elasticity estimates from Table 4. Column (2) uses $\eta_R = 0.086$, $\eta_F = 0.109$ from main specification (4) in that table. Column (3) uses time-varying elasticities from specifications (1), $\eta_R = 0.036$, $\eta_F = 0.042$, and (2), $\eta_R = 0.082$, $\eta_F = 0.112$, of Table 4 applied to 1991–1997 and 1997–2006/7, respectively. Column (4) assigns a common elasticity of $\eta_R = \eta_F = 0.086$. Wage and rents values are averaged between 2006 and 2007 for the endpoint. Standard errors in parentheses below the predictions are based on the covariance matrices of the respective $\widehat{\eta_R}, \widehat{\eta_F}$ estimates.

sure workers against idiosyncratic fluctuations in value added, a phenomenon documented by Guiso et al. (2005). Second, within-firm comparisons may exacerbate the impact of measurement error in value added, and instrumental variables can only partially remedy this (Card et al., 2018). Finally, Figure 7 suggested that relative wages are affected by lagged as well as contemporaneous value added. Appendix Table F.5 reports on regressions adding one lag or using the average of current and lagged value added, which tends to increase estimated rent-sharing elasticities, particularly in finance. In the specification with lags, the point estimate for the point estimate for the total rent-sharing elasticity rises by about 1–2 log points.

To summarize, across specifications and our two time periods, between one third to one half of the increasing finance wage premium for men during 1991–2006/07 can be attributed to rent sharing. Table F.7 shows that the relative contribution of rent sharing is at least as high for women. As a comparison, we can use the year-by-year estimates from Table E.2 to calculate the estimated contribution of talent and education for the corresponding period. According to these estimates, 20% of the increase in relative male finance wages 1991–2006/07 can be attributed to changing returns to talent and education combined (and 8% to education alone).[53]

[53] In the shorter period 1998–2006/7, talent and education would explain 12% and education by itself essentially none of the finance premium's increase, using the detailed year-by-year estimates in Table E.2.

7 Finance Sector Entry and Social Networks

We now examine two potential mechanisms that might help explain why more talented workers did not enter finance despite relative wages increasing, contrary to the predictions of Baumol (1990) and Murphy et al. (1991). First, we study whether the tenure-profile and wage risk make the expected finance premium smaller in utility terms for workers who consider taking a finance job. Second, we explore access to social networks as a potential barrier to entry into finance. As we will show, the first mechanism is unlikely to explain why more talented workers have not entered the sector over time, whereas the second may provide a partial explanation.

7.1 Finance Sector Entry by Age and Life-Cycle Earnings

Panel (a) of Figure 8 shows that entrants into finance are relatively young. For each sector, we compute the number of entrants in a given year that are at most age 30, divided by the number of entrants older than age 30, and then average this across years. While we observe that young workers are always a higher fraction of entrants (the ratio is always above one), finance stands out. This especially applies to "Banking associate professionals", the largest occupation in the sector. The below-30 versus above-30 ratio of entrants is close to three for finance and exceeding four for banking professionals while most other sectors range between 1.5 and 2.5.[54]

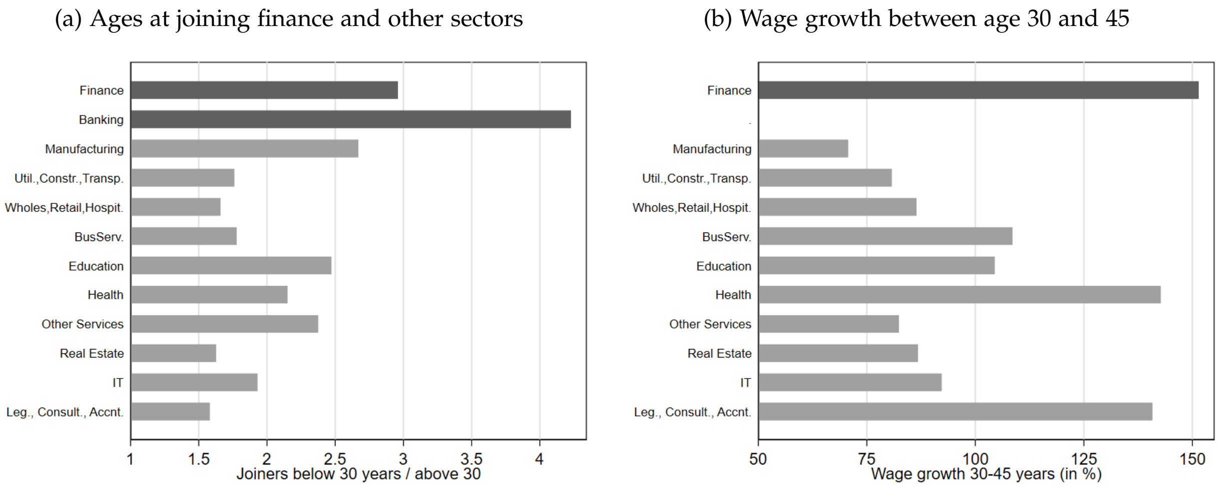
This has two implications for entry into finance. First, marginal individuals considering to enter finance will be young and likely to compare the present value of future wages with other sectors, taking risk and time discounting into account. Figure 8b shows that finance has a steep wage profile. Between age 30 and 45, wages rise by more than 150% while they rise by 110% or less in most other sectors. In Appendix G, we show that the finance profile has also steepened over time, consistent with what Philippon and Reshef (2012) find in the U.S., while the wage premium for young entrants is more modest and has remained so over time.

A steep wage–tenure profile and the need to enter finance early in the career raise the possibility that the wage premium is lower in net present value terms. This is because more backloaded pay results in lower discounted earnings and because it introduces additional risk

[54] Appendix Figure G.1 shows more detailed histograms of entry ages in different sectors. Almost fifty percent of entrants into the finance sector are younger than 30 years old, which is higher than in the other main sectors of the economy. Among banking professionals, the most common finance job, this share is close to sixty percent.

Our results are in line with Oyer (2008), who shows that MBA graduates working in finance—particularly those in the highest-paid finance jobs, such as investment banking—enter shortly after graduation, and that it is difficult (even for MBAs) to switch into finance later in the career.

Figure 8. Age at sector entry and wage growth



Notes: Panel (a) shows the average number of workers that enter a sector per year at age 30 or below, scaled (i.e., divided) by the number of workers entering above age 30. Panel (b) shows the wage growth in real terms between age 30 and 45 of workers in different sectors. Note we are not including wage growth for banking professionals separately in panel (b): since we do not observe occupational information during 1991–2000, and the occupational classification changes in 2014, we are unable to obtain precise estimates of age 30 to 45 wage growth for this subgroup. The sample includes all males age 20–60 in the years 2005–2017. Source: Swedish population data LISA.

(e.g., failing to get promoted or getting fired before realizing the higher wage premium, or the wage profile changing during the course of one's career). In Appendix Table G.1 we study the career paths of 30-year old males working in finance to account for the potentially higher longitudinal risk in earnings or unemployment. We also consider job risk by comparing negative earnings outcomes and total years of unemployment, but do not find that finance jobs are riskier than real-economy jobs (if anything, they seem less risky). We then calculate the present value of realized future income between age 30 and 45, finding that the finance premium's increase in present value terms is large even with substantial discount rates, rising from 30% for the 1950 cohort (whose relative wages peaked in the early 1990's) to 70% for the 1970 cohort (whose wages peaked around the financial crisis). Hence, higher risk and more backloaded wages are unlikely to explain why more talented workers have not entered the finance sector.

7.2 Social Connections and Entry into Finance

The second implication from finance workers entering at young ages is that the typical applicant will be relatively inexperienced and employers will have little evidence on observable talents when choosing among potential employees. Some individuals may thus not be able to enter the finance early in their career even if they are willing to and ex post suitable for the job. Social networks can partly overcome such information frictions (Dustmann et al., 2015). In addition, if there are substantial rents to be earned in a firm, insiders have an incentive to restrict entry to keep more of the rents for themselves or only share them with a selected group of people to whom they are connected. It may then be difficult for workers without social connections in the finance industry to enter the sector. Also, observing friends or family members with high-paying finance jobs might make the wage premium more salient to the individual (Fehr et al., 2009) and increase the likelihood of choosing a finance career.

One social network that we can measure well in our registry data is family ties. We consider whether sons with a father who works in finance are more likely to enter the sector relative to workers without this connection. Parents' networks may be particularly important early in the career or when entering the job market (Kramarz and Skans, 2014). Appendix Figure G.5 compares the "over-representation" of father–son pairs who work in the same sector relative to the unconditional sector size across different sectors. It shows, while the over-representation of same-sector fathers is a general phenomenon, it is strongest in finance, consistent with family connections being particularly important for entry into this sector.

A caveat of the father–son links is that they could be correlated with other factors such as genetic human capital or preferences. In order to reach beyond these factors, we use local variation in the density of finance workers when the individual was growing up as an additional connections measure. In particular, we compute the density of finance workers at the time in the municipality where the individual lived at age 16. We then study whether selection into the financial sector is affected by this density, which can be interpreted as learning opportunities, informational advantages, or having a better access to the network of finance workers.

Table 6 reports linear probability regressions for working in finance at age 30 on the density of financial sector workers at age 16.[55] Column (1) shows that individuals growing up in municipalities with a higher density of finance workers are significantly more likely to enter the sector themselves. The coefficient for the father working in finance is also positive and significant. Column (2) adds fixed effects for the current municipality and the coefficients are largely unchanged. Column (3) shows that the results are unaffected when we control for the

[55] We control for the corresponding density in the current municipality and focus on county movers, that is, workers who lived in a county at age 16 different from their current county of residence. We also include a dummy for whether the father works in finance and standardize the densities for comparability. Our framework follows Guiso et al. (2021) who study whether future entrepreneurs learn from other entrepreneurs, measured by the firm density in the location where individuals grew up.

Table 6. **Probability of working in the financial sector at age 30**

	(1)	(2)	(3)	(4)	(5)	(6)
Density in finance (young)	0.004***	0.004***	0.004***	0.003***	0.003***	0.004***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Father in finance	0.047***	0.047***	0.047***	0.047***	0.047***	0.047***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Density in other sector (young)				0.001	0.001**	0.001***
				(0.001)	(0.001)	(0.000)
Father in other sector				0.016***	0.003	−0.001
				(0.003)	(0.003)	(0.001)
Municipality (today) fixed effect		Yes	Yes	Yes	Yes	Yes
Share of movers (young)			Yes	Yes	Yes	Yes
Other sector				LCA	IT	Health
Observations	425,730	425,730	425,730	425,730	425,730	425,730
R^2	0.031	0.034	0.034	0.034	0.034	0.034

Notes: Shown are linear probability models for males' choice of working in finance at age 30. Density in finance (young) is the share of financial sector workers in the municipality where an individual was living at age 16. Density in other sector are the respective shares of the law, consulting, and accounting (LCA), IT, and health sectors. For comparability, the sector densities are standardized to have a standard deviation of one. Share of movers (young) is the fraction of individuals moving out of a municipality when young. Father in finance is a dummy indicating whether the individual's dad is working in the financial sector. The sample consists of movers only, i.e., individuals who live in different counties at age 30 than at age 16. All regressions control for density in finance/other sector today (i.e., current share in the municipality of residence), education, cognitive and non-cognitive ability, and birth-year dummies. Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$.

share of the population that is leaving a municipality (as a proxy for overall mobility rates).

The effect that we uncover is also meaningful in economic terms. In column (3), increasing the share of finance workers in the municipality where an individual grew up by one standard deviation (normalized to 1) raises the probability of working in finance at age 30 by 0.44 percentage points, which amounts to a 22% increase relative to the unconditional mean. The effect of having a father in finance is even larger, although subject to the caveats mentioned above.

Columns (4)–(6) of Table 6 add the corresponding densities when growing up of three other high-skilled sectors (LCA, IT, and Health). The coefficients on the density in finance when young (and of father in finance) hardly change, whereas the coefficients on local density (and paternal ties) in the other sectors are smaller and partly insignificant. This suggests that the network variables capture the importance of finance-specific connections rather than proxying for higher levels of human capital in the municipality or family correlated with networks.

To sum up, young individuals who are better connected to the financial sector are more likely to enter finance. This may be part of the explanation for why talent and employment in the sector have not changed, despite the rising finance wage premium.[56]

8 Conclusion

This study was motivated by the dramatic increase of relative finance wages over the last couple of decades. We have assessed two potential candidates for explaining this increase: the "Talent-Competition Hypothesis" and the "Rent-Sharing Hypothesis".

According to the first hypothesis, the productivity of the most skilled workers rose more in finance than in other sectors, which lead to an increased demand for skill from the financial sector and pushed up wages. Using Swedish population-wide register data, with individual-level measures of cognitive and non-cognitive ability ("talent") and uncensored wage information, we find limited support for this explanation. Relative talent of workers in the financial industry has not increased, neither on average nor at the top of the distribution. While the relative share of educated workers in finance did increase, changing returns to talent and education can account for at most 20% of the rising relative wages. Notably, relative wages in the financial sector have surged across the entire talent and education distribution.

We find more support for the second hypothesis in our data. Both financial and non-financial firms share rents with their employees, and the faster increase of finance-sector rents over our sample period can explain as much as half of the increase in relative finance wages. Our results show that both high- and lower-level finance jobs experienced significant relative wage increases in both Sweden and the U.S. While we do not aim to uncover the underlying reasons for why rent-sharing occurs or why overall rents in finance increased in the first place, several explanations have been proposed in the literature that would be consistent with our findings, including poor governance, moral hazard rents, fairness concerns, and production complementarities.[57] Our results also demonstrate that wage rents can persist over time rather than being competed down by more talented outsiders entering the sector. We provide suggestive evidence on two frictions—based on the finance tenure profile and the importance of

[56] In addition to our evidence on social connections, anecdotal evidence of discrimination and nepotism suggest that insiders' networks may be important in finance (see Bloomberg, 2020). For the U.S., Michelman et al. (2022) show that students who were able to join Harvard old boys' clubs (a highly exclusive social network) became much more likely to work in finance and earned more later on, despite academically performing worse than their peers.

[57] See e.g. Bebchuk et al. (2010) and Bivens and Mishel (2013) on poor governance leading to higher wages, and Axelson and Bond (2015) and Biais and Landier (2020) for the need for incentive pay to mitigate moral hazard problems, in turn leading to rents in finance. Fairness concerns (Akerlof and Yellen, 1990) and production complementarities (Kremer, 1993) may explain why rent sharing occurs even further down the firm hierarchy. Explanations for the increased rents in the financial sector have been proposed by Gennaioli et al. (2014); Philippon (2015).

social connections—that can make labor supply less responsive to relative wages.

One possible concern is that our talent measures may not capture all the relevant characteristics that determine worker productivity in the financial industry. For instance, the traits that make someone a great trader or investment banker might not be well measured by aptitude scores or high-school grades. While this is possible, a few comments are in order. First, our measures are indeed highly valued in finance. High cognitive and non-cognitive talent are overrepresented among finance workers, and relative wages are positively related to talent. The limited role for the Talent-Competition Hypothesis comes from the fact that these differences are not *increasing* over time, despite increasing relative wages. Second, if the wage rise is driven by some unobserved or acquired skill, which is becoming increasingly rewarded over time, it would have to be more or less uncorrelated with our observable talent measures.[58] In that case, "brain drain" to the financial sector (à la Murphy et al., 1991) should still not be a concern, since demand for this trait would not increase the competition for the cognitive and non-cognitive talents that make a worker productive in other sectors. As Terviö (2009) shows, when talent is industry-specific and only revealed on the job, the financial sector can end up with a sub-optimally low talent pool, i.e., the opposite of the "brain drain" prediction.

A final question is about the extent to which our results are generalizable. For example, the 1990s economic crisis and subsequent recovery were particularly strong in Sweden. Whenever available data allowed us to compute corresponding measures, we therefore showed that our key findings can be replicated for the U.S. as well. We also believe that our findings are informative not just about finance wages, but about the potential role of industry wage rents more generally (thereby informing a classic literature that includes Krueger and Summers, 1988; Abowd et al., 1999, among others). Our study shows that when an industry experiences rising rents over a longer period of time, this can lead to persistent wage premium increases (after accounting for skills) that are unrelated to worker productivity. The unique talent measures make it possible to directly analyze potential sorting effects (e.g., Lamadon et al., 2022), which turn out insignificant in our case, perhaps due to labor market frictions being particularly large in finance. While the financial sector exhibits specific characteristics such as high levels of regulation, economies of scale, and relative opaqueness, which limit competition and

[58] When discussing our results with a high-level manager at one of the Nordic banks, he commented: "I have been thinking about what the most successful people in our bank have in common. They are not the smartest people. They are not the nicest people. But they are the ones who really, really like to make money." Such a characteristic might of course be uncorrelated with our talent measures.

give rise to industry rents, there are other sectors that share similar characteristics. More generally, De Loecker and Eeckhout (2020) and others argue that market power has increased across North American and European economies since the 1980s, particularly in some sectors such as technology (see Shapiro, 2019). We believe that studying the joint evolution of industry rents and wage premia more broadly, and its effect on the allocation of human capital across sectors—or sometimes lack thereof—is an exciting avenue for future research.

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