Bill Francis – Iftekhar Hasan – Kose John – Maya Waisman

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Urban Agglomeration and CEO Compensation

Bill Francis
Lally School of Management and Technology, Rensselaer Polytechnic Institute
110 8th Street Troy, New York 12180, francb@rpi.edu

Iftekhar Hasan
Schools of Business, Fordham University and Bank of Finland, Helsinki
1790 Broadway, 11th Floor, New York, NY 10019, ihasan@fordham.edu

Kose John
Stern School of Business, New York University
44 West 4th Street Suite 7-177 New York, NY 10012, kjohn@stern.nyu.edu

Maya Waisman
Fordham University – Finance Area
33 West 60th Street New York, NY 10023, waisman@fordham.edu

Abstract

An underlying assumption in the executive compensation literature is that there is a national labor market for CEOs. The urban economics literature, however, documents higher ability among workers in large metropolitans, which results in a real and stable urban wage premium. In this paper, we investigate the link between the spatial clustering of firms in big, central cities (i.e., urban agglomeration) and the level and structure of CEO compensation. Using CEO compensation data for the period 1992-2004, we document a positive relation between the size and centrality of the city in which the firm is headquartered and the total, as well as the equity based portion of CEO pay. Our results are robust to a host of control variables, sensitivity and endogeneity tests, indicating that urban agglomeration may reflect positive externalities, such as knowledge spillovers, business connections and improved access to private information that have a positive effect on CEO pay and incentive driven compensation for good performance. We document gradual human capital gains acquired from big city work experience that are transferable to the rural area, and rewarded for, once the CEO relocates into a smaller, less central community. Our tests provide novel evidence of information spillovers and networking opportunities in big cities that can directly affect how CEOs are compensated. Such sources of information and influence represent something for which firms are willing to pay higher and more incentive driven pay, evidence in favor of a market-based explanation for CEO compensation.

Key words: Agglomeration, CEO, Compensation, Incentive, Geography.

JEL Code: D8, G3, J3, R1

1 Introduction

For over a century, labor economists have noted that the agglomeration of high quality workers in large metropolitans provides positive externalities that are primary determinants of local productivity and wages (Marshall, 1890; Weber, 1899).[1,2] In contrast, a recent line of research contends that because of the high mobility of CEOs, managerial compensation is determined by a national labor market and not by the business environment at the hiring firm's locale (see, e.g. Kedia and Rajgopal, 2009). In this paper we propose and examine one channel through which the geographical clustering of economic agents around big cities creates local segmentation in managerial labor markets which significantly impacts the level and structure of CEO compensation. This is important because as Graham, Li and Qiu (2010) point out, a failure to account for the role of unobservable managerial latent skills or social capital could significantly distort our understanding of compensation policies, an issue that has received a considerable amount of attention from practitioners, academicians and policymakers.

The economics literature provides ample evidence showing that firms clustered in large metropolitan areas pay their workers significantly more than their non-urban counterparts, even after adjusting for cost of living factors.[3,4] This pay gap holds for any profession or industry and becomes especially large for white collar, highly skilled individuals (Möller and Haas, 2003; Gould, 2007; Bacolod, Blum and Strange, 2008).[5] There are two main explanations for these findings. One is that high ability individuals are attracted to densely populated areas with a wealth of employment opportunities, where they are more easily matched with better jobs and paid the value of their marginal product in competitive labor markets (see, e.g., Helsley and Strange, 1990, 1991; and Glaeser, Kallal, Scheinkman, and Shleifer, 1992). The second is that economic density provides workers with positive externalities, such as knowledge spillovers, access to private information and business connections that foster the accumulation of human capital which lead to better performance and higher wages (see, e.g., Christoffersen and Sarkissian, 2009; Audretsch and Feldman, 1996; Yankow, 2006; and Gould, 2007, among others).

These studies predict that for any occupational group or industry, and especially for high ability individuals such as firms' CEOs, who tend to be attracted to big cities and therefore more likely to benefit

[1] The US Census documents that about 85 percent of all jobs are in large metropolitan areas. Census 2000 Summary File 1 (SF 1), GCT-P1 urban/rural and metropolitan/non-metropolitan population, US Census Bureau, 2000.

[2] There is an extensive labor and urban economics literature that addresses location issues and their effect on workers. For excellent reviews see Fujita and Thisse (2002) and Duranton and Puga (2003). We also provide a detailed discussion about the effect of urban agglomeration on workers and corporations in section 2.

[3] We use the words metropolitan, urban and cities interchangeably.

[4] For example, Wheeler (2001), Combes, Duranton, and Gobillon (2008), Fu (2007), Rosenthal and Strange (2006), Yankow (2006) and DiAddario and Potacchini (2008), among others, find that real wages are higher in large cities with large concentrations of employment compared to smaller, less densely populated cities. Wheaton and Lewis (2002), Combes, Duranton, and Gobillon (2008), and Fu (2007), find evidence that wages increase with concentrations of employment in an individual's own occupation or industry. Many of these studies also find a positive link between wages and the human capital level associated with employment concentration.

[5] Gould (2007) finds an urban wage premium of about 11 percent for young, white collar workers; Möller and Haas (2003) find that the doubling of employment density leads to an average gross wage increase of 2.5 percent that is increasing in employee skill; Bacolod, Blum and Strange (2008) find evidence that large city workers with cognitive and people skills, as opposed to those endowed with motor skills, are paid significantly more than their non-urban counterparts.

from their positive externalities (Christoffersen and Sarkissian, 2009; Almazan, de Motta, and Titman, 2007), wages should be significantly higher in large metropolitans.[6] Thus given the theoretical arguments outlined in the extant literature, compensation packages and incentive pay schemes designed to attract, retain and reward appropriate managerial talent should vary positively with the size of the city where the firm is headquartered. In this paper, we empirically confront this prediction by looking at CEO compensation data for the years 1992-2004, and examine whether firms headquartered in large metropolitans provide managers with higher and more incentive based pay.

We focus on CEOs because, unlike other workers, managers are generally high ability individuals, who are key players in the determination of corporate practices, firm performance and community involvement (see, e.g., Bertrand and Schoar, 2003; Hong, Kubik and Stein, 2005; Landier, Nair and Wulf, 2006), and thus provide us with an ideal study group for examining the spatial cross sectional variation of pay for highly skilled individuals.

Our approach is motivated by the notion that companies headquartered in large and central metropolitans are located near a large base of other headquarters, investors, institutions, executives and media outlets. As such, CEOs in these densely populated areas have better access to private information about local product markets, technologies, innovations and competitive threats, suppliers and service providers, as well as networking opportunities with other local executives, investment bankers and institutional investors (see, e.g., Coval and Moskowitz, 1999, 2001; Christoffersen and Sarkissian, 2009; Butler, 2008; Massa, Yasuda and Zhang, 2009). Compared to managers in more remote, less central areas of the country, CEOs based in large metropolitans are also more likely to serve on the board of a nearby firm (Ivkovic and Weisbenner, 2005; Kono, Palmer, Friedland and Zafonte, 1998; Mace, 1986), and become more exposed, over time, to media coverage, publicity, and the attention of prominent headhunters. All of these factors provide large city CEOs with opportunities for networking with other skilled and influential individuals, facilitate access to private information about nearby firms, and result in faster learning that, in turn, enables CEOs to make better decisions.[7] Such sources of information and networking are valuable to firms, which as a result are willing to compensate their CEOs more highly and utilize more incentive driven pay.

We start our analysis by merging CEO compensation data with demographic information from the US Census about firms' headquarters locations. The first piece of evidence in support of the conjecture that

[6] We know from Christoffersen and Sarkissian (2009) that highly skilled fund managers are drawn to densely-populated financial centers, where they gain valuable experience and perform better than their counterparts based in smaller cities. Similarly, Almazan, de Motta, and Titman, (2007) show that local clusters tend to attract the most efficient workers.

[7] The finance literature has many examples of learning that occurs within local clusters of economic agents. Such learning could come, for example, from local social interaction, peer group effects and/or imitation (Hong, Kubik and Stein, 2004; Hamermesh, 1975; Barnea and Guedj, 2006; Sorenson and Stuart, 2001), interlocking directorates in locally headquartered firms (Kono, Palmer, Friedland and Zafonte, 1998; Mace, 1986), localized informational cascades (Bikhchandani, Hirshleifer and Welch, 1992) or herding propensities of managers based in the same area (Massa, Yasuda and Zhang, 2009).

geography impacts CEO compensation is illustrated in Figure 1. Plot A shows a clear, positive relationship between the size of the city where the firm is headquartered and the median total CEO compensation for the most highly populated cities in the US. Similar evidence is illustrated in Plot B, where we see a positive relationship between equity based incentives and the population size of the city where the CEO is employed.

To analyze the relationship between city size and CEO compensation in more detail, we follow Coval and Moskowitz (1999), Ivkovic and Weisbenner (2005), Loughran and Schultz (2005) and Loughran (2008), among others, and aggregate headquarters locations by metropolitan statistical areas, classifying firms as *Urban Agglomerates*, *Urban* or *Rural*, based on the size of the city where the firm is headquartered and its distance from major population clusters.[8,9] Comparing the structure and size of CEO compensation packages across these three location groups, we find several striking results. First, controlling for firm, industry and CEO characteristics and adjusting for cost of living, we find that the total compensation of CEOs in *Urban Agglomerates* is 14% higher than the total pay of their *Rural* counterparts. Second, we find that the equity based portion of CEO pay is about 40% higher for CEOs in *Urban Agglomerates* compared to similar CEOs in *Rural* areas. In contrast, *Rural* CEOs' cash based portion of compensation is approximately 26% higher than that of their *Urban Agglomerates* counterparts. These results provide compelling evidence that holding everything else the same, geographical location in general, and spatial clustering, in particular, have an economically important impact on the level and structure of CEO compensation. To the best of our knowledge, this is the first paper that shows such a distinct difference in the structure of urban and rural CEO compensation contracts, in contrast to what a national labor market for CEOs would predict (Kedia and Rajgopal, 2009).

Third, we find a significant, positive relationship between managerial experience in the same city and firm and the total and equity based portion of compensation in *Urban* and *Urban Agglomerate* companies. On the contrary, we find no evidence of a relation between experience and pay among managers located in *Rural* firms. This compensation differential between large and small city firms is increasing in CEO experience and city size, and does not disappear over time. The above findings hold after controlling for differences in managerial ability that could potentially contribute to any pay differences we observe across cities (Glaeser, 1999). This indicates that managers learn faster and gain more experience, especially in *Urban Agglomerate* firms, which is reflected in significantly higher total and equity based compensation.

[8] Specifically, *Urban Agglomerates* are defined as firms headquartered in the ten largest metropolitan areas of the US, based on the 2000 Census Bureau. *Urban* companies are those located in metropolitan areas with at least 1,000,000 residents that are not *Urban Agglomerates*, and *Rural* firms include all companies based at least 250 kilometers away from *Urban Agglomerate* or *Urban* firms. (Discussed in more detail in section 3).

[9] The general concept of a metropolitan statistical area (MSA), as defined by the US Census Bureau, is that of a large population nucleus, together with adjacent communities having a high degree of social and economic integration with that core. Thus, our largest CMSAs represent not only the most highly populated areas in the country, but also the most economically dense regions in terms of number of workers, headquarters, investors, banks and institutions.

The above results are robust to a host of endogeneity and sensitivity tests, including alternative measures of geographic location, sample selection criteria, firm, CEO and industry controls, information asymmetry, governance and monitoring proxies, asymmetric benchmarking and peer pay benchmarking schemes. Taken together these findings provide strong support for the occurrence of a significant amount of learning, networking opportunities and informational spillovers for CEOs within densely populated areas (Jacobs, 1969; Lucas, 1988; Glaeser, 1999; Welch, 1992; Bikhchandani, Hirshleifer and Welch, 1992; Hong, Kubik and Stein, 2005; and Christoffersen and Sarkissian, 2009) for which urban firms are willing to pay a premium. This indicates that geography is an important determinant of the level and structure of CEO compensation.

Because high ability workers are predicted to perform better and obtain pay improvement as they move to jobs that better match their skills (Helsley and Strange, 1990, 1991; Glaeser, 1999), we next determine whether the sorting of managers with superior skills into big cities is the driving force behind the documented higher total and incentive pay for *Urban* and *Urban Agglomerate* CEOs. If this is the case, then controlling for managerial skill and holding everything else equal, we should find no such pay premium for managers in firms that have not experienced CEO turnovers (Christoffersen and Sarkissian, 2009). Consistent with information transfer and human capital externalities in big cities, but in contrast with more able CEOs sorting into large metropolitans, we once again find a total and equity based pay premium for CEOs in larger cities that is increasing in CEO experience in the same city, even for firms without managerial replacements.

Finally, we examine whether there are other potential factors that could be driving our results. For example, firms based in large cities could afford to pay higher wages and equity incentives because of higher local demand and/or lower production costs (Mills, 1967; Henderson, Kuncoro and Turner, 1995), or because certain CEOs may require a compensating premium for bearing a lower quality of life in highly congested urban areas (Roback, 1982; Deng and Gao, 2011). Similarly, it is possible that some rural CEOs substitute monetary pay for the ability to remain in their home state (Yonkers, 2010) or for the ability to satisfy a preference for lower risk taking (Graham, Harvey and Puri, 2010; Hayes, Lemmon and Qiu, 2010). Another possibility is related to peer group compensation benchmarking.[10] Although such benchmarking is typically done against similar size, performance and operational-complexity firms (Bizjak, Lemmon, and Nguyen, 2011), some companies could potentially benchmark a CEO's compensation against a group of self-selected, highly paid *local* peers. This could happen, for example,

[10] It has become a regular practice for firms to justify their high CEO compensation by referring to a group of companies with highly paid CEOs (Bizjak, Lemmon, and Naveen, 2008; Faulkender and Yang, 2010), claiming they compete for managerial talent with those selected peer companies. Albuquerque, De Franco, and Verdi, (2009) argue that compensation peer benchmarking is consistent with the equilibrium outcomes of the CEO labor market. Hayes and Schaefer, (2009) model the Lake Woebegone effect in which firms distort CEO pay upward in an attempt to affect market perceptions of firm value. DiPrete, Eirich, and Pittinsky, (2010) show the effects of leapfrogging potentially explain a considerable fraction of the overall upward movement of executive compensation over a recent 15 year period.

because of social pressure or envy among local CEOs (Ang, Nagel and Wang, 2009; Bouwman, 2009). Given these possibilities, controlling for managerial ability and holding everything else equal, CEOs in firms that relocate their headquarters into larger cities should experience an immediate increase in total and incentive pay, and firms leaving a large city and relocating into a smaller, less central community should experience an immediate reduction in total and incentive pay. These arguments, however, do not predict that managers are able to acquire *extra* human capital (i.e., learn in the city) which is transferable to rural areas. If it is the case that the dense economic activity in large metropolitans makes managers more able or influential, perhaps through knowledge spillovers, business connections and/or improved access to private information about competitors, innovations and product markets, then CEOs in large cities should be able to at least partially transfer these ability gains once they relocate to firms based in smaller cities.

Consistent with the latter conjecture we find, after controlling for differences in the cost of living and the ability of CEOs across locations, that the relocation of a firm's headquarters from a small city to a large metropolitan does not result in an *immediate* pay premium. Additionally, managing a firm based in a large metropolitan generates a positive effect on compensation that *does not* disappear once the firm moves away to a smaller, less central community. These findings are consistent with studies in the economics literature that attribute a human capital accumulation effect to large metropolitans that results in greater ability and wages, especially for highly skilled individuals who are more prone to take advantages of the positive externalities in urban areas (see, e.g., Christoffersen and Sarkissian, 2009; Audretsch and Feldman, 1996; and Gould, 2007).

Our paper contributes to several streams of research in the finance and economics literature. An enduring characteristic of the compensation literature is the large heterogeneity in the size and structure of executive pay that is left unexplained by standard compensation models (see Murphy, 1999; and Core, Guay and Larcker, 2003 for excellent reviews). While many view this heterogeneity as a sign of corporate governance failure and CEOs' abuse of power (e.g., Bebchuk and Fried, 2004; and Bertrand and Mullainathan, 2001), others argue that CEO compensation simply reflects market equilibrium where the board of directors optimally structures pay to motivate and retain CEOs (e.g., Murphy and Zabojnik, 2004; Oyer, 2004; Baranchuk, MacDonald and Yang, 2006; Gabaix and Landier, 2008; Edmans, Gabaix and Landier, 2009; and Kaplan and Rauh, 2010). Because our results are not driven by the governance environment of the firm, managerial skimming or self-selected local peer groups, this paper provides evidence in favor of a market based explanation for CEO compensation. Taken together, our findings strongly support the idea that CEOs are also paid for their valuable, portable local network and access to private information in densely populated areas.

Our paper also contributes to the very limited work on the role of managerial heterogeneity in explaining CEO compensation by examining a potentially important source of managerial ability that has not been acknowledged in the literature about CEO compensation.[11] While the extant literature has explored the roles of observable managerial characteristics, such as job tenure and gender in determining executive compensation, little is known about the importance of unobservable managerial characteristics, such as latent managerial skills or social capital. To the extent that human capital acquired in the city is transferable to other (rural) areas in the country, then living in the city should be considered not just as a decision about location of residence, but also as an investment in human capital. This type of investment may be costly, particularly for individuals with distaste for living in an urban area. However, moving to a city temporarily could be a worthwhile human capital investment in the same manner that it pays to invest in other costly forms of learning such as education, internships, training, etc. Therefore, determining whether working in a large city fosters human capital accumulation that has an effect on the extent that managers are successful and therefore, how they are compensated has implications regarding how CEOs balance their careers, human capital decisions, and location of residence over time, issues that have not been addressed in the CEO compensation literature.

Our study also contributes to the urban economics literature that, in general, studies how and why cities form and grow. A central feature of most of the theoretical models of urban economics is that the clustering of economic activity raises worker productivity and results in higher wages, especially for high ability individuals.[12] An important question in this literature is whether the concentration of employment results in higher productivity and therefore, higher wages or whether high quality workers have simply sorted themselves into areas with higher concentrations of employment (see, e.g., Glaeser and Maré, 2001). While much of the empirical findings in the economics literature are focused on lower level, observationally equivalent workers, the availability of data on executive compensation allows us to perform a detailed analysis of wages, skills, turnover, and relocation decisions across firms, industries and cities, thereby, enabling us to disentangle the competing theories.

Finally, this paper is related to the recent literature on social networks in finance. Hallock, (1997); Kirchmaier and Stathopoulos, (2008); Fracassi, (2008); Hwang and Kim, (2009); Barnea and Gurdj, (2010); Leary and Roberts, (2010); and Engelberg, Gao and Parsons, (2010) all find that the quality and size of an executive's social network is predictive of compensation and/or firm performance, with information spillover as the key driver behind such network effects. Because people are most likely to come in contact with those that live or work nearby (Bayer, Ross and Topa, 2008; Bertrand, Kramarz,

[11] See Iranzo, Schivardi, and Tosetti (2008), Graham, Li and Qiu (2010) and Bertrand and Schoar (2003) for recent work about the effect of latent managerial ability on executive pay.

[12] See Audretsch and Feldman (2004), Duranton and Puga (2004), Moretti (2004) and Rosenthal and Strange (2004) for detailed discussions of the literature of the nature and sources of agglomeration economies and production externalities within large cities.

Schoar and Thesmar, 2005; and Faccio and Parsley, 2009), our study provides additional evidence that supports the idea that CEOs are paid for their valuable, portable network of local social connections that confer information into the firm.

The remainder of the paper is organized as follows. In section 2 we present a brief literature review on urban agglomeration and how it can affect managerial ability and compensation. Section 3 describes the data, variables and methodology. We present and discuss the empirical finding in sections 4, 5 and 6. Section 7 concludes.

2. The relevant literature

2.1. Evidence on urban agglomeration and its effect on corporations

Corporate headquarters tend to be concentrated in large metropolitan areas. For example, Shilton and Stanley (1999) report that more than 40 percent of all US publicly traded companies are based in only 20 counties, and the US Census documents that 85 percent of all jobs are located in large metropolitan areas.[13] There is also extensive evidence that this spatial concentration of firms and workers is positively associated with productivity. For example, Ciccone and Hall (1996) find that the doubling of local employment density increases productivity by six percent in the US. Similar results are reported by Ciccone (2002) for Italy, France, Germany, Spain and the UK.[14] Wheeler (2001) shows that an increase in the size of a city increases the wage return to education, a measure positively correlated with productivity.

The economics literature attributes these stylized facts to cities having a comparative advantage in providing support for headquarters operations. This raises the following question: what exactly are the comparative advantages of large metropolitans? An advantage that is often cited in the literature is that firms based in dense areas save on transport costs. For instance, density makes it easier to reach consumers (Krugman, 1991) and suppliers (Ciccone and Hall, 1996). Further, access to major airports and highways facilitates the interaction with production plants, subsidiaries and industry colleagues at conventions and trade shows, both locally and internationally (Boyle, 1990).

Other benefits associated with metropolitans come from firms acquiring ideas from other neighboring firms (Jacobs, 1969; Lucas, 1988; Glaeser, Kallal, Scheinkman and Shleifer, 1992; Rauch, 1993; and Glaeser, 1999, among others). According to this reasoning, the proximity of firms encourages technological and informational spillovers. Innovative ideas are rarely kept secret when employees from different firms can easily get together and talk, gossip or even spy on one another (Orlando and Verba,

[13] Census 2000 Summary File 1 (SF 1), GCT-P1 urban/rural and metropolitan/non-metropolitan population, US Census Bureau, 2000. http://fastfacts.census.gov/servlet/DatasetTableListServlet?_ds_name=DEC_2000_SF1_U&_type=table&_program=DEC&_lang=en

[14] See also Glaeser, (1999); Glaeser and Maré, (2001); Helsley and Strange, (1990); Glaeser, Kallal, Scheinkman and Shleifer, (1992); Henderson, Kuncuro, and Turner, (1995); and Audretsch and Feldman, (1996), among others, for evidence about a positive correlation between city size and productivity.

2005; Jaffe, Trajtenberg and Henderson, 1993), and high density of economic activity facilitates such an exchange of information (see, e.g., Walcott, 2001; Hong, Kubik and Stein, 2004; and Christoffersen and Sarkissian, 2009).[15] Large metropolitans also enable companies to learn about and acquire services more effectively from sources outside of their own industry. This is the case because big cities are home to a large concentration of business service firms, such as media, law, accounting and consulting that enable firms to achieve cost and price advantages by shopping among a large number of nearby business service providers (Ono, 2001).

Another possible explanation for the positive relationship between urban agglomeration and productivity is related to the accumulation of human capital (Helsley and Strange, 1990; Wheeler, 2001). For instance, urban density can increase the rate of interaction between high-skill individuals, increase the rate at which agents have new experiences, facilitate coordination and allow individuals to specialize (Jacobs, 1969; Glaeser, 1991; and Becker and Murphy, 1992). Professionals and highly skilled personnel are also more easily recruited and retained in cluster locations because, job mobility is enhanced by the information and career advancement opportunities that proximity to a host of firms and jobs provide (Ady, 1986).

Overall, the existing evidence suggests that large metropolitans have a comparative advantage in hosting corporate headquarters which helps to explain the large prominence of corporations in urban areas.[16,17] In the next sub-section, we discuss the possible implications of corporate location and urban agglomeration on worker wages, in general, and CEO compensation, in particular.

2.2. Urban agglomeration and its effect on wages

There is extensive evidence that average wages are significantly higher in big cities than outside metropolitan areas, a phenomenon typically known as the "urban wage premium". The relationship between wages and city size is neither new nor temporary and has been documented for over a century in various countries around the world. For example, Weber (1899) shows that the urban wage premium in nineteenth century Germany was over 50 percent. Glaeser and Maré (2001) find that in the largest US

[15] Walcott (2001) documents the location of both health and biotech firms in proximity to Eli Lilly in Indianapolis (and in other production centers) as contributing to the company's successful acquisition of information. Jaffe, Trajtenberg and Henderson (1993) use patent data to document the extent to which distance limits the flow of ideas. Hong, Kubik and Stein (2004) show how information and learning are transferred within a city as they provide evidence that fund managers in the same city hold similar portfolios and imitate each other. Christoffersen and Sarkissian (2009) provide further evidence on learning and information spillovers among equity fund managers in large financial centers, reflected in better performance.

[16] Nevertheless, spatial analysis of metropolitan areas has shown that urban centers are not the only places for the growth of economic activities (Scott, 1982; Stroper, 1986; and Davelaar, 1991). Our aim is not to explain the choice of corporate location in one region versus another, a question extensively explored in the economic geography literature, but rather to study the real effects of agglomeration and headquarters location on a firm's CEO compensation.

[17] Studies of agglomeration use a wide variety of approaches in studying production externalities within cities, including examining productivity (Ciccone and Hall, 1996; Henderson, 2003), employment (Glaeser et al., 1992; Henderson, Kuncoro, and Turner, 1995), establishment births and relocations (Carlton, 1983; Duranton and Puga, 2001; Rosenthal and Strange, 2004), co-agglomeration of industries (Ellison, Glaeser, and Kerr, 2009; Dumais, Ellison, and Glaeser, 2002), product innovation (Audretsch and Feldman, 1996; Feldman and Audretsch, 1999) and land rents (Rauch, 1993; Dekle and Eaton, 1999).

cities, earnings were 36 percent higher than in rural areas during the 1970s and 24-28 percent during the 1980s and 1990s. Applying cost-of-living adjustments, DuMond, Hirsch, and MacPherson (1999) find that workers in areas with populations between 200 and 500 thousand garner roughly a 5-percent wage advantage, those in areas with populations between 0.5 to 2 million a 7-percent advantage, and those in areas 2 million and over an approximate 10 percent advantage, compared to areas with population of less than 200 thousand. Combes, Duranton and Gobillon (2008) also report that in most developed countries, workers in the richest, most densely populated areas earn up to twice as much as those in the poorest rural regions, with larger gaps in developing countries.

While most studies focus on the urban wage premium that arises for the average urban worker, others explicitly take into account differences in the type of workers and find that high ability individuals earn a comparatively larger wage premium. For example, Gould (2007) finds that while white collar workers receive an 11-percent wage premium that is increasing in city experience and is not due to skilled individuals sorting themselves into large cities, higher urban wages for blue collar workers arise exclusively from geographical labor market sorting effects. Similarly, Möller and Haas (2003) document an agglomeration wage premium in Germany for high-skilled but not for low-skilled individuals. Bacolod, Blum and Strange (2008) also find evidence that workers with cognitive and people skills that are typical for white collar professionals, as opposed to those endowed with motor skills associated with blue collar workers, receive a sizeable urban wage premium.

So far, we have presented a brief discussion of the existing empirical literature that indicates the presence of superior productivity and correspondingly higher wages in urban areas. Next, we continue our discussion with an outline of the main theoretical explanations of the urban wage premium offered in the agglomeration economics literature, with special attention to the testable implications emerging therein.

2.2.1. Cost of living differences

Given the existence of an urban wage premium, we should observe workers that are mobile moving from rural areas to urban areas. This should especially be the case for CEOs given their higher level of human capital. This is not generally observed, so the question is why do we not observe this phenomenon? The most obvious answer is that the nominal wage premium collected by urban workers may simply reflect a higher cost of living in large cities. If this is the primary explanation for the observed wage difference between urban and non-urban workers, then the urban wage premium would be purely a nominal phenomenon. This implies that once we control for the local cost of living there should not be a real wage difference between urban and non-urban CEOs (or other workers) of similar characteristics and ability. However, any real wage difference that remains after controlling for inter-area

price variation would be consistent with a real skill or productivity difference between urban and non-urban managers.

2.2.2. Ability-sorting

A second explanation offered for the urban wage premium is that cities demand, attract, and retain higher-quality workers than do employers in non-urban areas, and these skills are not reflected fully in measured variables (Fuchs, 1959). Highly skilled and motivated workers may be particularly attracted to the thick labor market in cities, where their skills can be most advantageously matched with better jobs, and can more easily find employers that require their skills in case they lose their jobs (Borjas, Bronars, and Trejo, 1992; Helsley and Strange, 1990, 1991). To the extent that high ability CEOs are attracted to big cities, the outcome of such labor market sorting is an equilibrium in which urban CEOs realize higher pay and incentive pay schemes designed to attract, retain and reward appropriate managerial talent than observationally similar CEOs located in non-urban areas.

The ability-sorting hypothesis offers several testable implications. First, if personal ability is the primary explanation for the urban wage premium, controlling for CEO skill, there should be no difference in real wages between urban and non-urban CEOs. Second, pay and incentive improvements are only expected for CEOs who change jobs and move to firms that better match their skills. And third, if the urban wage premium merely reflects a skill sorting effect across various locations, observationally equivalent executives who migrate from a large city should experience an immediate real pay and conversely an incentive pay reduction after moving to a rural area.

2.2.3. Firm-level productivity differences

The firm-level productivity hypothesis asserts that workers are more productive in firms located within cities due to economies of agglomeration. That is, the marginal product of labor is higher for city-based firms due to the production and consumption benefits of urban density (Ciccone and Hall, 1996). This, for example, could be due to a lower cost of transporting goods to the product market, a lower cost of acquiring inputs from local suppliers, or because of greater local demand. This hypothesis offers a very clear empirical prediction: CEOs moving into large cities should receive real, sizeable and immediate pay and incentive pay gains, whereas CEOs leaving large cities should experience immediate (and symmetrical) pay and incentive pay reductions.

2.2.4. Learning and accumulation of human capital

Finally, there is the learning hypothesis which postulates that cities speed up the rate of human capital accumulation. Glaeser (1999) contends that urban density accelerates the rate of interaction between

people and that when people learn through interactions, human capital accumulation is accelerated. He argues that these externalities are significantly more likely to be present in large cities because of the increased contact between particularly knowledgeable and highly skilled people. This conjecture is supported empirically. For example, Lucas (1988), Rauch (1993), Audretsch and Feldman (1996), Yankow (2006), Gould (2007), and others, find a positive association between individual earnings and the average level of human capital in cities. It should be noted that because workers only become more productive with time in the city, the learning hypothesis implies that CEOs moving into cities will not experience substantial, immediate real wage gains, but rather exhibit a gradual increase in pay and incentives. Likewise, CEOs leaving cities should not experience wage losses except through that part of the wage related to cost-of living differences.

3. Data

3.1. Sample and methodology

Our primary dataset for executive compensation and CEO characteristics comes from the Execucomp database. Because a firm's CEO makes most major corporate decisions and exerts the greatest influence on the firm among senior executives, we focus on compensation and incentive provisions for CEOs. We also focus on CEOs because the Execucomp identity of the five highest paid executives often varies year-by year, whereas looking at the CEO as the unit of observation mitigates this problem. Following Milbourn (2003) and others, we identify CEOs by the fields "BECAMECE" and "CEOANN". We then collect data about analysts from the Institutional Broker Estimation System (I/B/E/S) annual consensus-earnings forecasts. Next we match our sample with the percentage of shares held by outside blockholders using data from Dlugosz, Fahlenbrach, Gompers and Metrick (2006) that were obtained from Compact Disclosure.[18] To control for firm level governance and information asymmetry, we obtain the Bebchuk, Cohen and Ferrell (2005) antitakeover index (*BCF index*), and the Easley, Hvidkjaer and O'Hara (2002) measure of probability of informed trading (*PIN*).[19]

Finally, we control for cost of living and per capita income differentials across localities. Cost of living information for every city in our sample is collected from *Sperling's Cost of Living Index Calculator* (http://www.bestplaces.net/col/), and per capita income data are from the *US Bureau of Economic Analysis* (http://www.bea.gov/regional/docs/spi2006/).[20] In controlling for cost of living, we follow DuMond, Hirsch and MacPherson (1999), among others, and use local cost of living as an

[18] We obtain data on outside equity blockholders from http://finance.wharton.upenn.edu/~metrick/data.htm

[19] Available at http://www.law.harvard.edu/faculty/bebchuk/data.shtml and http://www.smith.umd.edu/faculty/hvidkjaer/, respectively.

[20] *Sperling's Cost of Living Index* is based on the costs of housing, food, transportation, utilities, health care, and miscellaneous expenses such as clothing, services and entertainment. Controlling for the MSA median housing price from the *National Association of Realtors* as a factor that may affect cost of living considerations produces qualitatively similar results.

explanatory variable rather than deflating all compensation measures by cost of living. DuMond et al. argue that because the cost of living index is calculated using a fixed bundle of consumer goods and services, it systematically overstates the true cost of living in more expensive areas.[21] They contend that the relationship between wages and prices is non linear because consumers can and do substitute goods and local amenities across locations.[22] Thus, in order to keep utility constant as one moves from less costly to more costly areas nominal wages must increase, but only at a *decreasing* rate. Consequently, it is common practice in labor and urban economics research to endorse a partial cost of living adjustment method that uses the cost of living as an explanatory variable rather than deflating the dependent variable directly. All monetary terms used in the sample are in 1992 constant dollars. To remove the inflation effect from the empirical study, compensation is presented in real terms by adjusting nominal pay with CPI.

To classify firms as *Urban Agglomerate*, *Urban* or *Rural*, we follow a number of authors, including Coval and Moskowitz (1999), Ivkovic and Weisbenner (2005), and Loughran and Schultz (2005), among others, and use a company's headquarters as a proxy for its location. We obtain the headquarters locations from Compustat, Execucomp and Hoover's. We then find the latitude and longitude data for each firm's headquarters using the *US Census Bureau's Gazetteer city-state files*.[23]

We classify a company as an *Urban Agglomerate* firm if it is headquartered in one of the ten largest consolidated metropolitan statistical areas (CMSAs) of the United States according to the 2000 Census. These include New York City, Los Angeles, Chicago, Washington - Baltimore, San Francisco, Philadelphia, Boston, Detroit, Dallas, and Houston. Companies located in a suburb of one of these cities are also included in the *Urban Agglomerate* portfolio. A company is classified as *Urban* if it is not an *Urban Agglomerate* firm and if it is headquartered in a metropolitan statistical area (MSA) with at least 1 million residents as defined by the US Census. Finally, *Rural* firms are those located at least 250 kilometers away from *Urban Agglomerate* and *Urban* firms and based in MSAs with less than 1 million residents. To classify each firm into its respective city size category, we use the latitude and longitude

[21] Most cost of living measures (including the one employed here) are based on a Laspeyres index that compares relative prices for the same bundle of goods. Because the bundle is fixed, it does not accurately measure the compensating differential necessary to provide equivalent utilities across any two regimes. Measured price indices undercompensate for price differences as one moves from low cost areas (where the priced bundle of goods is suboptimal and not purchased) toward average cost of living areas where the measured bundle provides the preferred (i.e., utility maximizing) mix of goods and services. But as one moves from average cost areas toward higher cost cities, measured price indices overcompensate for price differences. In both cases, the difference between a standard fixed bundle index and a utility constant price index stems from the ability of workers to change their consumption mix from that measured in the fixed bundle. An implication of the above is that the relationship between wages and prices should be nonlinear (see also Braithwait, 1980 on the substitution bias of cost of living indexes).

[22] For example, aspiring actors may find it optimal to accept low wages in high-priced Los Angeles, but would require a high wage to live in, say, College Station, Texas. Conversely, workers who care about good barbecue will readily accept low wages in low-priced College Station, but would not do so in L.A. Similarly, CEOs who care about clean air and lower congestion will readily accept lower pay in low priced rural areas, but would not do so in big cities. Although resulting in a lower urban wage gap, deflating compensation measures by the cost of living yields qualitatively similar results (available upon request).

[23] Available at http://www.census.gov/geo/www/tiger/tigermap.html.

data and compute the distance between each firm's headquarters and the ten largest US metropolitan areas including their suburbs, and between each firm and the US metropolitan areas of at least 1 million people as defined by the 2000 Census. We use the standard formula for computing the distance *d(a,b)* in statutory kilometers between two points, *a* and *b* as follows:

$$d(a,b) = \arccos[\cos(a_1)\cos(a_2)\cos(b_1)\cos(b_2) + \cos(a_1)\sin(a_2)\cos(b_1)\sin(b_2) + \sin(a_1)\sin(b_1)]r \quad \text{.....(1)},$$

where, a_1 and b_1 are the latitudes and longitudes of the two points (expressed in radians), respectively, and *r* denotes the radius of the earth (approximately 6,378 statutory kilometers).

In order for a firm to be included in our sample, data on the firm's headquarters location, population size, leverage, assets, sales, analyst coverage information, total pay and the composition of CEO pay, CEO tenure, CEO age, the percentage of shares held by the CEO, market-to-book, return on assets, firm age, outside equity blockholders and *PIN* must be available. We also exclude observations if the firm does not have a PERMNO or has no executive identified in a particular year (i.e., no CO_PER_R). A total of 10,107 CEO-year observations containing 777 publicly traded firms, covering the years 1992-2004 meet these criteria. A discussion of the variables we use in the study follows.

3.2. Description of variables

Our dependent variable of interest is CEO compensation. We use the logarithm of the total compensation variable, which includes base salary, bonuses, options (Black– Scholes value), restricted stocks, and other compensation. This variable is referred to as *TDC1* in the Execucomp database. We also separately analyze the logarithm of the equity based portion of compensation, defined as the log of the total value of options (Execucomp variable *BLK VALUE*) and restricted stock awarded to the CEO (Execucomp variable *RSTKGRNT*) as a percentage of total compensation. We use CEO-specific, firm-specific and demographic control variables in our analysis. CEO-specific measures include *CEO age* and CEO tenure (*Tenure*) in years. Older executives and/or those who have been in office longer may receive compensation because they are more reputable (Milbourn, 2003) or because longer tenure strengthens the CEO's ability to influence the board's compensation decisions (Hermalin and Weisbach, 1998, and Baker and Gompers, 2003). To capture this dimension of managerial experience we measure *Tenure* as the difference between the current year and the year when the CEO was appointed by the company.

In addition, to account for CEO unique skills that are acquired through experience with the firm, we measure CEO ability (*Skill*) as the residual from a regression of firm raw returns on the equal weighted

and value weighted 2-digit SIC code industry returns, as in Garvey and Milbourn (2006). If skilled CEOs are more likely to be clustered around large cities, as predicted by the ability-sorting hypothesis, then controlling for CEO ability would potentially mitigate the spatial cross-sectional variation in executive compensation, *ceteris paribus*.

Our firm-specific variables are obtained primarily from Compustat and include headquarters location, the firm's asset size (*Size*), firm age (*Firm age*) measured as the difference in years between the current year and the year of the company's incorporation; firm leverage (*Leverage*), calculated as the ratio of long-term debt to total assets; and firm profitability (*ROA* and *market-to-book ratio*). We calculate *ROA* as the ratio of earnings before interest, tax, depreciation and amortization, divided by total assets. For the *market-to-book* ratio, we use the end of the previous year's CRSP market value of equity scaled by the prior fiscal year's book value (defined as Compustat book value of equity plus balance-sheet deferred taxes and investment credit minus the book value of preferred stock). Because the literature suggests that firms facing larger risk with respect to their prospects tend to provide higher compensation to their managers (e.g., Core et al., 1999), we also account for firm risk using the prior 5-year average Black-Scholes percentage volatility (*Volatility*).

We next account for a firm's monitoring needs and information asymmetry with the following variables. Our information asymmetry proxies include the number of analysts following the firm (*Log(1+Analysts*)), analyst forecast error (*Analyst forecast error*), and the probability of informed trading (*PIN*). Existing work has shown that the information production role of analysts increases with their proximity to target firms (Bae, Stulz and Tan, 2006) and is associated with greater information accuracy and availability (Malloy, 2005). Analyst coverage is defined as the number of analysts reporting current fiscal year annual earnings estimates prior to June of year *t*. We use the log of one plus the number of one-year-ahead analyst earnings forecasts as our measure of analyst following. Firms without I/B/E/S coverage are assigned a value of zero analysts. We compute the analysts' coverage error, which is positively associated with information asymmetry (Gilson, Healy and Noe, 1998), as the absolute difference between the actual annual EPS and the mean analysts' forecast, standardized by the closing price at fiscal year-end. Finally, *PIN*, a measure developed by Easley, Hvidkjaer and O'Hara (2002), provides an estimate of the level of private information associated with a firm's stock. To the extent that corporate location affects executive compensation through information dissemination by the firm's analysts and informed traders, once we control for information dissemination measures, we should observe a significant reduction of the effect of urban agglomeration on firms' CEOs compensation contracts.

Because better governed firms are expected to be less affected by city size and distance from central cities, we control for several institutional and governance related variables, namely, the percentage of

outside blockholdings (*outside blockholders*) and the level of antitakeover defenses (*BCF index*). Shleifer and Vishny (1997) point out that institutional blockholders have the incentive and the power to effectively monitor management. Loughran and Schultz (2005) and Loughran (2008), among others, present evidence of a local (close proximity) bias of (security) holdings by institutions that serves to enhance their ability to monitor. To construct this variable, we match the percentage of shares held by outside blockholders with our sample, using data from Dlugosz, Fahlenbrach, Gompers and Metrick (2006). If local institutions hold shares of remote *Rural* firms, such firms will face fewer governance problems that could be potentially reflected in CEO compensation contracts. This would mitigate informational differences between *Rural* and *Urban Agglomerate* companies and reduce the likelihood of finding a significant location effect. As an additional governance proxy, we use the Bebchuk, Cohen and Ferrell (2005) antitakeover index (*BCF index*), which is the sum of six dummy variables equaling 1 if the sample firm has a poison pill, requires supermajority approval of mergers, has a golden parachute, has limits to amend its bylaws, has a staggered board, and/or limits to amend its charter. These measures are often used to proxy for managerial entrenchment (Bebchuk, Cohen and Ferrell, 2005).

Finally, we create dummy variables to track the headquarters location of each company, forming three groups: firms based in large cities (*Urban Agglomerates*); firms headquartered in large, non-*Urban Agglomerate* areas (*Urban*); and firms headquartered in remote rural areas (*Rural*) as a control group. We also use alternative, continuous spatial measures, and collect data on the demographic features associated with the firm's headquarters locale. Similar to Christoffersen and Sarkissian (2009), we use two demographic measures from the US Census Bureau: *Population size*, and *Population density* (per square mile of land area).

3.3. Summary statistics

We segment our total of 10,107 CEO-year observations representing 777 firms into firms headquartered in *Urban Agglomerate* areas (5,000 observations), *Urban* areas (3,923 observations) and *Rural* areas (1,184 observations). Table 1 presents the distribution of our sample across the three location groups, the major city, population size and the Census Bureau's code associated with each CMSA/MSA during 1992-2004. Overall, there are 143 distinct CMSAs/MSAs (10 *Urban Agglomerate* CMSAs, 39 *Urban* MSAs and 94 *Rural* MSAs) hosting the firms in our sample. According to the 2000 Census, their population size ranges from 28,149 in Yazoo City, Mississippi to about 21.2 million in New York City's CMSA.

[Insert Table 1 about here]

Table 1 displays the distribution of our sample across the continental US where we see that most firms are headquartered in or near the ten largest US cities. Areas of the country that we classify as *Rural* include a significantly lower concentration of firms headquartered in areas such as upstate New York, New England, most of Alabama, Mississippi, Arkansas, Western and Southern Texas, the Great Plains states, parts of Georgia and South Carolina, Northern Minnesota, Wisconsin and Eastern Washington and Oregon. These areas are also the most sparsely populated areas in the country.

[Insert Table 2 about here]

Table 2 provides the summary statistics for the variables used throughout the analysis. Panel A presents a comparison of the demographic characteristics across the three location groups. As expected, firms headquartered in *Urban Agglomerates* are in the most populous areas with an average population size of 7.4 million and density of 4,271 people per square mile, compared to 1.9 (0.5) million and 1,224 (268) people per square mile in *Urban* (*Rural*) areas.

In Panel B of Table 2 we compare firm, managerial and institutional characteristics across *Urban Agglomerate*, *Urban* and *Rural* based firms. Firms headquartered in *Rural* areas are significantly younger and smaller than firms headquartered elsewhere whereas, *Urban Agglomerates* host the oldest and largest firms in the sample. Consistent with the findings in Loughran and Schultz (2005) that remote rural firms are less likely to issue equity and have a higher debt ratio, we find that *Rural* firms are significantly more levered than *Urban* and *Urban Agglomerate* firms as indicated by the leverage ratios of 28.385%, 22.482%, and 20.391%.

Consistent with Malloy (2005), Loughran and Schultz (2005) and others, we find that *Rural* companies have a lower percentage of shares held by the CEO, as well as lower outside blockholdings, less analysts coverage, a higher analysts forecasts error and a higher *PIN*, in comparison to their *Urban* and *Urban Agglomerate* counterparts. These findings suggest that remote rural based firms have lower visibility and familiarity, along with greater information asymmetry, compared to both *Urban* and *Urban Agglomerates.* To the extent that information dissemination and external monitoring can ameliorate agency problems thereby, leading to more effective compensation and incentive pay, city size and distance from major cities, would further exacerbate the effect of rural location on CEO compensation.

In Panel C of Table 2 we examine how executive compensation is affected by headquarters location. The median total pay of the CEOs in our sample is $2.6 million, with *Rural* CEOs earning the lowest pay ($2.1 million), compared to *Urban* ($2.2 million) and *Urban Agglomerate* managers ($3.2 million).

Rural CEOs also earn the lowest amount of equity based pay compared to their *Urban* and *Urban Agglomerate* counterparts, with median equity pay of $0.8 million, $1 million and $1.7 million, respectively. All incentive pay differentials are statistically significant at least at the 1% level. Consistent with a higher level of overall median pay for *Urban Agglomerate* CEOs, all components of executive compensation, namely options, cash based pay, including salary and bonuses are significantly higher for large city CEOs compared to their counterparts in *Urban* and *Rural* headquartered firms.

[Insert Figure 1 about here]

We continue the analysis by examining the relations between our demographic variables and CEO compensation. Figure 1 shows the median total compensation of the CEOs in our sample (Plot A) and their equity incentives (options and stocks) as a percentage of total pay (Plot B) across the 49 largest CMSAs/MSAs in the US, sorted by population size. Consistent with the urban economics literature, Plot A shows a clear, positive relationship between the population size of the central city associated with CMSA/MSA where the firm is headquartered and the median total CEO compensation for the most highly populated metropolitans in the US. Similar evidence is illustrated in Plot B, where we see a positive relationship between the population size of the metropolitan where the CEO is employed and the proportion of equity based incentives.

[Insert Figure 2 about here]

In Figure 2, we graphically illustrate the distribution of total median CEO pay (Plot A), average cash pay as a percentage of total pay (Plot B) and average equity pay as a percentage of total pay (Plot C) over time and across the three location groups. Consistent with the univariate results in Table 2, *Urban Agglomerate* CEOs exhibit the highest total pay during each year of the sample period, whereas *Rural* CEOs the lowest. *Urban Agglomerate* executives also receive the lowest level of cash based pay and the highest level of equity pay as a percentage of total compensation for every year during 1992-2004. The similarity of total, cash and equity pay patterns across the three location groups over time, as shown in Figure 2, indicates that the level and structure of compensation contracts across firms in various areas is not driven by macroeconomic conditions that are specific to a certain region.

In sum, Figures 1 and 2 and the univariate results show that on average, CEOs employed in firms headquartered in large, densely populated metropolitans earn substantially higher wages and equity based incentives compared to their counterparts employed in smaller, less populous areas. This preliminary evidence supports the findings in the urban economics literature of the existence of an urban wage

premium, as well as our conjecture that compensation packages and incentive pay schemes designed to attract, retain and reward appropriate managerial talent should vary positively with the size of the metropolitan where the firm is headquartered. Moreover, it suggests that the CEO market is not national as suggested by Kedia and Rajgopal (2009). However, total CEO pay and equity based incentives can differ across firm locations if there are systematic differences in firm, local or managerial characteristics. To address this issue, we next use regression analysis to examine whether changes in executive compensation contracts are attributable to the firm's headquarters location demographic features or are due to systematic differences in firm and CEO characteristics.

4. Empirical Results

In this section we use regression analysis to examine the effect of a firm's headquarters metropolitan size on CEO compensation, controlling for local, firm and CEO specific measures, as defined earlier.

4.1. Main results

Table 3 reports the main regression results, with *Urban Agglomerate* and *Urban* dummy variables as proxies for the size of the metropolitan that a CEO's firm is headquartered. *Urban Agglomerates* represent the ten most highly populated CMSAs in the US based on the 2000 Census. These areas also represent the largest, most persistent concentration of headquarters in our sample. *Urban* areas include MSAs with a population size of at least 1 million people that are not *Urban Agglomerates.* The primary specification is the following:

$$Log(Compensation_{it}) = \alpha_0 + \alpha_1 * Urban\_Agglomerate_i + \alpha_2 * Urban_i$$
$$+ \alpha_3 * [Tenure_{it-1}] * [Urban\_Agglomerate_i] + [Controls_{it-1}] + Industry\_Effects + Year\_Effects \quad (2)$$

Unless otherwise noted, $Log(Compensation_{it})$ represents the log of total CEO pay or the log of equity based pay as a percentage of total pay. The coefficient α_1 (α_2) represents the difference in CEO compensation between *Urban Agglomerate* (*Urban*) firms and *Rural* based companies. The lagged control variables are as specified in the previous section. The coefficient α_3 represents the interaction between CEO *Tenure* and the *Urban Agglomerate* dummy variable and captures the incremental effect of large metropolitan experience on CEO pay. We include industry and year fixed effects, using the Fama-French 48-industry dummies (Fama and French, 1997) and year dummies. In all regressions, we use robust standard errors, clustered at the CMSA/MSA level.

[Insert Table 3 about here]

Column (1) of Table 3 shows the results of a panel regression, where the dependent variable is the log of total CEO compensation (Execucomp variable *TDC1*). Total CEO compensation consists of salary, bonus, value of restricted stock granted, value of options granted (using Black– Scholes), long-term incentive payouts, and other compensation. We find, consistent with our conjecture, that both the *Urban Agglomerate and Urban* dummies are positive and statistically significant at the 1% level, indicating that CEOs in larger cities earn a significantly higher compensation than CEOs in rural areas. To be specific, controlling for cost of living, and adjusting for log transformation, column (1) shows that CEOs based in firms headquartered in one of the ten largest CMSAs in the US receive total compensation that is 13.8% higher than those of remote *Rural* firms. Similarly, although not as dramatic, CEOs of firms in smaller metropolitans (metropolitans that have at least 1 million residents) receive total compensation that is 4% higher than that received by CEOs of *Rural* firms. Consistent with the positive learning externalities associated with big cities, the interaction between CEO *Tenure* and the *Urban Agglomerate* dummy variable indicates that an additional year of experience can increase the average total pay of an *Urban Agglomerate* CEO by 2.6% more than a comparable CEO working in a *Rural* firm, ceteris paribus.

In columns (2) and (3) we run the primary regression using the log of equity and cash pay as a percentage of total compensation. The equity based portion of CEO compensation consists of the value of options and restricted stock, whereas the cash based portion consists of the value of salary and bonus pay. Adjusting for the log transformation, the findings in columns (2) and (3) indicate that the composition of equity incentives is significantly higher for *Urban Agglomerate* and *Urban* CEOs compared to their *Rural* counterparts while the opposite is obtained for cash compensation. These results suggest that, adjusting for the cost of living and holding everything else equal, compensation consultants and executive compensation committees do take urban agglomeration effects into account when setting the level of pay and the structure of CEOs compensation contracts.

The results in columns (2) and (3) are also economically meaningful. For example, in column (2), the coefficient on the average portion of equity pay is 0.147, suggesting that the portion of equity incentives for an *Urban Agglomerate* CEO is 40.3% higher than that of a CEO employed at a *Rural* based company. In column (3), the effect of geography on the cash based portion of CEO pay is negative and somewhat smaller in magnitude, with a negative coefficient of 0.129, suggesting that the level of cash based pay as a percentage of total pay of *Rural* CEOs is 25.7% higher than that of their *Urban Agglomerate* counterparts.

The coefficient estimates of the control variables used in the regressions all bear their expected signs and are statistically significant at conventional significance levels. More important, however, is that the relation between CEO compensation and city size is significant at the 1% level for all model specifications. Thus, these findings corroborate the univariate results that CEOs employed in firms headquartered in larger and more populous cities enjoy a significant city wage premium. These findings are revealing in that they show that this premium is not driven by cross-sectional differentials in cost of living, and is due primarily to the higher composition of equity based incentives.

We now further explore the effect of city size on equity and cash based components. To do so, we look separately at the option, stock, salary and bonus based portions of compensation. Results are reported in Table 4. Columns (1) and (2) contain regression results for options and stocks, with salary and bonus regressions results reported in Columns (3) and (4). Columns (1) and (2) results show that there is a positive and highly significant differential in option and stock compensation between *Urban Agglomerate* and *Rural* CEOs. In contrast, for the salary and bonus regressions (Columns (3) and (4)) the coefficient on the *Urban Agglomerate* and *Urban* dummy variables are negative and significant indicating that CEOs in *Rural* areas obtain a larger part of their compensation as salary and bonus than CEOs in *Urban* and *Urban Agglomerates.* Taken together, these findings indicate that the wage premium enjoyed by *Urban Agglomerate*, and to a lesser extent *Urban* CEOs, is due entirely to the equity component of compensation which more than offsets the lower portion of salary and bonus that they receive. It should also be noted that the higher equity based portion of pay for CEOs in large cities compared to their *Rural* counterparts is mainly attributable to stock compensation, and the higher cash based portion of pay for CEOs in *Rural* areas is mainly attributable to differences in salary.

[Insert Table 4 about here]

These results permit a simple, yet informative thought experiment: adjusting for the cost of living, how would moving a firm's headquarters from a *Rural* area to an *Urban Agglomerate* area affect the structure of CEO compensation contracts, ceteris paribus? The data suggest that if we were to move a company from say, rural Little Rock, AR to New York City, the CEO's portion of real salary (bonus) would decline by 32% (17%), and the portion of real stock (option) pay would increase by 42% (39%). Thus, the results in this section indicate that geography, in general, and the size of the city where the CEO's firm is headquartered, in particular, are important determinants of the level and structure of managerial pay.

4.2. Urban Agglomeration, learning and ability- sorting effects

Our results so far are consistent with those found by Gould (2007), among others, who documents higher wages for workers in large cities which he attributes to a city learning effect. However, the "city premium" reflected in a CEO's total and equity based pay, may not be due to the effect of positive city externalities, but rather may result from an ability-sorting effect of skilled CEOs migrating into large cities. This is the case because the coefficient on the location dummy variables may not be picking up higher human capital accumulation in the city, but rather higher returns to experience for CEOs who would get the same pay increases even if they did not move to an urban area.

To explore the implications of learning and ability-sorting effects in more detail, we specifically estimate the relation between CEO compensation, managerial skill, and city experience for firms located in *Urban Agglomerate*, *Urban* and *Rural* firms separately. We use a regression setting similar to Equation (2), except in this framework, we compare CEO compensation for firms based in our three location groups rather than using the *Urban Agglomerate* and *Urban* dummy variables as in the baseline regression. We again control for various characteristics, cost of living, firm, year, and industry effects. The panel regression model is as follows:

$$Log(Compensation_{it}) = \alpha_0 + \alpha_1 * Tenure_{it-1} + \alpha_2 * Skill_{it-1} + [Controls_{it-1}] + Industry\_Effects + Year\_Effects ...(3)$$

Where $Log(Compensation_{it})$ represents the log of total CEO pay or the log of the equity based portion of pay, and the coefficient α_1 (α_2) represents the marginal effect of managerial experience in the same city and firm (innate ability) on compensation. All variables in the regression are defined as before. In Table 5, we use panel regressions where the dependent variable is the log of total CEO compensation and columns (1) to (3) represent *Rural*, *Urban* and *Urban Agglomerate* firms. Columns (4) to (6) show the regression results for *Rural*, *Urban* and *Urban Agglomerate* firms separately, where the dependent variable is the log of the equity based compensation (Execucomp variables *BLK VALUE* + *RSTKGRNT*) as a percentage of total pay.

According to the learning hypothesis, managers earn more as they gain more experience in firms based in larger cities. As such, we expect the slope, α_1, to be significantly more positive for *Urban* and *Urban Agglomerates* than for *Rural* firms, even after controlling for managerial ability. In contrast, the ability-sorting hypothesis suggests that managers with better skills move to large cities, and it is skill

more so than learning that contributes to pay. Accordingly, we expect the slope, α_2, to be more positive for *Urban* and *Urban Agglomerate* firms than for *Rural* companies.

[Insert Table 5 about here]

Table 5 shows the regression results based on Equation (3) for firms headquartered in *Rural*, *Urban* and *Urban Agglomerate* areas separately. We first compare the slope coefficient on managerial experience, α_1, across different locations. Consistent with the learning hypothesis, we see a strong positive relation between experience and both total and equity based pay for managers employed in larger cities, with magnitudes substantially higher and more statistically significant for *Urban Agglomerate* CEOs. On the contrary, we find no evidence of learning among CEOs located in *Rural* areas, as the slope coefficient on managerial experience variable is insignificant for CEOs in *Rural* based companies. *F*-tests of whether the slope on managerial experience is the same for firms located in big cities and firms based in small rural communities are provided at the bottom of Columns (2), (3), (5) and (6). The difference in coefficients is statistically significant in all cases for both measures of CEO compensation. This indicates that managers learn faster and gain more experience, especially in *Urban Agglomerate* firms, which is reflected in significantly higher total and equity based pay.

We now turn our attention to the coefficient on the *Skill* measure, α_2. We note that the *Skill* coefficient is positive and highly significant for both compensation measures and across all three location groups, with similar magnitudes. This implies that managers with better innate skills indeed earn significantly more and that ability affects CEO compensation in the same manner, regardless of where the firm is located. Thus, the results in Table 5 provide support for the city learning hypothesis, and suggest that managers in big cities learn more over time relative to their peers working in small towns. This learning environment improves their overall compensation and incentive driven compensation for good performance, even after controlling for differences in managerial ability. In contrast, better innate skills are rewarded similarly in large and small cities, lending no support for the ability-sorting hypothesis.

An alternative way to distinguish between the learning and ability-sorting hypotheses is to separately look at firms that have experienced a CEO turnover. The learning hypothesis suggests that as a manager gains experience in the same firm in the big city, he should improve his performance and pay over time. In contrast, because this prediction excludes job changes, the ability-sorting hypothesis makes no prediction here. According to the ability-sorting hypothesis, high ability managers are predicted to perform better and obtain pay improvements only as they move to jobs that better match their skills

(Helsley and Strange, 1990, 1991; Glaeser, 1999). If this is the case, then controlling for managerial skill and holding everything else equal, we should find no such pay premium for managers in firms that experience no CEO replacements. To test the above assertion, we run our primary regression by separately looking at firms that experienced CEO turnover during our sample period versus firms that did not replace their CEOs during this period.

A total of 631 firms (81% of all sample firms) replaced their CEOs within our 13-year sample period, implying a replacement rate of about 6% of CEOs per year. This percentage is consistent with other studies that look at CEO turnover during a similar time period (e.g., Kaplan and Minton, 2006).

[Insert Table 6 about here]

Table 6 presents the results. Although the results indicate that the effect of urban agglomeration on the total pay and equity incentives of CEOs is slightly increasing in CEO turnover, an unreported Chow test (F-statistic = 0.73) does not reject the null hypothesis that no difference exists between the regression coefficients across the sub-sample groups of firms with and without CEO replacements. Thus, the results reported in Table 6 do not support the argument that the total pay and incentive pay gaps are driven by CEOs entering and exiting firms rather than changes in compensation to the same CEO in the same city. More important, in contrast to the ability-sorting hypothesis, we continue to document an urban wage premium for firms without managerial replacements, while controlling for differences in CEO skill across locations.

5. Robustness checks

The effect of geography on compensation is puzzling from the standpoint of optimal contracting theory. This theory (see, e.g., Holmstrom, 1979; and Holmstrom and Ricart i Costa, 1986) suggests that a CEO's compensation should depend on his reservation utility, his disutility for effort, risk aversion, the risk in the payoff, and his perceived ability. Under these models, geography has no role to play, especially given that, as pointed out by Kedia and Rajgopal (2009), CEOs are highly mobile, with highly transferable skills and moving costs that are relatively negligible compared to their overall wealth. In this section, we perform a variety of robustness checks to see if the surprisingly strong effect (both statistically and economically) of geography on CEO compensation goes away when we introduce additional variables that are known to influence CEO compensation as controls.

5.1. The role of familiarity, information asymmetry and monitoring

A potential cost that comes with sparsely populated, non-central and remote headquarters location is related to lower visibility, information asymmetry and monitoring (Loughran and Schultz, 2005). To the extent that information dissemination and external monitoring can ameliorate agency problems and result in more effective compensation and incentive pay, city size and distance from major cities, would further exacerbate the effect of rural location on CEO pay contracts. In Tables 7 and 8 we examine whether and to what extent these factors affect the relationship between city size and CEO compensation.

[Insert Table 7 about here]

We start the analysis by examining the implications of information asymmetry on executive pay, conditional on the headquarters location. Because large, densely populated metropolitans host more analysts and institutional investors than remote and sparsely populated cities, our findings of a positive relation between city size and pay could be primarily driven by the existence of information intermediaries and firm specific information measures that are correlated with big cities, and not by the positive learning externalities and social capital associated with urban agglomerates per se. We characterize the information environment of firms based on three proxies. These are the probability of informed trading (*PIN*), the number of analysts following the firm (*Log(1+Analysts)*), and the analyst forecast error (*Analyst forecast error*), all of which have been shown in the literature to be correlated with information dissemination.

Results are reported in Table 7. Columns (1), (2) and (3) contain results where total compensation is the dependent variable and *PIN*, *Log(1+Analysts)*, and *Analyst forecast error* are entered individually, respectively. The results indicate that the coefficient on each variable is insignificantly different from zero. In contrast, when we use equity based compensation as the dependent variable (results reported in Columns (4), (5) and (6)) that in each regression the variable is statistically significant. This suggests that with more information intermediaries and private information sources, principals have more incremental information to better structure managerial incentives. This is consistent with the findings of Kang and Liu (2008) that the pay for performance sensitivity of managerial compensation contracts is increasing in PIN and analyst coverage and decreasing in analyst forecast error. Importantly, however, while the *Urban Agglomerate* and *Urban* dummies are reduced in size compared to the baseline regression, they all remain both economically meaningful and statistically significant at the 1% level with positive coefficients. In sum, the results indicate that the urban agglomeration pay premium associated with a CEO's learning environment and social interaction with other local key individuals is not subsumed by other information intermediaries or firm-specific information environment attributes.

5.2. Monitoring and governance

We next examine the impact of external monitoring and firm level governance on the cross sectional variation of managerial pay across various headquarters locations. In general, there are several reasons to expect that the size and centrality of a city will be correlated with firm governance and monitoring. First, institutional investors are typically located in large cities and tend to overweight their portfolios toward investments in nearby companies (Coval and Moskowitz, 1999; Massa, Yasuda and Zhang, 2009), because these institutions find it more expensive, in terms of time and money, to visit and monitor companies located farther away (Loughran and Schultz, 2005). Second, if physical access to *Rural* firms is more difficult, then closely monitoring their management can potentially become increasingly costly which could result in greater agency problems between managers and shareholders. As a result, lower monitoring and firm specific governance costs *per se*, and not city centrality and size, could be the factors generating higher pay and equity based incentives for CEOs in large-city firms (Lambert, Larcker and Weigelt, 1993; and Core, Holthausen and Larcker, 1999).

We therefore, in Panel A of Table 8 examine whether the cross sectional variation in total CEO compensation is driven by differences in governance and monitoring. In Column (1) we add the Bebchuk, Cohen and Ferrell (2005) six-measure CEO entrenchment index (*BCF index*) to the primary regression specification. In Column (2) we add a measure of *Outside blockholders*, represented by the percentage of shares held by outside blockholders. We also include a dummy variable that accounts for board independence (*Independent board dummy*) in Column (3). Finally, in Column (4) we control for all three governance and monitoring variables along with our three information dissemination proxies. Consistent with the existing literature, we find that the fraction of outside blockholders and the dummy variable for board independence have a negative effect on total CEO compensation. The *BCF index*, although having the expected positive sign in all the estimations, is significant in only one of the four regressions. Importantly, the coefficients on the location dummy variables remain positive and highly significant indicating that the city compensation premium is not due to differences in governance and monitoring across the various locations.

[Insert Table 8 about here]

In Panel B of Table 8, we repeat the same exercise as in panel A, using the portion of equity based incentives as the independent variable. We find that the portion of equity based incentives is lower when shareholder rights are weaker (high *BCF index*), and when there is less monitoring

from outside blockholders and independent boards. Nevertheless, city size and centrality still remain economically and statistically significant factors in determining CEO incentive pay.

In Panel C of Table 8 we examine the impact of managerial skimming (see, e.g., Bertrand and Mullainathan, 2001; and Garvey and Milbourn, 2006), in which CEOs capture the compensation process and set pay in their own interests, on the cross sectional variation of executive compensation across cities. If CEOs are truly able to influence the setting of their pay, the real effect of city size on managerial compensation could be biased. That is, to the extent that more powerful CEOs are located in urban areas, then the city compensation premium that we have argued is due to the effect of agglomeration could in fact be due to skimming by powerful CEOs.

To address this concern, we replicate the methodology used by Garvey and Milbourn (2006), who report asymmetric benchmarking in CEO compensation. That is, CEOs are rewarded for good luck but not penalized for bad luck. Specifically, we measure the contribution of exogenous factors (*Luck*), as well as CEO skill (*Skill*) on various compensation components (equity, cash and other pay), and compare them across *Urban Agglomerate* firms and firms that are either *Rural* or *Urban* (*non-Urban Agglomerate*). *Luck* is measured as the predicted dollar value from a regression of firm raw returns on the equal and value weighted 2-digit SIC code industry returns, with *Skill* being the regression residual. To capture the asymmetry in benchmarking of pay against events that are beyond the CEOs control (i.e., market and industry factors), we create a dummy variable called *Luck is down*, which is equal to one when *Luck* is negative and zero otherwise. We also create a dummy variable called *Skill is down* which is equal to one when the value of *Skill* is negative and zero otherwise. We then create two interaction terms, *Luck * Luck is down*, and *Skill * Skill is down*, to estimate the marginal effect of *Luck* and *Skill* on pay when either one of them is negative. In addition, we control for the cumulative distribution function (*cdf*) of the dollar variance of firm returns, CEO *Tenure*, and an interaction of *Luck* with the *cdf* of the variance of luck, and *Skill* with the variance of *Skill*, plus executive fixed effects and year effects (not reported).

Columns (1) and (2) report the results for *Urban Agglomerate* and *Non-Urban Agglomerate* firms, respectively, with equity based compensation (options and restricted stock) as the dependent variable. The negative coefficient on the interaction term between *Luck* and *Luck is down* (*Luck * Luck is down*) for CEOs in *Non-Urban Agglomerate* firms supports the evidence found by Garvey and Milbourn (2006) that CEOs experience a reduction in exposure to luck based pay when luck is bad. For *Urban Agglomerate* CEOs, however, the coefficient on the same interaction term is positive, indicating that in contrast to their counterparts in smaller cities, the equity incentives of CEOs based in large cities are not shielded from bad luck events. Our point estimates imply that an executive at a *Non-*

Urban Agglomerate firm with median risk receives approximately 26 cents (0.529-0.5*0.530) in additional equity based compensation for every additional $1,000 increase in shareholder wealth because of luck. On the other hand, he loses only 9 cents (given by the sum of the median pay for luck sensitivity of 26 cents and the estimated coefficient on the *Luck * Luck is down* interaction term, 17.3 cents) for every $1,000 loss in shareholder wealth due to bad luck, a reduction of almost 65%.[24] Importantly, however, no such favorable asymmetry (from the executive's perspective) is evident for CEOs based in *Urban Agglomerate* firms.

The results are qualitatively similar when we look at the cash and other pay compensation components of CEO pay in Columns (3),(4),(5) and (6), respectively. While CEOs based in smaller cities are more shielded from bad luck, no such asymmetric pay indexation exists for *Urban Agglomerate* managers. Thus, given the absence of asymmetric pay benchmarking in *Urban Agglomerate* firms, our findings of the presence of a significant compensation premium for these firms' CEOs, cannot be attributed to the presence of skimming by CEOs. Further, to the extent that the pay-setting process is captured by more powerful CEOs (Morse, Nanda and Seru, 2010), the lack of asymmetric benchmarking of pay suggests that *Urban Agglomerate* CEOs are not more powerful than their *Urban* and *Rural* counterparts.

5.3. Other robustness checks

We now proceed with a battery of additional robustness checks, including alternative sample selection criteria, alternative measures of geographic location, and tests to rule out the presence of endogeneity in our models. These various tests generate qualitatively similar results to the ones reported above. Panel A of Table 9 uses total CEO pay as the dependent variable, and Panel B replicates the same set of tests using the portion of equity based compensation as a dependent variable.

In Column (1) we use a different geographic specification for large city location so that a firm is considered to be an *Urban Agglomerate* if it is headquartered in one of the five smaller *Urban Agglomerates* (Philadelphia, Boston, Detroit, Dallas, and Houston). Results of a total and incentive based urban pay premium hold, indicating that being headquartered in a populous area has an economically and statistically significant effect on CEO compensation.[25]

In Column (2) we estimate a median regression (minimizing the sum of absolute errors instead of squared errors) to ensure that our results are not driven by outliers. Results are qualitatively similar to the ones we report above.

[24] This result is consistent with claims by the compensation committee that benchmarking is done to retain valuable human capital in tight labor markets (Bizjak, Lemmon and Naveen, 2008; Carter and Lynch, 2001; and Chidambaran and Prabhala, 2003).
[25] The results are also robust to the exclusion of New York and California firms from the sample.

[Insert Table 9 about here]

In Columns (3) and (4) we present results when the primary regression is estimated for a sub-sample of high tech firms (SIC codes 3500-3599, 3600-3699, or 3800-3899) and non-high tech companies. High tech firms continue to receive wide spread attention as potential engines of local economic development. These firms are expected not only to pay higher wages and demand greater skills of their workers, but also to grow more rapidly than other types of firms (Barkley, Dahlgren and Smith, 1988; and Goetz and Rupasingha, 2002). It is also widely known that high tech firms tend to cluster in Silicon Valley or Boston's Route 128. The results, however, rule out the possibility that the urban CEO pay and incentive pay gaps are driven by this unique industry.[26]

We now proceed with tests that help us alleviate endogeneity concerns. Throughout the paper, we make the assumption that corporate location decisions are exogenous. That is, location is not a choice variable that is affected by the expected compensation in a certain area. Because location might be endogenous, we use a two-stage least squares approach that addresses this possibility. The results are generally consistent with those of the ordinary least square (OLS) models above. In the first stage, we use a probit framework to model the choice of *Urban Agglomerate* versus *Non-Urban Agglomerate* and the choice of *Urban* versus *Non-Urban* location in two separate probit regressions, using as an instrument the proportion of females that are 65 years or older in a firm's MSA in the year 1980.[27] The rationale for this variable as an instrument is that while it is plausible that some CEOs may endogenously locate in a certain area, it is less plausible that the average CEO will choose a certain location based on the historical proportion of elderly women in the area. In addition, because rural areas have a higher proportion of elderly residents and because women have a longer life expectancy than men, increases in age among rural residents result in a largely female population. Hence, while our instrument is highly correlated with our location dummies, it is uncorrelated with managerial location decisions. We include in the first stage regressions all of the exogenous variables from the second-stage regression. We then take the predicted value of the *Urban Agglomerate* and *Urban* dummy from the first stage for use in the second stage regressions, where the dependent variable is total CEO compensation or the equity based portion of compensation as before.

[26] In untabulated tests we also look at a sub sample of utility firms (SIC 4900-4999, according to the Fama and French (1997) industry classification codes). In general, there are several methodological advantages of testing our model using a sample of utility companies. First, looking at a single industry segment controls for a possible cross sectional variation in spreads that is driven by industry effects. Second and equally as important, looking at utility firms can help us alleviate endogeneity concerns. This is the case because examining utilities gives the economic rationale for companies choosing their location based on local resources, customers, market competition, etc., rather than CEO labor market considerations. Since a utility serves a particular geographic area, it cannot economically locate its headquarters away from its customer base and power generation. Hence, it is less plausible that results for utilities are biased by endogeneity. Indeed, as with our results above, we find a positive and significant association between an *Urban Agglomerate* (and *Urban*) location and total pay and incentive CEO pay.

[27] Demographic data can be found at: http://www.census.gov/PressRelease/www/2002/dp_compTables.html

[Insert Table 10 about here]

Table 10 presents the results from the first and second stage regressions. The first two columns show the first stage probit results. Column (1) contains results for the choice of location between *Rural* versus *Non-Rural (Urban* or *Urban Agglomerate*). The instrumental variable is highly significant at the 1% level, indicating that the concentration of females over 65 is highly correlated with our location dummies and thereby, justifying it as an appropriate instrument for our *Rural* dummy.

The broad conclusions from the previous sections go through when controlling for endogeneity. The differences between coefficients on many of the control variables in the second stage and OLS regressions are very small, but more importantly, the coefficients on the (instrumented) location *Rural* dummy variable are negative and highly significant. Thus the instrumental variable analysis confirms the main result that urban agglomeration appears to be the channel through which city size and centrality affect the compensation contracts of local CEOs.

6. Other potential explanations

Finally, we focus on other potential effects that could be driving our results. For instance, we specifically address the possibility that firm level productivity in urban areas makes workers more able and better paid due to production and consumption benefits of urban density (Ciccone and Hall, 1996; Mills, 1967; and Henderson, Kuncoro and Turner, 1995). This may result from a lower cost of transporting goods to the product market, a lower cost of acquiring inputs from local suppliers, or because of greater local demand. A second possibility is that certain CEOs may require a compensating wage premium along with high powered retention pay incentives for bearing a lower quality of life in highly congested urban areas (Roback, 1982; Deng and Gao, 2011). Similarly, it is possible that some rural CEOs substitute the ability to remain in their home state for monetary pay (Yonkers, 2010) or for the ability to satisfy a preference for lower risk taking (Graham, Harvey and Puri, 2010; Hayes, Lemmon and Qiu, 2010). A third possibility is that some companies may self-select into benchmarking CEO pay against a group of highly paid *local* peers, or imitate the pay practices of other nearby firms because of social pressure or pure envy among local CEOs (Ang, Nagel and Wang, 2009; and Bouwman 2009).

These potential explanations offer a very clear empirical prediction: CEOs moving into big cities should receive real, sizeable and immediate pay and incentive pay gains, whereas CEOs leaving big cities should experience immediate (and symmetrical) pay and incentive pay reductions. These theories, however, do not predict that managers are able to acquire "extra" human capital that is transferable back to the rural area. If this is the case, then controlling for cost of living and CEO skill, and holding everything else equal, CEOs moving into large cities should not experience substantial immediate real

wage gains, but rather exhibit a *gradual* increase in overall pay and incentives. Likewise, CEOs leaving big cities should not experience real wage losses.

To test whether other potential explanations, unrelated to the soft information spillovers and social networks associated with large cities could be driving our results, we collect data from Compact Disclosure on corporate relocations. Such relocations allow us to hold the firm and CEO constant but vary a CEO's presence in (or out of) large metropolitans, and thus examine the net effect of location on managerial compensation. In fact, analyzing corporate relocations is another powerful approach to deal with endogeneity concerns. This is the case because firm relocation choices are made for various reasons that are typically unrelated to CEO compensation. These could be, for example, the origin of the founding family or major shareholders, proximity to raw materials, suppliers, infrastructures, customers and institutional investors, local hiring pools, mergers, globalization, local taxes, synergies with other local firms and proximity to production facilities (see, e.g., Arland, Davis, Henderson, and Ono, 2007; Duranton and Puga, 2003; Fujita and Thisse, 2002).

To identify relocating companies, we first map the zip code of each headquarters in our sample into CMSAs/MSAs on an annual basis, and then identify all firms whose headquarters have moved from *Urban/Urban Agglomerate* CMSAs/MSAs into *Rural* ones or those that have moved in the opposite direction over our sample period. By focusing on firms that changed CMSAs/MSAs, we ensure that we exclude firms that have moved locally from one city to another within the same CMSA/MSA. To mitigate the concern that CEOs with independent power over location decisions could potentially steer headquarters relocations to places with higher pay, we also eliminate moves that are made by CEOs with independent power over board decisions. Following Adams, Almeida and Ferreira, (2005), such CEOs are defined as either founders, the only insider(s) sitting on the board and/or CEOs that are both president and chairman of the board.

The data also show that a relatively large number of headquarters relocations are a result of corporate mergers and acquisitions or other forms of major corporate restructuring. Because such activity could significantly affect CEO turnover and/or compensation (Jensen, 1986, and Scharfstein, 1988), we exclude such firms from the relocation sample. Many firms also relocate from one large metropolitan to another. For example, Fortune Brands Inc. moved its headquarters from the New York CMSA to the Chicago CMSA in 1999 to become closer to the majority of its operations. We exclude firms that have moved from *Urban/Urban Agglomerate* to *Urban/Urban Agglomerate* areas, as these observations do not reflect relocations from densely to sparsely populated areas, or vice versa.

The metropolitans that gained the largest number of headquarters are Houston, Washington and Atlanta, whereas the largest metropolitans, New York, San Francisco and Los Angeles, lost the most headquarters. Most *Rural* firms seem to relocate to larger metropolitans in an attempt to compete in

global markets. Notable examples include Pharmacia and Upjohn Inc. that moved its headquarters from Kalamazoo, Michigan to Bridgewater, New Jersey in 1999, and Gateway Computers that moved from Sioux City, South Dakota to San Diego, California in the same year. Our final relocation sample of firms consists of 108 migrations over the years 1992-2004, from which 61 represent moves from *Rural* to *Urban/Urban Agglomerate* areas and 47 represent moves in the opposite direction.

To measure the effect of headquarters relocation on CEO compensation, we could simply compare the average pay or equity based incentives before and after the relocation event. However, other events around the time of relocation could also affect the level and composition of CEO compensation. For instance, there could have been an increase in CEO pay for some relocating firms due to favorable local economic conditions or changes in the external governance mechanisms to which the firm is exposed. In that case, the change in CEO pay might not be due to the relocation per se. To account for this possibility, we adopt a difference-in-differences approach.

For each relocating company, we first measure the total or equity based portion of pay one year before and one year after the move, and calculate the change in total or the equity based portion of compensation as the corresponding difference. This controls for the impact of time invariant firm characteristics on pay, such as industry membership. We then calculate the same change in total and equity based portion of compensation for control firms over the same time period. We identify a control sample by using all Execucomp firms in our sample over the years 1992-2004 that are not included in the relocating firms' sample.

Firm characteristics can also change after the relocation event. Such changes can potentially confound our analyses. To address this issue, we use the following model to control for the impact of other determinants of CEO compensation:

$$\Delta(Compensation) = \alpha_0 + \alpha_1 \,\mathrm{Re}location + \beta \Delta Controls + Year\_Dummies + \varepsilon \ldots\ldots\ldots\ldots (4)$$

Where Δ(Compensation) is defined as the difference in total compensation or the difference in the portion of equity based compensation between the post- and pre-relocation periods. *Relocation* is a dummy variable that takes the value of 1 for relocating firms, and 0 for control firms. *Controls* represent the usual set of control variables (see, e.g., Table 9). Because we investigate the change in compensation, we use the lagged change in control variables in our regression analyses. Finally, we include year dummies to control for year-specific effects. [28]

[28] An important concern with the difference-in-differences methodology is that serial correlation of the error term can lead to understated standard errors (Bertrand, Duflo, and Mullainathan, 2004). In our regressions, however, we cluster standard errors at the MSA/CMSA level. This clustering not only accounts for the presence of serial correlation within the same firm, but also for any arbitrary correlation of the error terms across firms in the same CMSA/MSA in any given year as well as over time (see Petersen, 2009).

[Insert Table 11 about here]

Table 11 examines the effect of headquarters relocations across cities on a CEO's total compensation (Columns (1) and (2)) and the equity based portion of compensation (Columns (3) and (4)). Columns (1) and (3) represent a sample of *Rural* to *Urban/Urban Agglomerate* relocations with *Rural*, non-relocating firms as controls, and Columns (2) and (4) represent moves from *Urban/Urban Agglomerate* to *Rural* areas, with non-relocating *Urban/Urban Agglomerate* firms as a control sample. To conserve space we report only the results for the *Relocation* variable.

Consistent with our conjecture of a city learning effect, after controlling for differences in cost of living and the ability of CEOs across locations, we find that moving from a smaller city to a large metropolitan (Columns (1) and (3)) does not lead to an immediate total and equity based pay increase, as indicated by the insignificant coefficient on the *Relocation* dummy variable. Importantly, the insignificant coefficient on the same dummy in Columns (2) and (4) suggests that managing a firm based in a large metropolitan generates a positive effect on compensation that *does not* disappear once the CEO moves away to a smaller city and therefore does not lead to a pay reduction. These findings are consistent with studies in the economics literature that attribute a human capital accumulation effect to large metropolitans that results in better performance, especially for highly skilled individuals who are more prone to take advantages of the positive externalities in urban areas (Christoffersen and Sarkissian, 2009; Glaeser, 1999; Audretsch and Feldman, 1996; and Gould, 2007). Note however, that the findings are not consistent with firm level productivity, compensating premium for negative city externalities, in-state location on risk preferences, pay benchmarking against local peers, or CEO social pressure and envy theories/models.

7. Conclusions

A large body of literature examines the role of urban agglomeration in firm innovation and productivity. While earlier studies find a strong positive relationship between city size, employee skill, innovation, firm productivity and wages for high ability, lower level workers, there is no evidence regarding the implications of urban agglomeration for CEO compensation packages. One reason is that the literature on CEO compensation has traditionally considered labor markets for top executives as national rather than regionally segmented (see, e.g., Kedia and Rajgopal, 2009). In this paper, we make the first attempt to examine the impact of city size on CEO pay, suggesting and testing one channel through which the spatial agglomeration of economic agents could explicitly affect CEO compensation.

Using CEO compensation data for the years 1992-2004, and segmenting firms into groups based on their headquarters city size and distance from major population clusters, we find several striking results. First, controlling for firm, industry and CEO characteristics and adjusting for cost of living, we document a 14% differential between total CEO pay in *Urban Agglomerates* and *Rural* based firms. Second, we find that the equity based portion of CEO compensation is about 40% higher for CEOs based in *Urban Agglomerates* compared to their *Rural* counterparts. In contrast, the cash based portion of compensation for CEOs based in *Rural* areas is approximately 26% higher than the cash based portion of similar CEOs based in *Urban Agglomerates*. These findings are robust to a host of endogeneity and sensitivity tests, including alternative measures of geographic location, as well as sample selection criteria, firm, CEO and industry controls, managerial turnover, information asymmetry, governance and monitoring proxies.

Third, consistent with the hypothesis of positive learning externalities that exist in big cities but not in sparsely populated areas, we find a significant, positive relation between managerial experience in the same city and total and equity based compensation in *Urban* and *Urban Agglomerate* firms, which is especially strong for *Urban Agglomerate* CEOs. In contrast, we find no evidence of a relation between experience and pay among managers located in *Rural* companies. Our results also isolate the effect of job market ability-sorting on CEO compensation as, in contrast to the ability-sorting hypothesis, we see performance improvements for CEOs in firms that do not experience turnover throughout our sample period. The above findings hold after controlling for cost of living, firm, CEO and industry characteristics, including differences in managerial ability that would potentially contribute to any pay differences we observe across cities and firms (Glaeser, 1999).

We then shed light on the importance of several competing explanations for the observed gap in total compensation and equity based pay between CEOs in cities versus rural areas. Firms based in large cities could afford to pay higher wages and incentives because of higher local demand and/or lower production costs (Mills, 1967; Henderson, Kuncoro and Turner, 1995), or because certain CEOs may require a compensating premium for bearing a lower quality of life in highly congested urban areas (Roback, 1982). Another possibility is that companies benchmark CEO pay against highly paid local peers, or

imitate the pay practices of other nearby firms because of social pressure or envy among local CEOs (Ang, Nagel and Wang, 2009; and Bouwman 2009). These theories, however, do not explain our findings. Our estimates suggest gradual human capital gains acquired from working in the big city versus the rural area that are transferable to the rural area and are rewarded once the CEO relocates. Because our results are not driven by the governance environment of the firm, managerial skimming or self-selected local peer groups, this paper provides evidence in favor of a market based explanation for CEO compensation, according to which CEOs are also paid for their valuable, portable local network and access to private information in densely populated areas

Taken together, the empirical evidence suggests that the spatial clustering of firms may reflect faster learning, soft information spillovers, local social ties and connections to the right people (Christoffersen and Sarkissian, 2009; Glaeser, 1999; Audretsch and Feldman, 1996; Yankow, 2006; and Gould, 2007, and others**)**, for which local firms are willing to pay a premium and are therefore important factors for a CEO's compensation contract. This suggests that labor markets for top executives also have a regional component and that geographical factors should be included as controls in any empirical analysis of executive compensation. This is especially the case given that in practice, empirical researchers have not yet been able to completely explain the cross sectional variation in overall CEO pay and the structure of managerial compensation contracts. Perhaps more important, because working in a large city fosters human capital accumulation that has an effect on the way managers are compensated, our paper has implications regarding how CEOs balance their careers, human capital decisions, and location of residence over time, questions that have not been addressed in the existing literature about CEO pay and the effect of CEO characteristics on corporate policies.

References

Adams, R., H. Almeida and D. Ferreira, 2005, Powerful CEOs and their impact on corporate performance. Review of Financial Studies 18, 1403–1432.

Ady, R. M., 1986, "Criteria used for Facility Selection", In Financing Economic Development in the 1980s, Norman Walzer and David L. Chicone (eds.), New York: Praeger.

Albuquerque, A., De Franco, G., and Verdi, R., 2009. Peer choice and CEO compensation. Working paper, Boston University.

Almazan, A., de Motta, A, and Titman, S., 2007, Firm Location and the Creation and Utilization of Human Capital, Review of Economic Studies 74, 1305-1327.

Ang, S. A., G. L. Nagel and J. Yang, 2009, "The Effect of Social Pressures on CEO Compensation", working paper.

Arland, K., J. Davis, V. Henderson, and Y. Ono, 2007, Spatial organizations of firms: the decision to split production and administration. Rand Journal of Economics 38, 480-494.

Audretsch, D. B. and M. P. Feldman, 1996, "R&D Spillovers and the Geography of Innovation and Production", American Economic Review, 86: 630-640

Audretsch, D.B. and M. P. Feldman, 2004, "Knowledge Spillovers and the Geography of Innovation", In Henderson, V and Thisse, J.F. (eds.) Handbook of Urban and Regional Economics, Volume 4. New York: North Holland.

Bacolod, M., B. S. Blum and W. C. Strange, 2008, "Skills in the City", Journal of Urban Economics, 65, 136-153.

Bae, K. H., R. Stulz and H. Tan, 2006, "Do Local Analysts Know More? A Cross-Country Study of the Performance of Local Analysts and Foreign Analysts", Journal of Financial Economics 3, 581-606.

Baker, Malcolm and Paul A. Gompers, 2003. The Determinants of Board Structure at the Initial Public Offering. Journal of Law and Economics, 46, 569–597.

Baranchuk, N., MacDonald, G., Yang, J., 2006, The Economics of Super Managers. Working Paper, UT Dallas, Washington University in St. Louis, and Indiana University.

Barnea, A., and Guedj, I., 2006, "But, Mom, all the other kids have one!" – CEO Compensation and Director Networks. McCombs School of Business Working Paper, University of Texas at Austin.

Barkley, D.L. 1988, "The Decentralization of High-Technology Manufacturing to Non-Metropolitan Areas", Growth and Change 19, 13–30.

Bayer, P., S. Ross and G. Topa, 2008, Place of work and place of residence: informal hiring network and labor market outcomes, Journal of Political Economy 116, 1150-1195.

Bebchuk, L. A. and J. M. Fried, 2004, “Pay without Performance: The Unfulfilled Promise of Executive Compensation”, Harvard University Press, Cambridge, MA.

Bebchuk, L., A. Cohen, and A. Ferrell, 2005, “What Matters in Corporate Governance?”, Harvard Law School Olin Discussion Paper No. 528

Becker, G. S. and K. M. Murphy, 1992, “The Division of Labor, Coordination Costs, and Knowledge”, Quarterly Journal of Economics 107, 1137–1160.

Bertrand, M., and S. Mullainathan, 2001, “Are CEOs Rewarded for Luck? The Ones Without Principals Are”, The Quarterly Journal of Economics 116, 901-932.

Bertrand, M. and A. Schoar, 2003, “Managing with Style: The Effect of Managers on Corporate Policy”, The Quarterly Journal of Economics, 118, 1169-1208.

Bertrand M., E. Duflo, and S. Mullainathan, 2004, How much should we trust Differences-in Differences Estimates? Quarterly Journal of Economics 119, 249-275.

Bertrand, M., F. Kramarz, A. Schoar, and D. Thesmar, 2005, Politically connected CEOs and corporate outcomes: Evidence from France, working paper, University of Chicago and M.I.T.

Bikhchandani, S., D. Hirshleifer and I. Welch, 1992, “A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades”, Journal of Political Economy, 100, 992-1026.

Bizjak, J. M., M. L. Lemmon and L. Naveen, 2008, “Does the Use of Peer Groups Contribute to Higher Pay and Less Efficient Compensation?”, Journal of Financial Economics, 90, 152-168.

Bizjak, J., Lemmon, M., Nguyen, T., 2011. Are all CEOs above average: An empirical examination of compensation peer groups and pay design. Journal of Financial Economics, forthcoming.

Black, F., and M. Scholes, 1973, "The Pricing of Options and Corporate Liabilities", Journal of Political Economy, 81, 637-654.

Borjas, G.J., S.G. Bronars and S.J. Trejo, 1992, “Assimilation and the Earnings of Young Internal Migrants”, Review of Economics and Statistics 74, 170-175.

Bouwman, C. H. S., 2009, “The Geography of Executive Compensation”, working paper.

Boyle M. R., 1990, “Corporate Headquarters: An Elusive Economic Development Target”, Economic Development Commentary, 13, 20-30.

Braithwait, S. 1980, The Substitution Bias of the Laspeyres Price Index, American Economic Review, 70, 64-77.

Butler, A., 2008, Distance still matters: Evidence from municipal bond underwriting, Review of Financial Studies 21, 763-784.

Carter, M. E., and L. J. Lynch, 2001, “An Examination of Executive Stock Option Repricing”, Journal of Financial Economics, 61, 207-225.

Chidambaran, N. and N. Prabhala, 2003, “Executive Stock Option Repricing, Internal Governance Mechanisms and Management Turnover”, Journal of Financial Economics, 69, 153-189.

Christoffersen, S. E. K. and S. Sarkissian, 2009, “City Size and Fund Performance”. Journal of Financial Economics, 92, 252-275.

Ciccone, A., and R. E. Hall, 1996, “Productivity and the Density of Economic Activity”, American Economic Review, 86, 54-70.

Ciccone, A., 2002, “Agglomeration Effects in Europe”, European Economic Review, 46, 213– 227.

Combes, P. P., G. Duranton and L. Gobillon, 2008, "Spatial Wage Disparities: Sorting Matters!”, Journal of Urban Economics, 63, 723- 742.

Core, J., R. Holthausen and D. Larcker, 1999, “Corporate Governance, Chief Executive Officer Compensation, and Firm Performance”, Journal of Financial Economics, 51, 371-406.

Core, J. E., W. Guay, and D. F. Larcker, 2003, “Executive Equity Compensation and Incentives: A Survey”, Economic Policy Review, 9, 27-50.

Coval, J., Moskowitz, T., 1999, Home Bias at Home: Local Equity Preference in Domestic Portfolios, Journal of Finance 54, 2045-2073.

Coval, J., Moskowitz, T., 2001, “The Geography of Investment: Informed Trading and Asset Prices,” Journal of Political Economy 109, 811-841.

Deng, X. and H. Gao, 2011, “Nonmonetary Benefits, Quality of Life, and Executive Compensation”, Journal of Financial and Quantitative Analysis Forthcoming

Davelaar, E. J., 1991, “Regional Economic Analysis of Innovation and Incubation”, Aldershort, UK: Avebury.

Dekle, R. and J. Eaton, 1999, “Agglomeration and Land Rents. Evidence from the Prefectures”, Journal of Urban Economics 46, 200–214.

DiPrete, T., Eirich, G., Pittinsky, M, 2010. Compensation benchmarking, leapfrogs, and the surge in executive pay. American Journal of Sociology, forthcoming.

Dlugosz, J., R. Fahlenbrach, P. Gompers, and A. Metrick, 2006, “Large Blocks of Stock: Prevalence, Size, and Measurement”, Journal of Corporate Finance, 12, 594-618.

Dumais, G., G. Ellison and E. Glaeser, 2002, “Geographic Concentration as a Dynamic Process”, Review of Economics and Statistics, 84, 193-204.

DuMond, J. M., B. T. Hirsch and D. A. MacPherson, 1999, “Wage Differentials Across Labor Markets and Workers: Does Cost of Living Matter?”, Economic Inquiry, 37, 577-598.

Duranton, G. and D. Puga, 2001, “Nursery Cities: Urban Diversity, Process Innovation, and the Life Cycle of Products”, American Economic Review 91, 1454–1477.

Duranton, G. and Puga, D., 2003, From sectoral to functional urban specialization. Processed, London School of Economics and University of Toronto.

Duranton, G. and D. Puga, 2004, “Microfoundations of Urban Agglomeration Economies”, In Vernon Henderson and JacquesFrançois Thisse (eds.) Handbook of Regional and Urban Economics, volume 4. Amsterdam: NorthHolland, 2063–2117.

Easley D., S. Hvidkjaer and M. O'Hara, 2002, “Is Information Risk a Determinant of Asset Returns?”, Journal of Finance, 47, 2185-2221.

Edmans A, Gabaix X, Landier A. 2009. A multiplicative model of optimal CEO incentives in market equilibrium. Review of Financial Studies 22, 4881-917

Ellison, G., E. Glaeser and W. Kerr, 2009 "What Causes Industry Agglomeration? Evidence from Coagglomeration Patterns", NBER Working Paper 13068.

Engelberg, J., P. Gao, and C. A. Parsons, 2010, The Price of a CEO.s Rolodex, Forthcoming *Journal of Financial Economics*.

Faccio, M. and Parsley, D., 2009, Sudden Deaths: Taking Stock of Geographic Ties, Journal of Financial and Quantitative Analysis, 44, 683-718.

Fama, E. and K. French, 1997, “Industry Costs of Equity”, Journal of Financial Economics, 43, 153-193.

Faulkender, M., Yang, J., 2010. Inside the black box: The role and composition of compensation peer groups. Journal of Financial Economics 96, 257–270.

Fracassi, Cesare, 2008, Corporate Finance Policies and Social Networks, Manuscript.

Fu, S., 2007, “Smart Café Cities: Testing Human Capital Externalities in the Boston Metropolitan Area”, Journal of Urban Economics, 61, 86-111.

Fuchs, V. R., 1959, “Differentials in Hourly Earnings by Region and City Size”, National Bureau of Economic Research Occasional Paper No. 101. New York: NBER and Columbia University Press, 1967.

Fujita M. and J. F. Thisse, 2002, Economics of agglomeration: Cities, industrial location, and regional growth. Cambridge: Cambridge University Press.

Gabaix, X. and A. Landier, 2008. Why has CEO pay increased so much? Quarterly Journal of Economics 123, 49-100.

Garvey, G., and T. Milbourn, 2006, “Asymmetric Benchmarking in Compensation: Executives Are Rewarded for Good Luck but not Penalized for Bad", Journal of Financial Economics, 82, 197-225.

Gilson, S.C., P. M. Healy, C. F. Noe and K. Palepu, 1998, “Information Effects of Spin-Offs, Equity Carve-Outs, and Targeted Stock Offerings”, working paper.

Glaeser, E. L., 1999, “Learning in Cities”, Journal of Urban Economics, 46, 254-277.

Glaeser, E. L., H. Kallal, J. A. Scheinkman, and A. Shleifer, 1992, “Growth in Cities”, Journal of Political Economy, 100, 1126-11 1992.

Glaeser, E. L., and D. C. Maré, 2001, “Cities and skills”, Journal of Labor Economics 19, 316–342.

Goetz, S. J. and A. Ruspasingha, 2002, “High-Tech Industry Clustering: Implications for Rural Areas”, American Journal of Agricultural Economics, 84, 1229-1236.

Gould, E. D., 2007, “Cities, Workers, and Wages: a Structural Analysis of the Urban Wage Premium”, Review of Economic Studies 74, 477 -506.

Graham, R. J. S. Li, and J. Qiu, 2010, “Corporate Misreporting and Bank Loan Contracting,” Journal of Financial Economics, 89, 44-61.

Graham, J., Harvey, C., Puri, M., 2010. Capital allocation and delegation of decisionmaking authority within firms. Duke University Working Paper.

Hamermesh, D. S., 1975, Interdependence in the labor market. Economica, 42: 420-429.

Hallock, Kevin F., 1997, Reciprocally Interlocking Boards of Directors and Executive Compensation. Journal of Finance and Quantitative Analysis, 32, 331-344.

Hayes, R., Schaefer, S., 2009. CEO pay and the Lake Wobegon effect. Journal of Financial Economics 94, 280–290.

Hayes, R.M., M. Lemmon, and M. Qiu. 2010. “Stock options and managerial incentives for risk-taking: Evidence from FAS 123R.” University of Utah, working paper.

Helsley, R. W., and W. C. Strange, 1990, “Matching and Agglomeration Economies in a System of Cities”, Regional Science and Urban Economics, 20, 198-212.

Helsley, R. W., and W. C. Strange, 1991, “Agglomeration Economies and Urban Capital Markets”, Journal of Urban Economics, 31, 96-112.

Henderson, J. V., A. Kuncuro and M. Turner, 1995, “Industrial Development in Cities”, Journal of Political Economy, 103, 1067-1090.

Hermalin, B., Weisbach, M.,1998. Endogenously Chosen Boards of Directors and Their Monitoring of the CEO. American Economic Review, March 1998, 88 (1), 96–118.

Holmstrom, B., 1979, “Moral Hazard and Observability”, The Bell Journal of Economics 10, 74-91.

Holmstrom, B. and J. Ricart i Costa, 1986, “Managerial Incentives and Capital Management”, Quarterly Journal of Economics, 101, 835-860.

Hong, H., Kubik, J. and J. Stein, 2004, Social interaction and stock-market participation, Journal of Finance 59, 137-163.

Hong, H., J. D. Kubik, and J. C. Stein, 2005, Thy Neighbor’s Portfolio: Word-of-Mouth Effects in the Holdings and Trades of Money Managers. Journal of Finance 60, 2801-2824.

Hwang, B. H. and S. Kim, 2009, It Pays to Have Friends, Journal of Financial Economics, 93, 138-158.

Ivkovic, Z., Weisbenner, S., 2005, “Local Does as Local is: Information Content of the Geography of Individual Investors’ Common Stock Investments,” Journal of Finance 60, 267-306.

Iranzo, S., F. Schivardi and E. Tosetti, 2008, “Skill Dispersion and Firm Productivity: An Analysis with Employer-Employee Matched Data", Journal of Labor Economics, 26, 247-285.

Jacobs, J., 1969, The Economy of Cities. New York: Vintage.

Jaffe, A., M. Trajtenberg, and R. Henderson, 1993, “Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations”, Quarterly Journal of Economics, 108, 577-598.

Jensen, M., 1986. Agency costs of free cash flow, corporate finance and takeovers. American Economic Review 76, 323-329.

Kang, Q. and Q. Liu, 2008, Stock market, information production and executive incentives, Journal of Corporate Finance 14, 484-498.

Kaplan, S. N. and B. A. Minton, 2006, “How has CEO Turnover Changed? Increasingly Performance Sensitive Boards and Increasingly Uneasy CEOs”, NBER Working Paper.

Kaplan, S., and Rauh, J., 2010, Wall Street and Main Street: What Contributes to the Rise in the Highest Incomes? Review of Financial Studies, 23, 1004-1050.

Kedia, S. and S. Rajgopal, 2009, “Neighborhood matters: The impact of location on broad based stock option plans”. Journal of Financial Economics, 92, 109-127.

Kirchmaier, T. and K. Stathopoulos, 2008, From Fiction to Fact: The Impact of CEO Social Networks, Manuscript.

Kono C. D. Palmer, R. Friedland, and M. Zafonte, 1998, Lost in space: The geography of corporate interlocking directorates. American Journal of Sociology 103, 863-911.

Krugman, P., 1991, “History versus Expectations”, Quarterly Journal of Economics, 106, 651-667.

Landier, A., V. B. Nair and J. Wulf, 2006, Tradeoffs in Staying Close: Corporate Decision-Making and Geographic Dispersion. Review of Financial Studies, 22, 1119-1148.

Lambert, R. A., D. F. Larcker and K. Weigelt, 1993, "The Structure of Organizational Incentives", Administrative Science Quarterly, 38, 438-461.

Leary, M. T. and M. R. Roberts, 2010, Do Peer Firms Affect Corporate Finance Policy? Manuscript.

Loughran, T., Schultz, P., 2005, "Liquidity: Urban versus Rural Firms," Journal of Financial Economics 78, 341-374.

Loughran, T., 2007, "Geographic Dissemination of Information", Journal of Corporate Finance, 13, 675-694.

Loughran, T., 2008, "The Impact of Firm Location on Equity Issuance", Financial Management, 37, 1-21.

Lucas, R. E., 1988, "On the Mechanics of Economic Development", Journal of Monetary Economics, 22, 3–42.

Mace, M. 1986. Directors: Myth and Reality. Boston: Harvard Business School Press.

Malloy, C., 2005, "The Geography of Equity Analysis," Journal of Finance 60, 719-755.

Marshall, A., 1890, Principles of Economics. London: Macmillan. quoted from the eighth edition London: Macmillan 1920.

Massa, M., A. Yasuda, and L. Zhang, 2009, "Supply Uncertainty of Institutional Bond Investors and the Leverage of the Firm", Working paper, University of Pennsylvania.

Milbourn, T. T., 2003, "CEO Reputation and Stock-based Compensation", Journal of Financial Economics 68, 233-262.

Mills, E., 1967, "An Aggregative Model of Resource Location", The American Economic Review, 57, 197-210.

Möller, J., and A. Haas, 2003, "The Agglomeration Wage Differential Reconsidered: an Investigation Using German Micro Data 1984-1997", In Bröcker, J, D. Dohse and R. Soltwedel (eds.), Innovation Clusters and Interregional Competition. Berlin: Springer.

Morse A., V. Nanda and V. Seru, 2010, "Are Incentive Contracts Rigged By Powerful CEOs?", Forthcoming in the Journal of Finance.

Murphy, K. J., 1999, "Executive Compensation," in Handbook of Labor Economics, edited by Orley Ashenfelter and David Card, Vol. 3, Bk. 2., New York: Elsevier.

Murphy, K., Zabojnik, J., 2004, "CEO Pay and Appointments: A Market-Based Explanation for Recent

Trends." *American Economic Review Papers and Proceedings*.

Ono, Y., 2001, "Outsourcing Business Service and the Scope of Local Markets", Working paper, Federal Reserve Bank of Chicago.

Orlando, M. and M. Verba, 2005, "Do Only Big Cities Innovate? Technological maturity and the location of innovation", Federal Reserve Bank of Kansas City Economic Review, 90, 31-57.

Oyer, P., 2004, "Why Do Firms Use Incentives that Have No Incentive Effects?" *Journal of Finance*, 59, 1619-1649.

Petersen, M., 2009, Estimating standard errors in finance panel data sets: Comparing approaches, Review of Financial Studies 22, 435-480.

Rauch, J., 1993, "Productivity Gains from Geographic Concentration of Human Capital: Evidence from the cities", Journal of Urban Economics, 34, 380-400.

Roback, J., 1982, "Wages, Rents, and the Quality of Life", Journal of Political Economy, 90, 1257-1278.

Rosenthal, S. S. and W. C. Strange, 2004, "Evidence on the Nature and Sources of Agglomeration Economies", in J. V. Henderson and J.F. Thisse, eds., Handbook of Urban and Regional Economics, Volume 4.

Rosenthal, S. and W. Strange, 2006, "The Attenuation of Human Capital Spillovers: A Manhattan Skyline Approach", Journal of Urban Economics 64, 373-389.

Scharfstein, D. 1988, The Disciplinary Role of Takeovers. Review of Economic Studies, 55, 185-199.

Scott, A. J., 1982, "Locational Patterns and Dynamics of Industrial Activity in the Modern Metropolis", Urban Studies, 19, 111-142.

Shilton, L. and C. Stanley, 1999, "Spatial Patterns of Headquarters", Journal of Real Estate Research 17, 341-364.

Shleifer, A. and R. W. Vishny, 1997, "A Survey of Corporate Governance", The Journal of Finance, 52, 737-783.

Sorenson, O. and Stuart, T.E., 2001, Syndication networks and the spatial distribution of venture capital investments. American Journal of Sociology, 106, 1546-1588.

Stroper, M., 1986, "Technology and New Regional Growth Complexes: The Economics of Discontinuous Spatial Development", in: P. Nijkamp (ed), Technological Change, Employment and Spatial Dynamics, Berlin: Springer-Verlag, 46-75.

Weber, A. F., 1899, "The Growth of Cities in the Nineteenth Century", 3rd reprint 1968. Ithaca (N.Y): Cornell University Press

Welch, I., 1992, "Sequential Sales, Learning, and Cascades", Journal of Finance, 47, 695-732

Wheeler, C. H., 2001, Search, Sorting, and Urban Agglomeration. Journal of Labor Economics, 19(4), 879 - 899.

Walcott, S., 2001, “Growing Global: Learning Locations in the Life Sciences”, Growth and Change, 32, 511-532.

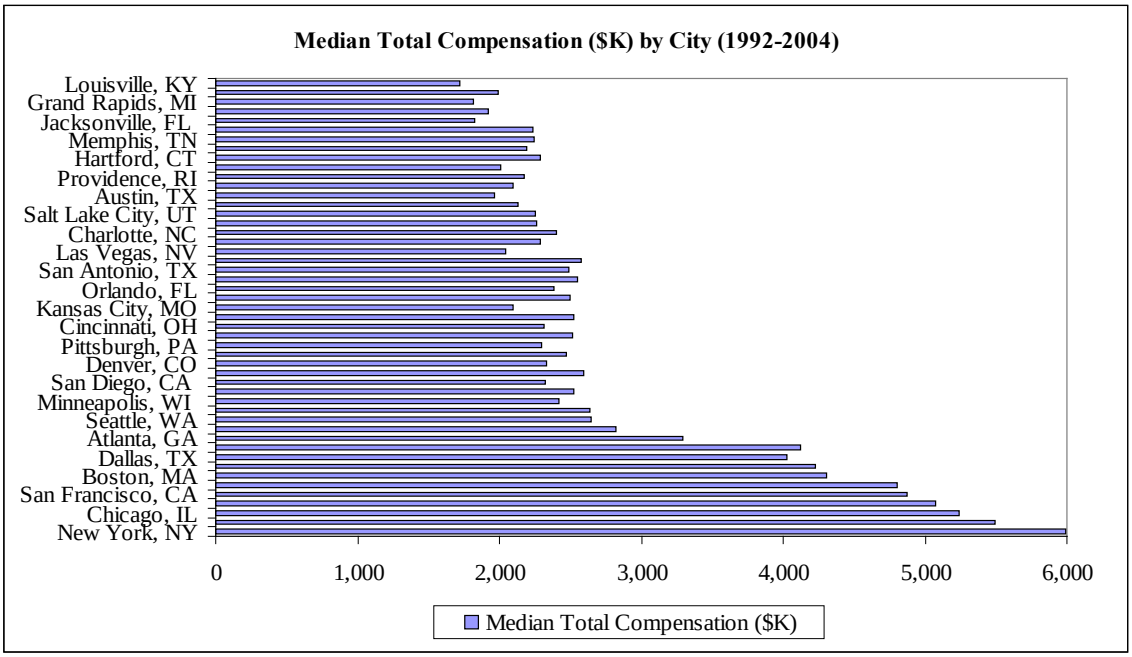
Yankow, J. J., 2006, “Why Do Cities Pay More? An Empirical Examination of Some Competing Theories of the Urban Wage Premium”, Journal of Urban Economics, 60, 139 - 161.

Yonkers, S., 2010, “Geography and the Market for CEOs.” Indiana University working paper.

Figure 1: Cities and CEO compensation

Plot A shows the median total compensation ($K) of CEOs based in the 49 largest US cities, sorted by the population size of the CEO's firm headquarters metropolitan/consolidated metropolitan statistical areas (MSA/CMSA). Plot B shows the size of equity incentives (options and stocks) as a percentage of total CEO pay, sorted by the headquarters MSA/CMSA population size in the 49 largest US cities. MSA/CMSA Population size data is from the 2000 Census (http://www.census.gov/population/www/cen2000/briefs/phc-t3/tables/tab03.txt). The data cover 10,107 firm-year observations over 1992-2004.

Plot A



Plot B

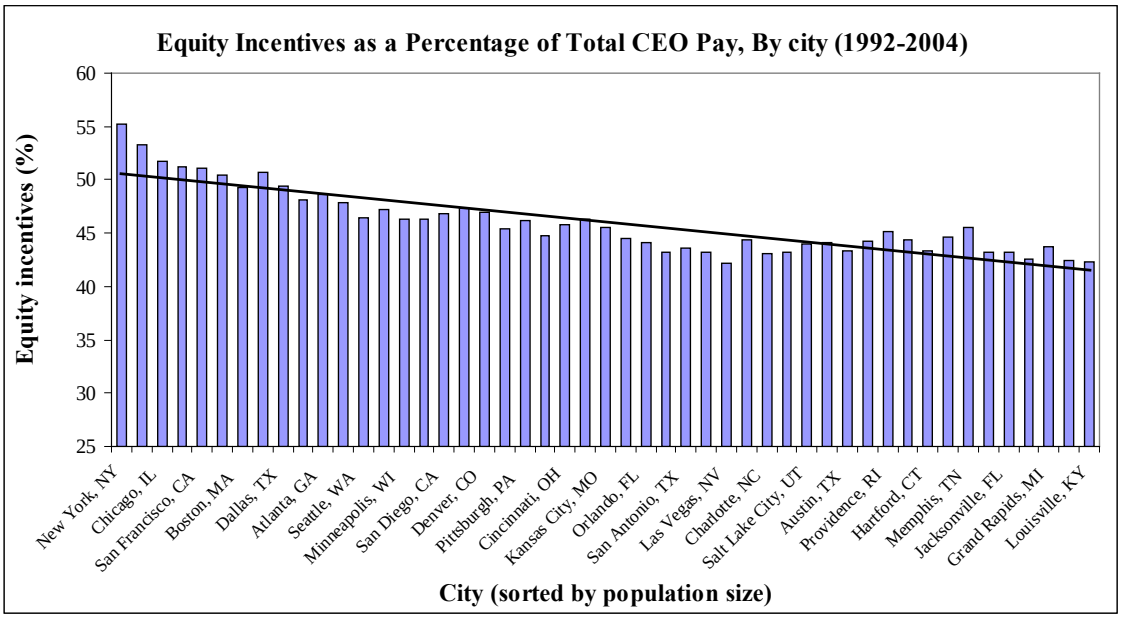
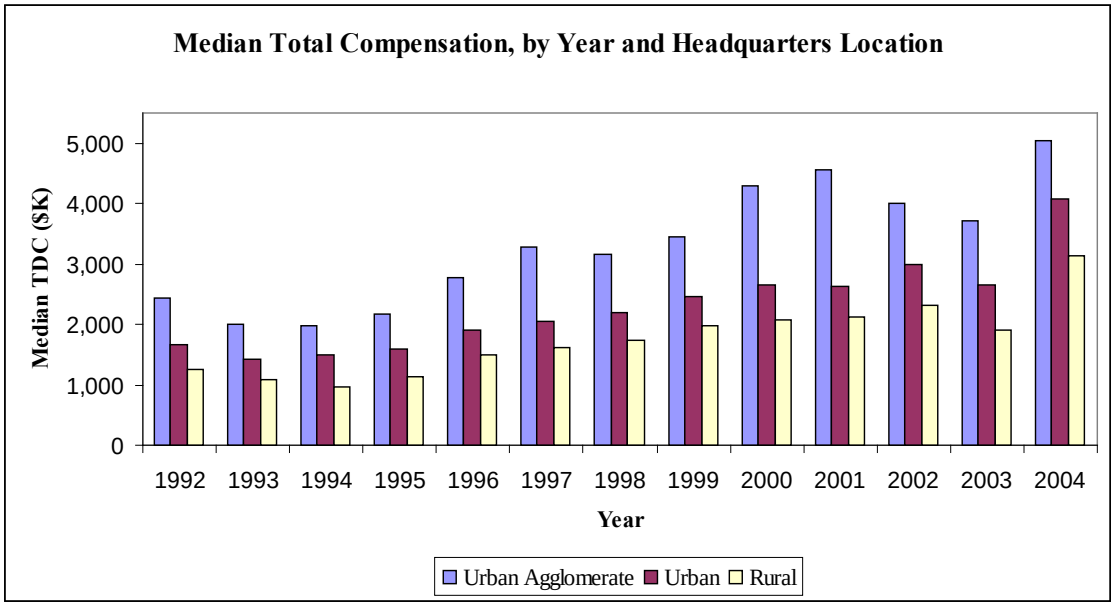


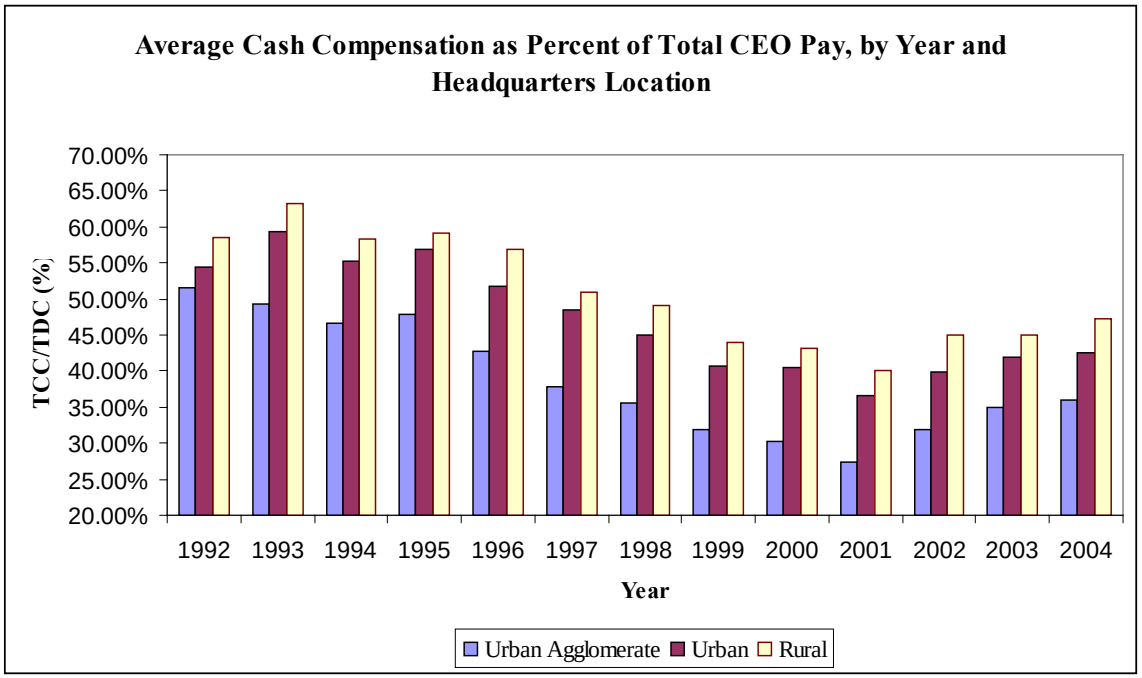
Figure 2: Annual trends in CEO compensation and headquarters location

Plot A shows the median CEO compensation sorted by year and firm headquarters location. Plot B presents average cash based pay as a percentage of total pay across time and headquarters location. Plot C shows average equity compensation as a percentage of total pay, sorted by location and time. *Urban Agglomerate* firms are those headquartered in a New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston CMSA. Urban firms are located in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten Urban Agglomerate areas. Rural companies are those located at least 250 kilometers away from Urban Agglomerate and Urban firms. The data includes 10,107 observations (5,000 *Urban Agglomerates*, 3,923 *Urban* and 1,184 *Rural*) during the years 1992-2004.

Plot A



Plot B



Plot C

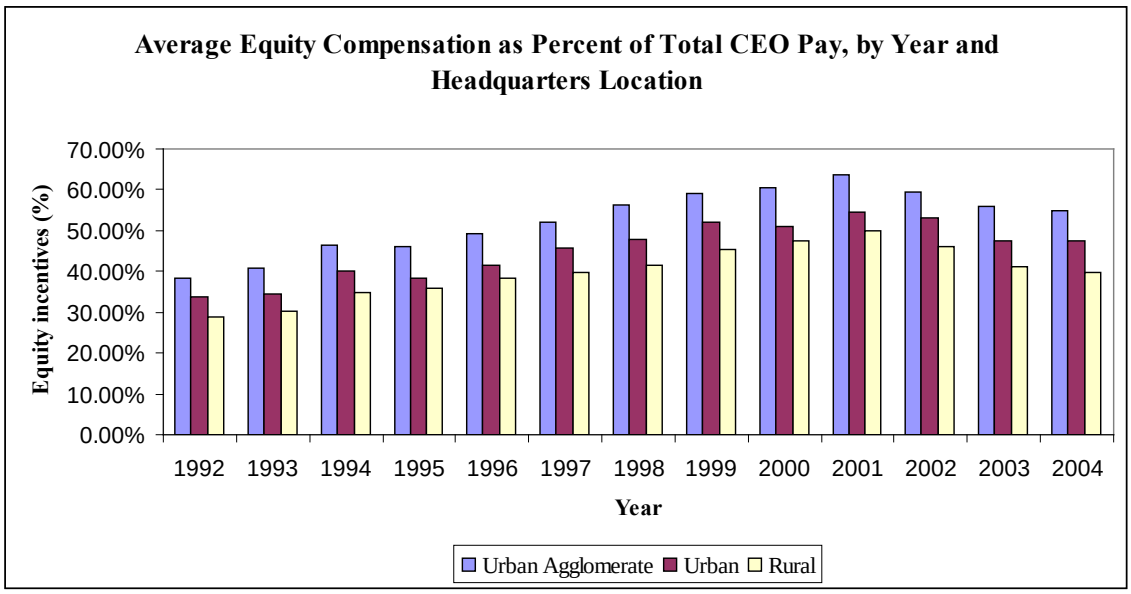

Average Equity Compensation as Percent of Total CEO Pay, by Year and Headquarters Location
Equity incentives (%)
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Year
Urban Agglomerate
Urban
Rural

Table 1: Distribution of sample across metropolitan areas

The following table provides a summary of the number of firm-year observations used in the analysis, across firm headquarters location and MSA/CMSA population size. The dataset is comprised of 10,107 observations associated with 777 firms over the period 1992-2004. Population size data is from the 2000 Census (**http://www.census.gov/population/www/cen2000/briefs/phc-t3/tables/tab03.txt**). *Urban Agglomerate* firms are those headquartered in a New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston CMSA. *Urban* firms are located in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten *Urban Agglomerate* areas. *Rural* companies are those located at least 250 kilometers away from *Urban Agglomerate* and *Urban* firms.

Classification	CMSA/MSA Code	Representative Major City, State	Population Size	No. of Observations	Percent
Urban Agglomerate	5602	New York, NY	21,199,865	1006	9.95
	4472	Los Angeles, CA	16,373,645	695	6.88
	1602	Chicago, IL	9,157,540	552	5.46
	8872	Washington—Baltimore, DC	7,608,070	405	4.01
	7362	San Francisco, CA	7,039,362	429	4.24
	6162	Philadelphia, PA	6,188,463	495	4.90
	1122	Boston, MA	5,819,100	312	3.09
	2162	Detroit, MI	5,456,428	404	4.00
	1922	Dallas, TX	5,221,801	283	2.80
	3362	Houston, TX	4,669,571	419	4.15
		Total		5,000	49.47
Urban	520	Atlanta, GA	4,112,198	357	3.53
	4992	Miami, FL	3,876,380	172	1.70
	7602	Seattle, WA	3,554,760	150	1.48
	6200	Phoenix, AZ	3,251,876	152	1.50
	5120	Minneapolis, WI	2,968,806	171	1.69
	1692	Cleveland, OH	2,945,831	104	1.03
	7320	San Diego, CA	2,813,833	166	1.64
	7040	St. Louis, MO	2,603,607	173	1.71
	2082	Denver, CO	2,581,506	166	1.64
	8280	Tampa, FL	2,395,997	153	1.51
	6280	Pittsburgh, PA	2,358,695	189	1.87
	6442	Portland, OR	2,265,223	117	1.16
	1642	Cincinnati, OH	1,979,202	87	0.86
	6922	Sacramento, CA	1,796,857	92	0.91
	3760	Kansas City, MO	1,776,062	86	0.85
	5082	Milwaukee, WI	1,689,572	107	1.06
	5960	Orlando, FL	1,644,561	71	0.70
	3480	Indianapolis, IN	1,607,486	52	0.51
	7240	San Antonio, TX	1,592,383	46	0.46
	5720	Norfolk, VA	1,569,541	62	0.61
	4120	Las Vegas, NV	1,563,282	50	0.49
	1840	Columbus, OH	1,540,157	51	0.50
	1520	Charlotte, NC	1,499,293	82	0.81
	5560	New Orleans, LA	1,337,726	51	0.50
	7160	Salt Lake City, UT	1,333,914	76	0.75
	3120	Greensboro, NC	1,251,509	68	0.67
	640	Austin, TX	1,249,763	79	0.78
	5360	Nashville, TN	1,231,311	86	0.85
	6480	Providence, RI	1,188,613	74	0.73
	6640	Raleigh, NC	1,187,941	55	0.54
	3280	Hartford, CT	1,183,110	70	0.69
	1280	Buffalo, NY	1,170,111	81	0.80
	4920	Memphis, TN	1,135,614	58	0.57
	8960	West Palm Beach, FL	1,131,184	64	0.63
	3600	Jacksonville, FL	1,100,491	60	0.59
	6840	Rochester, NY	1,098,201	50	0.49
	3000	Grand Rapids, MI	1,088,514	49	0.48
	5880	Oklahoma City, OK	1,083,346	82	0.81
	4520	Louisville, KY	1,025,598	64	0.63
		Total		3,923	38.81
Rural		Rest	< 1,000,000	1,184	11.71
		Total		10,107	100.00

Table 2: Comparative descriptive statistics

Panels A, B, and C provide mean, median and differences in means and medians across location groups summary statistics of the demographic, firm, managerial, institutional, and CEO compensation data employed in the analysis, respectively. The dataset is comprised of 10,107 observations for 777 firms, covering the period 1992-2004. A company is located in an *Urban Agglomerate* if its headquarters is in the CMSA of New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston. *Urban* firms are located in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten Urban Agglomerate areas. *Rural* companies are located at least 250 kilometers away from Urban Agglomerate and Urban firms. The variables include: *Population size* (in millions); *Population density* (per square mile of land area); Firm asset size (*Assets*); Return on assets (*ROA*); *Leverage* in %; *Annual volatility* denotes the prior 5-year average Black-Scholes volatility (in %); Market value is the firm's market capitalization (in $M); *Firm age* (in years); the average number of analysts covering the company (*Number of Analysts*); the percentage of *Outside* (equity) *blockholders*; *BCF* is the Bebchuk, Cohen and Ferrell (2005) six-measure managerial entrenchment index, based on IRRC; the probability of informed trading (*PIN*); The percentage of *Shares owned by the CEO*; *CEO age* (measured in years); *CEO tenure* (in years) defined as the difference between the current year and the year when the CEO was appointed; *Total compensation* ($K) is the variable TDC1 in Execucomp, which consists of salary, bonus, value of restricted stock granted, value of options granted (using Black– Scholes), long-term incentive payouts, and other compensation; *Equity based pay* ($K) consists of the value of the options (Execucomp variable BLK Value) and the value of the restricted stock (Execucomp variable RSTKGRNT). *Cash based pay* ($K) is the value of *Salary* and *Bonus* pay (Execucomp variables SALARY and BONUS, respectively); In Panel C, numbers without parentheses are medians, and numbers within parentheses are averages. T-statistic values represent differences in means (Panels A and B), whereas Chi-square statistic values represent differences in medians (Panel C). ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

Panel A: Demographic characteristics

Variables	All Firms: Mean (Median)	Rural (1)	Urban (2)	Urban Agglomerate (3)	T-stat. (1)-(2)	T-stat. (1)-(3)	T- stat. (2)-(3)
Population size (millions)	5.695 (4.192)	0.457	1.919	7.429	-21.880***	-36.949***	-52.921***
Population density (per $mile^2$)	2,890.372 (2,739.78)	268.279	1,224.19	4,271.397	-20.044***	-28.341***	-37.635***
Sample size	10,107	1,184	3,923	5,000			

Panel B: Firm, managerial and institutional characteristics

Variables	All Firms: Mean (Median)	Rural (1)	Urban (2)	Urban Agglomerate (3)	T-stat. (1)-(2)	T-stat. (1)-(3)	T- stat. (2)-(3)
Assets ($billions)	12.466 (1.597)	5.931	9.154	16.614	-3.035***	-5.283***	-6.115***
ROA (%)	3.881 (4.381)	2.425	3.971	4.156	-2.117**	-2.670***	-3.957***
Leverage (%)	22.139 (20.294)	28.385	22.482	20.391	2.328**	4.655***	1.967**
Annual volatility (%)	41.895 (36.021)	36.375	39.816	44.833	-5.161***	-11.143***	-10.210***
Market Value ($M)	7,218.545 (1,587.655)	3,700.062	5,413.364	9,468.066	-3.565***	-7.095***	-2.978***
Firm Age (years)	33.857 (29.358)	29.374	33.485	35.211	-1.675*	-3.793***	-1.844*
Number of analysts	5.362 (4.237)	2.381	4.388	6.833	-5.461***	-7.775***	-10.080***
Analyst forecast error	0.055 (0.052)	0.103	0.062	0.039	2.978***	3.050***	2.627***
% with analyst coverage	36.924 (35.131)	15.383	35.382	43.234	-5.925***	-5.925***	-7.607***
% Outside blockholders	16.264 (15.390)	10.384	15.322	18.394	-3.893***	-4.615***	-3.992***
BCF	2.530 (3.00)	2.589	2.518	2.526	0.840	0.765	-0.147
PIN	0.130 (0.121)	0.156	0.131	0.124	3.394***	4.492***	2.015**
Shares owned by CEO (%)	4.219 (1.480)	3.583	4.195	4.389	-2.018**	-2.301**	-1.587
CEO age (years)	55.747 (56.00)	55.290	55.920	55.719	-1.981**	-1.333	-0.971
CEO tenure (years)	6.303 (4.00)	5.544	6.193	6.569	-3.009***	- 4.596***	-2.560**
Sample size	10,107	1,184	3,923	5,000			

Panel C: CEO compensation

Variables	All: Median (Mean)	Rural (1)	Urban (2)	Urban Agglomerate (3)	Chi-Square stat. (1)-(2)	Chi-Square Stat. (1)-(3)	Chi-Square stat. (2)-(3)
Total compensation ($K)	2,625.821 (5,276.262)	2,089.024	2,196.072	3,236.732	-2.303	-210.698***	-112.077***
Equity based pay ($K)	1,211.177 (3,476.886)	838.7585	971.971	1,651.707	-8.278***	-213.695***	-140.803***
Cash based pay ($K)	984.361 (1,384.067)	847.585	950.674	1,045.803	-13.448***	-30.543***	-32.275***
Salary ($K)	584.253 (632.138)	558.341	563.055	601.231	-0.127	-27.884***	-27.444***
Bonus ($K)	400.002 (751.929)	300.664	375.001	450.027	-15.460***	-55.089***	-33.335***
Options ($K)	1,054.423 (3,052.814)	719.628	813.501	1,429.002	-4.612**	-162.982***	-226.459***
Sample size	10,107	1,184	3,923	5,000			

Table 3: Urban agglomeration and CEO compensation

This table estimates coefficients from regressing different components of CEO compensation on firm headquarters location dummies (*Urban Agglomerate* and *Urban*), and various control variables. The sample consists of a balanced panel of 10,107 observations representing 777 firms that exist in Execucomp between 1992 and 2004. *Urban Agglomerate* firms are defined as those located in the consolidated metropolitan area of New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston. *Urban* firms are headquartered in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten *Urban Agglomerate* areas. Control variables include: Firm asset size (*Size*); *Firm age* (in years) measured as the difference in years between the current year and the year of the company's incorporation; firm leverage (Leverage), calculated as the ratio of long-term debt to total assets; V*olatility*, which denotes the prior 5-year average Black-Scholes volatility (in %); return on assets in % (*ROA*); CEO *Tenure* (in years), defined as the difference between the current year and the year when the CEO was appointed; CEO *Skill*, measured as the residual from a regression of firm raw returns on the equal weighted and value weighted 2-digit SIC code industry returns, as in Garvey and Milbourn (2006); *CEO age*; *Per capita income*, which measures state level per capita personal income taken from the Bureau of Economic Analysis (BEA); and *Cost of living* from Sperling's Cost of Living Index Calculator. The intercept and industry and year fixed effects are included but not reported for brevity. Industry and year fixed effect are the Fama-French 48 industry dummies (Fama and French, 1997) and year dummies. Column (1) shows the results of a panel regression, where the dependent variable is the log of total CEO compensation (Execucomp variable TDC1). Total CEO compensation consists of salary, bonus, value of restricted stock granted, value of options granted (using Black– Scholes), long-term incentive payouts, and other compensation; Columns (2) and (3) run the primary regression using the log of the equity and cash based portion of CEO compensation, respectively. The equity based portion of CEO compensation consists of the value of the options (Execucomp variable BLK VALUE) and the value of the restricted stock (Execucomp variable RSTKGRNT) as a percentage of total pay. The cash based portion of CEO pay consists of the value of salary and bonus pay (Execucomp variables SALARY and BONUS, respectively) as a percentage of total compensation. The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

Variable	Dependent variable: Total compensation (1)	Dependent variable: Equity based portion of pay (2)	Dependent variable: Cash based portion of pay (3)
Urban Agglomerate	0.056***	0.147***	-0.129***
	(0.000)	(0.022)	(0.024)
Urban	0.017***	0.033***	-0.021***
	(0.000)	(0.002)	(0.000)
Size	0.058***	0.052***	-0.046***
	(0.003)	(0.006)	(0.007)
Firm age	0.031***	0.026***	0.017***
	(0.000)	(0.001)	(0.000)
Leverage	0.018	0.024	0.022
	(0.021)	(0.023)	(0.021)
Volatility	0.575***	0.756***	-0.816***
	(0.068)	(0.073)	(0.071)
ROA	0.003	0.001*	0.0004
	(0.006)	(0.0008)	(0.0008)
Tenure	0.003***	0.002**	0.005***
	(0.000)	(0.001)	(0.001)
Tenure*(Urban Agglomerate)	0.011***	0.029***	-0.018***
	(0.000)	(0.000)	(0.000)
Skill	0.002***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)
CEO age	0.002	-0.004***	0.004***
	(0.002)	(0.001)	(0.0016)
Per capita income	0.003***	0.004***	0.003***
	(0.000)	(0.001)	(0.000)
Cost of living	0.011***	0.003***	0.007***
	(0.000)	(0.000)	(0.000)
Adjusted R^2	0.612	0.627	0.621
No. of observations	10,107	10,107	10,107

Table 4: Urban agglomeration and compensation components

This table estimates coefficients from regressing CEO compensation components on firm headquarters location dummies (*Urban Agglomerate* and *Urban*), and various control variables. The sample consists of a balanced panel of 10,107 observations representing 777 firms that exist in Execucomp between 1992 and 2004. *Urban Agglomerate* firms are defined as those located in the consolidated metropolitan area of New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston. *Urban* firms are headquartered in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten *Urban Agglomerate* areas. Control variables include: Firm asset size (*Size*); *Firm age* (in years) measured as the difference in years between the current year and the year of the company's incorporation; firm leverage (Leverage), calculated as the ratio of long-term debt to total assets; *Volatility*, which denotes the prior 5-year average Black-Scholes volatility (in %); return on assets in % (*ROA*); CEO *Tenure* (in years), defined as the difference between the current year and the year when the CEO was appointed; CEO *Skill*, measured as the residual from a regression of firm raw returns on the equal weighted and value weighted 2-digit SIC code industry returns, as in Garvey and Milbourn (2006); *CEO age*; *Per capita income*, which measures state level per capita personal income taken from the Bureau of Economic Analysis (BEA); and *Cost of living* from Sperling's Cost of Living Index Calculator. The intercept, industry and year effects are included but not reported for brevity. Industry and year fixed effect are the Fama-French 48 industry dummies (Fama and French, 1997) and year dummies. Columns (1) and (2) show the results of a panel regression, where the dependent variable is log of the CEO's option compensation (Execucomp variable BLK VALUE) and the log of the value of restricted stock (Execucomp variable RSTKGRNT) as a percentage of total pay, respectively. Columns (3) and (4) present the results using the log of the value of salary (Execucomp variable SALARY) and bonus compensation (Execucomp variable BONUS) as a percentage of total pay, respectively. The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

Variable	Dependent variable: Option compensation (1)	Dependent variable: Stock compensation (2)	Dependent variable: Salary compensation (3)	Dependent variable: Bonus compensation (4)
Urban Agglomerate	0.144***	0.151***	-0.168***	-0.079***
	(0.031)	(0.040)	(0.035)	(0.028)
Urban	0.015***	0.049***	-0.031***	-0.009***
	(0.000)	(0.001)	(0.006)	(0.006)
Size	0.072***	0.083***	-0.270***	-0.0001
	(0.007)	(0.018)	(0.011)	(0.009)
Firm age	0.021***	0.020***	0.032***	0.033***
	(0.002)	(0.001)	(0.000)	(0.001)
Leverage	0.014	0.017	0.021	0.022
	(0.036)	(0.028)	(0.027)	(0.027)
Volatility	1.325***	-0.560**	-1.601***	-1.287***
	(0.066)	(0.222)	(0.113)	(0.102)
ROA	0.002***	-0.0003	-0.003	0.003
	(0.0007)	(0.001)	(0.002)	(0.002)
Tenure	0.002*	0.004**	0.001***	0.001
	(0.0014)	(0.002)	(0.000)	(0.002)
Tenure*(Urban Agglomerate)	0.042***	0.022***	-0.031***	-0.012***
	(0.000)	(0.000)	(0.000)	(0.000)
Skill	0.001***	0.002***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
CEO age	0.004***	0.007	0.005***	0.005***
	(0.001)	(0.004)	(0.002)	(0.0016)
Per capita income	0.007***	0.022*	0.014**	0.0099*
	(0.002)	(0.012)	(0.007)	(0.006)
Cost of living	0.003***	0.004***	0.009***	0.012***
	(0.000)	(0.000)	(0.001)	(0.000)
Adjusted R^2	0.617	0.638	0.631	0.522
No. of observations	10,107	10,107	10,107	10,107

Table 5: CEO pay, skill and experience in big cities

This table shows the estimation results from the panel regression of CEO compensation components on managerial city experience (measured as tenure) and skill, and various control variables. The sample consists of a balanced panel of 10,107 observations representing 777 firms that exist in Execucomp between 1992 and 2004. *Urban Agglomerate* firms are defined as those located in the consolidated metropolitan area of New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston. *Urban* firms are headquartered in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten *Urban Agglomerate* areas. Control variables include: Firm asset size (*Size*); *Firm age* (in years) measured as the difference in years between the current year and the year of the company's incorporation; firm leverage (Leverage), calculated as the ratio of long-term debt to total assets; V*olatility*, which denotes the prior 5-year average Black-Scholes volatility (in %); return on assets in % (*ROA*); CEO *Tenure* (in years), defined as the difference between the current year and the year when the CEO was appointed; CEO *Skill*, measured as the residual from a regression of firm raw returns on the equal weighted and value weighted 2-digit SIC code industry returns, as in Garvey and Milbourn (2006); *CEO age*; *Per capita income*, which measures state level per capita personal income taken from the Bureau of Economic Analysis (BEA); and *Cost of living* from Sperling's Cost of Living Index Calculator. The intercept, industry and year effects are included but not reported for brevity. Industry and year fixed effect are the Fama-French 48 industry dummies (Fama and French, 1997), and year dummies. Columns (1)-(3) show the results of a panel regression, where the dependent variable is the log of total CEO compensation (Execucomp variable TDC1), and the sub samples examined are those representing *Rural, Urban* and *Urban Agglomerate firms*, respectively. Columns (4)-(6) show the regression results, where the dependent variable is the log of the equity based portion of CEO compensation (Execucomp variables BLK VALUE + RSTKGRNT) as a percentage of total pay, and the sub samples examined are those representing *Rural, Urban* and *Urban Agglomerate firms*, respectively. The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. The F-test (U-R or UA-R) compares the coefficient on Experience (*Tenure*) across locations. In a pooled regression including all observations and the same control variables, it tests the equality of the coefficient estimates on *Tenure**D(M) and *Tenure**(1-D(M)), where D(M) is a dummy for *Urban* or *Urban Agglomerate firms.*

Variable	Dependent variable: Total compensation			Dependent variable: Equity based portion of pay		
	Rural (1)	Urban (2)	Urban Agglomerate (3)	Rural (4)	Urban (5)	Urban Agglomerate (6)
Firm age	0.028***	0.026***	0.029***	0.034***	0.038***	0.041***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	0.016	-0.017	0.014	-0.018	0.021	0.014
	(0.023)	(0.022)	(0.023)	(0.021)	(0.030)	(0.024)
Size	0.042***	0.044***	0.047***	0.051***	0.053***	0.056***
	(0.007)	(0.005)	(0.004)	(0.004)	(0.007)	(0.007)
Volatility	0.513***	0.526***	0.572***	0.784***	0.721***	0.753***
	(0.035)	(0.035)	(0.032)	(0.059)	(0.063)	(0.064)
ROA	0.002	0.001	0.003*	0.001	0.001	0.002
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Tenure	-0.003	0.005*	0.009***	-0.002	0.001**	0.003***
	(0.004)	(0.003)	(0.003)	(0.003)	(0.000)	(0.001)
Skill	0.003***	0.002**	0.002***	0.001***	0.001**	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CEO age	0.002	0.003	0.005*	-0.003**	-0.004**	-0.005*
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
Per capita income	0.008***	0.006***	0.007***	0.006***	0.004***	0.003***
	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Cost of living	0.009***	0.005*	0.007**	0.004***	0.004***	0.003***
	(0.000)	(0.003)	(0.003)	(0.000)	(0.001)	(0.000)
No. of observations	1,184	3,923	5,000	1,184	3,923	5,000
F-test (U-R or UA-R)		3.42*	9.39***		4.38**	5.59**
p-value		(0.066)	(0.002)		(0.037)	(0.017)

Table 6: Urban agglomeration, CEO compensation and managerial turnover

This table estimates coefficients from regressing the log of total CEO compensation (Columns (1) and (2)) and the log of the CEO's equity based portion of compensation (Columns (3) and (4)) on firm headquarters location dummies *Urban Agglomerate* and *Urban*, and various control variables. Total compensation is the variable TDC1 in Execucomp, which consists of salary, bonus, value of restricted stock granted, value of options granted (using Black– Scholes), long-term incentive payouts, and other compensation. The equity based portion of pay consists of the value of options (Execucomp variable BLK Value) and the value of restricted stock (Execucomp variable RSTKGRNT) as a percentage of total compensation. The sample consists of a balanced panel of 10,107 observations representing 777 firms that exist in Execucomp between 1992 and 2004. *Urban Agglomerate* firms are defined as those headquartered in one of the consolidated metropolitan areas of New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston. *Urban* firms are headquartered in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten *Urban Agglomerate* areas. Control variables are defined in Table 3. Columns (1) and (3) run the regression using a sub sample of firms that have experienced CEO turnover during the sample period, whereas Columns (2) and (4) run the regression using firms that did not experience CEO turnover during the same period. Intercepts, industry and year effects are not reported for brevity. The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. ***, **, * denote statistical significance at the 1%, 5% and 10%, respectively.

	Dependent variable: Total compensation		Dependent variable: Equity based portion of pay	
	CEO turnover (1)	No CEO turnover (2)	CEO turnover (3)	No CEO turnover (4)
Urban Agglomerate	0.046***	0.042***	0.136***	0.131***
	(0.000)	(0.000)	(0.000)	(0.000)
Urban	0.015***	0.013***	0.028***	0.025***
	(0.000)	(0.000)	(0.000)	(0.000)
Outside blockholders	-0.003***	-0.004***	0.004***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
BCF	0.008	0.001	-0.005	-0.004
	(0.006)	(0.001)	(0.004)	(0.003)
PIN	0.031	0.019	0.025***	0.014***
	(0.032)	(0.038)	(0.021)	(0.014)
Size	0.056***	0.045***	0.068***	0.062***
	(0.000)	(0.000)	(0.002)	(0.005)
Firm age	0.044***	0.056***	0.021***	0.032***
	(0.003)	(0.006)	(0.002)	(0.002)
Leverage	-0.011	0.012	0.021	0.019
	(0.024)	(0.022)	(0.036)	(0.022)
Volatility	0.573***	0.558***	0.747***	0.749***
	(0.000)	(0.000)	(0.048)	(0.036)
ROA	0.002	0.001	0.001	0.002
	(0.003)	(0.002)	(0.001)	(0.003)
Tenure	0.000***	0.003***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
CEO age	0.003***	0.002***	-0.009***	-0.006***
	(0.000)	(0.000)	(0.002)	(0.000)
Skill	0.004***	0.006***	0.001***	0.002***
	(0.001)	(0.001)	(0.000)	(0.000)
Per capita income	0.006***	0.007***	0.006***	0.006***
	(0.002)	(0.003)	(0.001)	(0.002)
Cost of living	0.011***	0.014***	0.004**	0.003***
	(0.001)	(0.001)	(0.002)	(0.001)
Adjusted R^2	0.681	0.639	0.667	0.641
No. of observations	8,136	1,971	8,136	1,971

Table 7: Urban agglomeration, information asymmetry and CEO compensation

This table estimates coefficients from regressing CEO compensation components on firm headquarters location dummies (*Urban Agglomerate* and *Urban*), and various control variables. The sample consists of a balanced panel of 10,107 observations representing 777 firms that exist in Execucomp between 1992 and 2004. *Urban Agglomerate* firms are defined as those headquartered in one of the consolidated metropolitan areas of New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston. *Urban* firms are headquartered in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten *Urban Agglomerate* areas. Control variables include: *Firm Age*, defined as the difference in years between the current year and the year of the company's incorporation; firm asset size (*Size)*; firm leverage (Leverage), calculated as the ratio of long-term debt to total assets; *Volatility*, which denotes the prior 5-year average Black-Scholes volatility (in %); return on assets in % (*ROA*); CEO *Tenure* (in years), defined as the difference between the current year and the year when the CEO was appointed; CEO *Age*; and *Per capita income*, which measures state level per capita personal income taken from the Bureau of Economic Analysis (BEA); *Cost of living* from Sperling's Cost of Living Index Calculator; *Skill* is measured as the residual from a regression of firm raw returns on the equal weighted and value weighted 2-digit SIC code industry returns, as in Garvey and Milbourn (2006); *PIN* is a measure of the probability of informed trading, which provides an estimate of the level of private information associated with a firm's stock; Log of one plus the number of analysts covering the company *Log*(1+ *Analysts*); and *Analyst forecast error*, equal to the absolute difference between the actual annual EPS and the mean analysts' forecast, standardized by the closing price at the fiscal year end. The intercept, industry and year effects are included but not reported for brevity. Industry and year fixed effects are the Fama-French 48 industry dummies (Fama and French, 1997), and year dummies. Columns (1)-(3) and (4)-(6) show the results of a panel regression, where the dependent variable is the log of the CEO's total compensation (Execucomp variable TDC1) and the log of the equity based portion of compensation, respectively. Equity based pay consists of the value of options (Execucomp variable BLK Value) and the value of restricted stock (Execucomp variable RSTKGRNT). The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

	Dependent variable: Total compensation			Dependent variable: Equity based portion of pay		
	PIN (1)	Number of analysts (2)	Analyst forecast error (3)	PIN (4)	Number of analysts (5)	Analyst forecast error (6)
Urban Agglomerate	0.039***	0.041***	0.038***	0.127***	0.122***	0.123***
	(0.000)	(0.000)	(0.001)	(0.011)	(0.013)	(0.016)
Urban	0.014***	0.015***	0.016***	0.021***	0.019***	0.018***
	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(0.002)
Firm age	0.054***	0.044***	0.045***	0.024***	0.022***	0.027***
	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.001)
Leverage	-0.017	0.011	0.014	0.026	0.023	-0.024
	(0.023)	(0.032)	(0.028)	(0.033)	(0.036)	(0.031)
PIN	0.022	0.023	0.024	0.015***	0.012***	0.011***
	(0.038)	(0.031)	(0.032)	(0.003)	(0.001)	(0.001)
Log(1+Analysts)		-0.017			0.063*	
		(0.019)			(0.038)	
Analyst forecast error			0.002			-0.001***
			(0.002)			(0.000)
Size	0.056***	0.054***	0.049***	0.046***	0.049***	0.051***
	(0.003)	(0.002)	(0.004)	(0.003)	(0.004)	(0.003)
Volatility	0.516***	0.521***	0.528***	0.893***	0.778***	0.823***
	(0.074)	(0.073)	(0.069)	(0.063)	(0.072)	(0.064)
ROA	0.003	0.004	0.003	0.002**	0.001	0.002**
	(0.002)	(0.003)	(0.006)	(0.001)	(0.001)	(0.001)
Tenure	0.003***	0.002	0.002**	0.002**	0.002***	0.001***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)
CEO age	0.006	0.003	0.002	-0.004***	-0.003***	-0.004***
	(0.005)	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)
Skill	0.001***	0.003***	0.001***	0.001***	0.000***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Per capita income	0.006*	0.004**	0.004**	0.007*	0.009*	0.006**
	(0.004)	(0.002)	(0.002)	(0.004)	(0.005)	(0.003)
Cost of living	0.005*	0.004**	0.006**	0.004**	0.007***	0.006***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Adjusted R^2	0.614	0.615	0.610	0.638	0.642	0.636
No. of observations	10,107	10,107	10,107	10,107	10,107	10,107

Table 8: Urban agglomeration, corporate governance and CEO compensation

Panel A: Total compensation

This table estimates coefficients from regressing CEO total compensation (Execucomp variable TDC1) on firm headquarters location dummies *Urban Agglomerate* and *Urban*, and various control variables, including governance related measures. The sample consists of a balanced panel of 10,107 observations representing 777 firms that exist in Execucomp between 1992 and 2004. *Urban Agglomerate* firms are defined as those headquartered in one of the consolidated metropolitan areas of New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston. *Urban* firms are headquartered in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten *Urban Agglomerate* areas. Control variables are defined in Table 3. Governance control measures include the *BCF index*, denoting the Bebchuk, Cohen and Ferrell (2005) six-measure antitakeover index; the percentage of *Outside* (equity) *blockholders;* and an *Independent board dummy* variable; Column (1) runs the primary regression using the *BCF index* as a control variable for firm specific governance. Column (2) adds the *Outside blockholders* measure; In column (3) we control for board independence, by adding the independent board dummy to the primary regression; Column (4) adds information proxies (*PIN, Log(1+Analysts)* and *Analyst forecast error*) to the governance control measures; Intercepts, industry and year effects are not reported. The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

Dependent variable: Total compensation	BCF index (1)	Outside blockholders (2)	Independent board (3)	Information and monitoring (4)
Urban Agglomerate	0.035***	0.034***	0.029***	0.030***
	(0.001)	(0.002)	(0.003)	(0.001)
Urban	0.014***	0.013***	0.013***	0.011***
	(0.002)	(0.003)	(0.001)	(0.002)
BCF index	0.007	0.011	0.008*	0.006
	(0.011)	(0.014)	(0.005)	(0.011)
Outside blockholders		-0.002**	-0.003***	-0.004***
		(0.001)	(0.001)	(0.000)
Independent board dummy			-0.022***	-0.017***
			(0.003)	(0.003)
PIN				0.024
				(0.031)
Log(1+Analysts)				-0.021
				(0.018)
Analyst forecast error				0.003
				(0.003)
Size	0.054***	0.058***	0.059***	0.051***
	(0.002)	(0.003)	(0.003)	(0.002)
Firm age	0.051***	0.053***	0.057***	0.050***
	(0.000)	(0.000)	(0.002)	(0.004)
Leverage	-0.012	0.014	0.013	0.012
	(0.028)	(0.021)	(0.026)	(0.023)
Volatility	0.561***	0.553***	0.568***	0.561***
	(0.044)	(0.036)	(0.043)	(0.044)
ROA	0.002	0.003	0.001	0.001
	(0.004)	(0.005)	(0.005)	(0.004)
Tenure	0.003***	0.002***	0.002**	0.002***
	(0.002)	(0.000)	(0.001)	(0.000)
CEO age	0.002	0.003	0.005*	-0.007
	(0.002)	(0.002)	(0.003)	(0.008)
Skill	0.001***	0.001***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Per capita income	0.004***	0.003*	0.003***	0.004***
	(0.001)	(0.002)	(0.000)	(0.000)
Cost of living	0.013***	0.011***	0.0012***	0.013***
	(0.000)	(0.001)	(0.001)	(0.001)
Adjusted R^2	0.587	0.599	0.617	0.594
No. of observations	6,483	6,483	6,483	6,483

Panel B: Equity based compensation

This table estimates coefficients from regressing the log of the CEO's equity based portion of compensation on firm headquarters location dummies *Urban Agglomerate* and *Urban*, and various control variables, including governance related measures. The equity based portion of pay consists of the value of options (Execucomp variable BLK Value) and the value of restricted stock (Execucomp variable RSTKGRNT) as a percentage of total compensation. The sample consists of a balanced panel of 10,107 observations representing 777 firms that exist in Execucomp between 1992 and 2004. *Urban Agglomerate* firms are defined as those headquartered in one of the consolidated metropolitan areas of New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston. *Urban* firms are headquartered in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten *Urban Agglomerate* areas. Control variables are defined in Table 3. Governance control measures include the *BCF index*, denoting the Bebchuk, Cohen and Ferrell (2005) six-measure antitakeover index; the percentage of *Outside* (equity) *blockholders;* an *Independent board dummy* variable; Column (1) runs the primary regression using the *BCF index* as a control variable for firm specific governance. Column (2) adds the *Outside blockholder*s measure; In column (3) we control for board independence, by adding the independent board dummy to the primary regression; Column (4) adds information proxies (*PIN*, *Log(1+Analysts)* and *Analyst forecast error*) to the governance control measures; Intercepts, industry and year effects are not reported. The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

Dependent variable: Equity based portion of pay	BCF index (1)	Outside blockholders (2)	Independent board (3)	Information and monitoring (4)
Urban Agglomerate	0.121***	0.118***	0.116***	0.111***
	(0.000)	(0.000)	(0.000)	(0.000)
Urban	0.016***	0.015***	0.014***	0.012***
	(0.002)	(0.001)	(0.002)	(0.002)
BCF index	-0.005	-0.006	-0.004	-0.005*
	(0.011)	(0.016)	(0.010)	(0.003)
Outside blockholders		0.006**	0.004***	0.003***
		(0.002)	(0.002)	(0.001)
Independent board dummy			0.003***	0.002***
			(0.000)	(0.000)
PIN				0.018***
				(0.001)
Log(1+Analysts)				0.057***
				(0.003)
Analyst forecast error				-0.002***
				(0.00)
Size	0.050***	0.052***	0.058***	0.064***
	(0.004)	(0.003)	(0.004)	(0.008)
Firm age	0.023***	0.019***	0.024***	0.028***
	(0.002)	(0.004)	(0.003)	(0.002)
Leverage	0.021	-0.027	-0.031	0.019
	(0.031)	(0.034)	(0.030)	(0.028)
Volatility	0.843***	0.937***	0.821***	0.852***
	(0.065)	(0.062)	(0.061)	(0.048)
ROA	0.001*	0.000	0.001	0.001
	(0.0007)	(0.000)	(0.001)	(0.001)
Tenure	0.002**	0.002**	0.002***	0.001***
	(0.001)	(0.001)	(0.000)	(0.000)
CEO age	-0.003***	-0.004***	-0.004***	-0.007***
	(0.000)	(0.001)	(0.001)	(0.002)
Skill	0.001***	0.002***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Per capita income	0.0006***	0.006**	0.005**	0.006***
	(0.001)	(0.003)	(0.002)	(0.001)
Cost of living	0.004***	0.003***	0.002**	0.003***
	(0.000)	(0.001)	(0.001)	(0.000)
Adjusted R^2	0.609	0.615	0.622	0.658
No. of observations	6,483	6,483	6,483	6,483

Panel C: Urban agglomeration and asymmetric pay indexation

This table contains the median regression results for CEO compensation components (equity, cash or other pay) on the contribution of exogenous factors (luck) to firm performance measured in dollar returns, and the interactions of both luck and skill with dummy variables indicating whether luck or skill are negative. *Luck* (*Skill)* is measured as the predicted (residual) dollar value from a regression of firm raw returns on the equal and value weighted 2-digit SIC code industry returns, as in Garvey and Milbourn (2006). We also control for the cumulative distribution function (cdf) of the dollar variance of firm returns, executive tenure, and an interaction of luck with the cdf of variance of luck (*Luck * cdf variance of luck*) and for skill with the cdf of variance of skill (*Skill * cdf variance of skill*), level of cdf of variance of luck and skill and year and two-digit industry fixed effects (not reported). *Equity compensation* consists of the value of options (Execucomp variable BLK Value) and restricted stock (Execucomp variable RSTKGRNT). *Cash compensation* is the value of salary and bonus pay (Execucomp variables SALARY and BONUS, respectively). *Other compensation* (Execucomp variable OTHER) includes perquisites and other personal benefits, contributions to defined contribution plans (e.g., 401k), life insurance premiums etc. Columns (1) and (2) present regression results in which the dependent variable is equity based compensation, whereas in columns (3), (4) and (5), (6), the dependent variable is cash based pay and other compensation, respectively. Columns (1), (3), and (5) look separately at Urban Agglomerate based firms, whereas columns (2), (4) and (6) present the results for a sub sample of firms that are not headquartered in Urban Agglomerate areas (*Urban* and *Rural* firms). Intercepts are not reported. The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. ***, **, * denote statistical significance at the 1%, 5% and 10%, respectively.

	Dependent variable: Equity compensation		Dependent variable: Cash compensation		Dependent variable: Other compensation	
	Urban Agglomerate (1)	Non-Urban Agglomerate (2)	Urban Agglomerate (3)	Non-Urban Agglomerate (4)	Urban Agglomerate (5)	Non-Urban Agglomerate (6)
Luck	0.536***	0.529***	0.180***	0.279***	0.051**	0.086***
	(0.196)	(0.186)	(0.048)	(0.054)	(0.025)	(0.029)
Skill	0.479***	0.447***	0.298***	0.496***	0.068***	0.117***
	(0.156)	(0.141)	(0.038)	(0.041)	(0.020)	(0.022)
Luck * Luck is down	0.023	-0.173**	-0.005	-0.044**	0.001	0.013
	(0.183)	(0.068)	(0.004)	(0.020)	(0.002)	(0.011)
Skill * Skill is down	0.020	-0.017	0.005	-0.003	0.0006	-0.002
	(0.015)	(0.027)	(0.004)	(0.008)	(0.002)	(0.004)
Luck * cdf variance of luck	-0.530***	-0.466**	-0.176***	-0.258***	-0.050*	-0.087***
	(0.196)	(0.191)	(0.048)	(0.056)	(0.025)	(0.030)
Skill * cdf variance of skill	-0.448***	-0.390***	-0.298***	-0.488***	-0.067***	-0.115***
	(0.159)	(0.147)	(0.039)	(0.043)	(0.021)	(0.023)
Adjusted R^2	0.638	0.631	0.664	0.673	0.572	0.574
Prob. (Luck = Skill)	0.078	0.029	0.099	0.027	0.847	0.203
No. of observations	5,000	5,107	5,000	5,107	5,000	5,107
Year fixed effects	+	+	+	+	+	+
Two digit industry effects	+	+	+	+	+	+

Table 9: Urban agglomeration and compensation– additional robustness checks

Panel A: Total Compensation

This table estimates coefficients from regressing the log of total CEO compensation (Execucomp variable TDC1) on firm headquarters location dummies, *Urban Agglomerate* and *Urban*,, and various control variables. The sample consists of a balanced panel of 10,107 observations representing 777 firms that exist in Execucomp between 1992 and 2004. *Urban Agglomerate* firms are defined as those headquartered in one of the consolidated metropolitan areas of New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston. *Urban* firms are headquartered in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten Urban Agglomerate areas. Control variables are defined in Table 3. Column (1) runs the primary regression, excluding the five most highly populated CMSAs; Column (2) reports coefficients of a median regression; Column (3) runs the regression for a sub sample of high-tech firms (SIC code 3500-3599, 3600-3699, or 3800-3899); In column (4) we exclude high-tech firms from the sample; Intercepts, industry and year effects are not reported for brevity. The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. ***, **, * denote statistical significance at the 1%, 5% and 10%, respectively.

Dependent variable: Total compensation	Excluding 5 largest cities (1)	Median regression (2)	High-tech (3)	Excluding high-tech (4)
Urban Agglomerate	0.023***	0.029***	0.022***	0.037***
	(0.001)	(0.000)	(0.002)	(0.000)
Urban	0.010***	0.011***	0.008***	0.012***
	(0.002)	(0.000)	(0.001)	(0.000)
Outside blockholders	-0.004***	-0.005***	-0.003***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
BCF	0.008	0.009	0.007	0.008
	(0.011)	(0.010)	(0.012)	(0.011)
PIN	0.022	0.021	0.018	0.024
	(0.034)	(0.032)	(0.029)	(0.028)
Size	0.052***	0.061***	0.059***	0.048***
	(0.011)	(0.014)	(0.015)	(0.013)
Firm age	0.047***	0.042***	0.054***	0.050***
	(0.003)	(0.002)	(0.003)	(0.003)
Leverage	-0.011	-0.010	0.012	-0.014
	(0.018)	(0.021)	(0.024)	(0.022)
Volatility	0.538***	0.491***	0.524***	0.537***
	(0.035)	(0.038)	(0.042)	(0.046)
ROA	0.002	0.001	0.002	0.004
	(0.003)	(0.003)	(0.004)	(0.004)
Tenure	0.002***	0.003***	0.002***	0.004***
	(0.000)	(0.001)	(0.000)	(0.000)
Age	-0.006	-0.007	-0.006	-0.007
	(0.009)	(0.008)	(0.005)	(0.005)
Skill	0.001***	0.002***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Per capita income	0.003***	0.004***	0.003***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Cost of living	0.012***	0.011***	0.013***	0.010***
	(0.002)	(0.003)	(0.000)	(0.001)
Adjusted/Pseudo R^2	0.653	0.669	0.577	0.662
No. of observations	4,503	6,483	988	5,495

Panel B: Equity based compensation

This table estimates coefficients from regressing the log of the equity based portion of CEO compensation on firm headquarters location dummies, *Urban Agglomerate* and *Urban*,, and various control variables. Equity based pay consists of the value of options (Execucomp variable BLK Value) and the value of restricted stock (Execucomp variable RSTKGRNT). The sample consists of a balanced panel of 10,107 observations representing 777 firms that exist in Execucomp between 1992 and 2004. *Urban Agglomerate* firms are defined as those headquartered in one of the consolidated metropolitan areas of New York City, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston, Detroit, Dallas, or Houston. *Urban* firms are headquartered in metropolitan areas of at least 1 million people, as defined by the 2000 census, that are not one of the ten Urban Agglomerate areas. Control variables are defined in Table 3. Column (1) runs the primary regression, excluding the five most highly populated CMSAs; Column (2) reports coefficients of a median regression; Column (3) runs the regression for a sub sample of high-tech firms (SIC code 3500-3599, 3600-3699, or 3800-3899); In column (4) we exclude high-tech firms from the sample; Intercepts, industry and year effects are not reported for brevity. The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. ***, **, * denote statistical significance at the 1%, 5% and 10%, respectively.

Dependent variable: Equity based portion of compensation	Excluding 5 largest cities (1)	Median regression (2)	High-tech (3)	Excluding high-tech (4)
Urban Agglomerate	0.086***	0.101***	0.122***	0.096***
	(0.002)	(0.000)	(0.000)	(0.001)
Urban	0.011*	0.014***	0.013**	0.017***
	(0.006)	(0.005)	(0.006)	(0.004)
Outside blockholders	0.001	0.001	0.002	0.002
	(0.001)	(0.001)	(0.002)	(0.002)
BCF	-0.004	-0.003	-0.003	-0.006
	(0.011)	(0.016)	(0.011)	(0.010)
PIN	0.009***	0.011***	0.011***	0.014***
	(0.002)	(0.001)	(0.002)	(0.001)
Size	0.048***	0.061***	0.060***	0.057***
	(0.012)	(0.016)	(0.011)	(0.008)
Firm age	0.021***	0.020***	0.014***	0.022***
	(0.001)	(0.003)	(0.000)	(0.001)
Leverage	-0.011	-0.012	0.009	-0.009
	(0.026)	(0.022)	(0.031)	(0.029)
Volatility	0.726***	0.832***	0.827***	0.852***
	(0.029)	(0.021)	(0.033)	(0.032)
ROA	-0.000	0.001	0.002	-0.001
	(0.001)	(0.001)	(0.003)	(0.001)
Tenure	0.002***	0.001***	0.003***	0.001***
	(0.000)	(0.000)	(0.001)	(0.000)
Age	-0.003***	-0.002*	-0.004***	-0.006***
	(0.000)	(0.004)	(0.000)	(0.001)
Skill	0.003***	0.003***	0.001***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Per capita income	0.002***	0.003*	0.004***	0.005***
	(0.000)	(0.002)	(0.001)	(0.001)
Cost of living	0.001***	0.003***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted/Pseudo R^2	0.633	0.651	0.542	0.647
No. of observations	4,503	6,483	988	5,495

Table 10: The effect of urban agglomeration on CEO pay, controlling for endogeneity

The first-stage regression models the choice of location (Rural versus Urban/Urban Agglomerate in Column (1)) using an instrument to capture the proportion of women over 65 in the firm's MSA in the year 1980. Firm, industry and year dummies are included in both stages. The dependent variables in the second-stage regressions are the log of total compensation (Column (2)) and the log of the equity based portion of compensation (Column (3)). The instrumented variable "*Rural*" is the predicted value from the first stage, and is used in the second stage in place of the actual "*Rural*" dummy variable. Total compensation is the variable TDC1 in Execucomp, which consists of salary, bonus, value of restricted stock granted, value of options granted (using Black– Scholes), long-term incentive payouts, and other compensation. The equity based portion of pay consists of the value of options (Execucomp variable BLK Value) and the value of restricted stock (Execucomp variable RSTKGRNT) as a percentage of total compensation. The sample consists of a balanced panel of 10,107 observations representing 777 firms that exist in Execucomp between 1992 and 2004. Control variables are defined in Table 3. The instrumental variable, *Proportion of women over 65*, is based on data from the 1980 Census on demographic profiles on the MSAs utilized in our sample. Intercepts are not reported. Intercepts, industry and year effects are not reported for brevity. The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. ***, **, * denote statistical significance at the 1%, 5% and 10%, respectively.

	First Stage Probit	Second Stage	
	Dependent variable = Rural	Dependent variable: Total compensation (3)	Dependent variable: Equity compensation (4)
Rural (instrumented)		-0.021***	-0.083***
		(0.003)	(0.000)
Outside blockholders	-0.002**	-0.003***	0.004***
	(0.001)	(0.000)	(0.001)
BCF	0.003	-0.004	0.002
	(0.012)	(0.004)	(0.003)
PIN	-0.011	0.009	0.008***
	(0.006)	(0.007)	(0.002)
Size	-0.032***	0.042***	0.048***
	(0.011)	(0.012)	(0.012)
Firm age	-0.029**	0.052***	0.015***
	(0.012)	(0.06)	(0.004)
Leverage	0.113	-0.003	0.011
	(0.616)	(0.003)	(0.002)
Volatility	0.148	0.523***	0.772***
	(0.159)	(0.002)	(0.004)
ROA	-0.025	0.005	0.001
	(0.051)	(0.004)	(0.002)
Tenure	-0.019**	0.003***	0.002***
	(0.009)	(0.001)	(0.000)
CEO age	-0.012	0.017	0.019
	(0.012)	(0.044)	(0.043)
Skill	0.002	0.002***	0.003***
	(0.003)	(0.000)	(0.000)
Per capita income	-0.004***	0.003***	0.004***
	(0.001)	(0.000)	(0.001)
Cost of living	-0.007***	0.006***	0.001***
	(0.000)	(0.003)	(0.000)
Instrument: Elderly Women Population	0.024***		
	(0.002)		
Pseudo/Adjusted R^2	0.218	0.427	0.423
No. of observations	10,107	10,107	10,107

Table 11: Evidence from firms that relocate

This table reports regression results of the following equation for the period t-1 to t+1, where t is the relocation year.

$$\Delta(Compensation) = \alpha_0 + \alpha_1 \,\mathrm{Re}\, location + \beta \Delta Controls + Year\_Dummies + \varepsilon$$

Δ*(Compensation)* is defined as the difference in total or the equity based portion of compensation between the post- and pre-relocation periods. *Relocation* is a dummy variable with value 1 for relocating firms and value 0 for non relocating, control firms. *Controls* represent the usual set of control variables (see, e.g., Table 9). Because we investigate the change in compensation, we likewise use the lagged change in control variables in our regression analyses. All other variables are as defined in Table 9. Relocation data is collected from Compact Disclosure by mapping the zip code of each firm's headquarters into CMSAs/MSAs on an annual basis. The sample of relocating firms includes 108 migrations over the years 1992-2004, from which 61 represent moves from *Rural* to *Urban/Urban Agglomerate* areas and 47 represent moves in the opposite direction. Our control sample includes all firms in our sample over the years 1992-2004 that are not included in the relocating firms' sample. The dependent variable in Columns (1) and (2) is the change in total compensation, whereas the dependent variable in Columns (3) and (4) is the change in the equity based portion of pay. Columns (1) and (3) represent *Rural* to *Urban/Urban Agglomerate* relocations, with *Rural* non-relocating firms as controls; Similarly, Columns (2) and (4) represents moves from *Urban Agglomerate/Urban* areas into *Rural* areas, with *Urban Agglomerate/Urban* as a control sample. To conserve space we report only the results for the *Relocation* variable. The numbers in parentheses are robust standard errors, clustered at the CMSA/MSA level. ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

	Dependent variable: Change in total compensation		Dependent variable: Change in equity based portion of pay	
	Rural to *Urban/Urban Agglomerate* (1)	*Urban/Urban Agglomerate* to *Rural* (2)	*Rural* to *Urban/Urban Agglomerate* (3)	*Urban/Urban Agglomerate* to *Rural* (4)
Relocation	0.003	-0.001	0.007	-0.008
	(0.011)	(0.009)	(0.023)	(0.016)
Adjusted R^2	0.512	0.589	0.591	0.621
No. of observations	1,245	8,970	1,245	8,970

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