Bankers and bank investors: Reconsidering the economies of scale in banking *

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Abstract

We study economies of scale in banking by viewing banks as combinations of financial and human capital that create rents which accrue to investors and bankers. In this way we find larger economies of scale in returns to bankers as compared to investors. Scale economies are particularly strong in the top size decile of banks. Introducing observable proxies for funding efficiency, presence in wholesale banking activities and leverage largely accounts for observed scale economies.

Keywords: banking structure, banking efficiency, banker compensation, economies of scale, economies of scope

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1 Introduction

Banking sectors have developed in very different ways around the world; however, despite this diversity of origins, the structure of modern banking sectors is remarkably similar among major countries. Typically there is a small number of very large banks and a large number of medium and small institutions. In addition to having an extensive presence in retail banking the largest banks tend to dominate investment banking, market making, and in the provision of a number of other wholesale services to other financial institutions. And the deep involvement of the largest banks in the market for government debt naturally creates strong links between big banks on the one hand and central banks and national treasuries on the other.

Despite its prevalence, the desirability of big banking has been called into question by the massive public sector support for the banking sector starting since 2008, much of it going to the largest banks. In this period, the first wave of public interventions in the banking sector involved numerous take-overs of insolvent banks by large healthy ones, which tended to increase banking concentration. Subsequently, the thrust of regulation of banking has tended to reduce the power of the largest banks by separating deposit taking from proprietary trading (Volker Rule) or investment banking more generally (the "ring fencing" proposed by the UK's Independent Commission on Banking). Furthermore, heightened regulatory capital charges mandated by the revised Basel Accord and supplementary measures imposed on institutions deemed to be "systemically significant" have created incentives for many of the largest banks to shed assets and to retreat from market segments where they find themselves in a competitive disadvantage. Still further measures to rein in big banking are being seriously contemplated including the active use of anti-trust remedies to break-up the biggest banks (Reich, 2009).

The fact that many wholesale market activities tend to be dominated by relatively few players, suggests that there may be extensive economies of scale in these types of banking activities. And the fact that often it is the same banks that are dominant in most of these lines of business suggests further that there may be some economies of scope that operate across a range of such activities. However, the current broad support for public sector measures toward reducing the dominance of large banks is built upon a deep scepticism that there are any large efficiency benefits in big banking. This thinking in part reflects the fact that most of the early studies of banking efficiency failed to find any evidence of economies of scale in banking that could rationalize large fraction of banking services that are provided by the biggest banks. Berger *et al* (1993) summarize this early literature and conclude that "...the average cost curve has a relatively flat U-shape, with medium sized firms being slightly more scale efficient than either very large or very small firms." They suggest that the minimum efficient scale was something less than $300 million total assets. By way of comparison, a total assets of $300 million was approximately the 6th percentile by size of bank holding companies in our data set of banks in 1990.

More recently these results have been called into question by studies using data from recent periods or other countries and employing methodologies that depart significantly from past studies. A number of these studies have found significant evidence of positive economies of scale. Despite this, the received wisdom that there are few efficiency gains to large scale banking has proved very persistent so that the question of benefits and costs of large scale banking remains open.

In our view, part of the difficulty identifying potential efficiency gains to larger scale banking lies in the fact that the benefits of such gains need not accrue wholly to bank customers nor to bank shareholders but rather can accrue to powerful bankers who are able to exploit their negotiating power to extract rents. Specifically, in this paper we postulate that banking activities create value through the combination of financial capital provided by investors, principally shareholders, and human capital provided by bankers. Depending upon the markets where the bank operates and the organization of the bank, the value created by the bank will accrue in varying degrees to shareholders and bankers. How the bank trades off between these two will reflect the relative bargaining power of bank shareholders (the "principal") and bankers (the "agent"). The "efficiency frontier" describes the maximum benefit to bankers for a given benefit to investors. In this framework, a bank that differs from a second bank in size or other characteristics is more efficient if its efficiency frontier dominates the latter's frontier in the sense that it produces a higher benefit to bankers for a given level of benefit to investors. Using a variety of returns to bankers' human capital and investors financial capital and using a variety of statistical techniques we explore the evidence of economies of scale in the sense that the efficiency frontiers of large banks tend to dominate those of smaller banks. We then ask whether any apparent scale economies are attributable to banks' involvement in particular wholesale banking activities. Once we allow for the possibility of rent extraction by bankers we find strong evidence of higher returns being associated with larger scale. Furthermore, we find these apparent benefits of larger scale can largely be accounted for by three characteristics of the bank's business, namely, funding efficiency, presence in wholesale banking and leverage.

The remainder of the paper is organized as follows. First in Section 2 we review some of the recent banking literature which has extended previous efficiency studies importantly and has revealed stronger evidence of economies of scale in banking. In Section 3 we set out a simple model that clarifies our own approach and describes how efficiency differences can be analyzed in the presence of rent extraction by bankers. Section 4.1 presents preliminary evidence on increasing returns to investors, bankers and banks overall. Section 4.2 then explores the extent to which the advantages of large scale can be accounted for by characteristics of banks' business models. Section 4.3 then shows that our qualitative conclusions are robust a wide variety of modifications of the model specification. Section 5 estimates the sharing of quasi-rents between shareholders and bankers. Finally conclusions are given in Section 6.

2 Literature review

Earlier efficiency literature reviewed by Berger *et al* (1993) concentrated on the United States in a period when the banking sector remained highly fragmented. This reflected in part the combined influence of the Glass-Steagall Act's separation of investment banking and commercial banking and the numerous prohibitions of inter-state branching in banking. It is possible that some of the weak evidence of scale economies in the US might be attributable to administrative obstacles to exploiting possible efficiency gains of increasing a bank's reach either geographically or in product space.

In contrast a number of other national banking markets have been much more welcoming to large scale banking, and one might expect banking efficiency studies of those cases to reveal greater evidence of scale economies. Allen and Rai (1996) study banking efficiency in 15 countries during the period 1988-92. They split the sample into "separated" and "universal" banking countries. Separated banks are found to be relatively more X-inefficient and have higher risk exposure. Vander Vennet (2002) finds that financial conglomerates and universal banks are more cost efficient than specialized banks when both traditional and non-traditional banking activities (non-interest income related) are taken into account. Baele et al (2007) use Tobin's Q adjusted for a frontier estimate of X-inefficiency as a proxy for franchise value. They find this measure is an increasing function of non-interest income share in sample of large European banks between 1989 and 2004. They interpret this as supporting the hypothesis that diversification of income sources is value creating.

Over time in the US restrictions on interstate branching and combining commercial banking with other financial services have been progressively relaxed. They were effectively removed through the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 and the Gramm-Leach-Bliley Act in 1999. These regulatory and legal changes have coincided with a rapid transformation of the structure of banking in the US which has seen a large number of mergers and acquisitions and an increase in concentration. This plus the many changes in information technology that have taken place in banking have stimulated renewed interest in banking efficiency studies to see whether these changes have produced evidence of efficiency gains through increased scale and scope. In this literature a variety of methodologies have been employed which go beyond the earlier approach of measuring scale economies using a parametric cost function that is assumed to hold for a wide cross sections of banking firms. While the results have been somewhat mixed, some of the studies have found much stronger evidence of increasing returns to scale than was found previously.

DeYoung and Roland (2001), Stiroh (2004) and Stiroh (2006) find that US banks that diversified away from pure commercial banking resulted in no significant gains either in the form of greater profitability or reduced earnings volatility. Hughes *et al* (1996) argue that even though diversifying across a wider range of banking products might potentially reduce risk, banks may in fact respond to the new technology by taking on more risk. They develop a methodology that allows for managerial utility maximization with respect to banking characteristics which indirectly determine the level of risk taken on. Using a specific functional form for preferences and banking technology they find evidence of larger economies of scale than had be found previously. In a different vein, Wheelock and Wilson (2001) argue that a weakness of most earlier efficiency studies was that they employ specific functional forms that may not be applicable across a diverse range of banks of different sizes or product mixes. While one can try to avoid this problem by making separate estimations of technical parameters for subsets of banks grouped by size, this makes it difficult to compare scale economies directly across groups. Instead, they apply a non-parametric approach to the full range of banks in sample of commercial banks and bank holding companies. They find evidence of positive economies of scale up to about $500 million of total assets, that is, somewhat larger than in most previous studies.

More recently, two studies have re-examined the question of scale economies using data on US banks and bank holding companies since 2000. Wheelock and Wilson (2012) use a non-parametric approach over the full range of their sample which is expanded to cover 1984 to 2006. Their estimate of economies of scale, S, is based on a hypothetical growth of output, y, by a factor, θ, as follows $S(\theta) = C(\theta y, w, k)/\theta C(y, w, k)$. Here $C(.)$ is the cost function, y is a vector of outputs, w is vector of prices of variable inputs, and k is a vector of fixed inputs which they take to be equity capital and premises plus fixed capital. They find evidence of positive returns to scale (i.e., $S(\theta) < 1$ for $\theta > 1$) that operate for most banks and bank holding companies including those in the largest size category. Following Hughes and Mester (2003) they take a broad view of a bank's outputs and include non-interest income. One possible limitation of their approach is that in measuring C they define cost relatively narrowly as the sum of cost of purchased funds, core deposits and labor expenses. This omits non-interest, non-compensation expense which may be crucial to the operation of a diverse business lines and can be considerable in some institutions.[1] This could possibly bias the result toward finding lower cost in banks with relatively high levels of these expenses.

Hughes and Mester (2013) study US bank holding companies in 2003, 2007 and 2010. They consider four alternative functional specifications. Their preferred specification is based on the framework described in Hughes *et al* (1996). This supposes bank managers choose inputs and output so as to maximize managers' utility over profits and inputs, conditional on given prices for inputs and output. Managerial preferences are specified rather generally and reflect attitudes toward risk among other considerations. They use a specific, but flexible, functional form and estimate structural parameters of preferences and technology in a two-stage procedure. First, input demand and profit choice are estimated conditional on a level of financial capital. Second, given first stage results to calculate the indirect utility function, the optimal level of financial capital is estimated using the first-order condition from maximizing indirect utility with respect to financial capital. The resulting parameter estimates are used to calculate the cost function and the associated coefficient of economies of scale. They estimate this system in cross sections of firms grouped by size for the three years separately. They find positive returns to scale in each size category with the largest estimated scale economies in either of the largest categories (either total assets of \$50-\$100 billion or \$100 billion +). This finding holds over all three years, i.e., before, during and after the banking crisis in the US. In contrast, the three alternative estimating frameworks impose constraints not present in their preferred specification. In one variant they estimate the minimum cost function of a profit maximizing firm conditional on given output and omitting financial capital (and therefore leverage). The second estimates static cost conditional upon output and also conditional on financial capital. In the third variant the agent's utility maximizing choice of variable inputs is considered but is made conditional on the observed level of financial capital (in contrast with their preferred specification where this is chosen optimally). In these three alternative spec-

[1]For example, in 2012 JP Morgan Chase reported non-interest, non-compensation expense of \$34 billion as compared to a total compensation expense of \$30 billion. Non-interest, non-compensation expense also exceeded compensation expense in 2010 and 2011.

ifications, the scale efficiency coefficients are small or in some cases negative, i.e., there may be cost diseconomies of scale. The authors view these alternative estimates as less convincing because either they ignore possibly managerial risk aversion or because they conditional on suboptimal levels of financial capital.

To summarize, a number of studies either based on national banking systems that have long been open to combining commercial and investment banking or on the US system since 2000 have found greater evidence of significant efficiency gains in large scale banking. Some of these studies have adopted estimation methodologies that go beyond parametric estimation of cost in a profit maximizing firm. However, none has focussed on the possibility that potential efficiency gains may accrue in part to input suppliers who possess some degree of market power. In the next section we set out an estimation framework based on this possibility.

3 The model

In this section we develop a framework for the analysis of banking efficiency that allows for the possibility both that an efficiency advantage will give a bank some degree of power in product markets and that rents generated by that advantage may to some extent accrue to bankers. While this approach has not been adopted in the previous banking efficiency studies, it is a familiar theme in the labor market literature which has used a variety of models to explore this "rent extraction" hypothesis (see,e.g., Van Reenen, 1996).

Our approach is illustrated by Figure 1. We suppose a bank's business will generate returns for both investors and for bankers. Following the principal/agent paradigm (see, e.g., DeMarzo and Fishman, 2007), an efficient bank is one that maximizes the return to investors for given amount of return for bankers. The figure depicts hypothetical efficiency frontiers for two classes of banks characterized as "large" and "small". To compare the efficiency of these classes of banks we need to look at the distance between one frontier and the other. For example, we could measure the distance from the origin along a ray for each class and then take the ratio of the outer frontier to the inner frontier. In the Figure 1 large banks are 25% more efficient than small banks by that measure.

This framework is a fundamental departure from the approach traditionally taken in past studies of banking efficiency. The key difference is that we explicitly allow for possible market power in product markets and for bargaining over bank rents (or quasi-rents if they are transient) between bank managers and shareholders. These rents may reflect some combination of operational efficiency and product market power. Different organizational forms or product mixes may affect the operational efficiency and the sharing of surplus among consumers, bankers, and shareholders.

This can be made explicit using the following simplified model. We suppose that the market for banking services is somewhat localized and that banks possess some degree of market power. Consider first a bank operating in a single market. The main characteristics can be illustrated with the minimum of algebraic complexity in the case of a monopoly bank with a Cobb-Douglas production technology which faces a linear demand for banking services. Specifically, we suppose that the price, p, of banking services is of the form $p = a - q$ where q is the quantity of banking services provided and a is a parameter that determines the size of the market. The quantity of banking services is given by

$$q = \theta K^{.5} L^{.5} \tag{1}$$

where L is the amount of labor input purchased and K is the amount of capital provided by bank investors. Given the input prices of capital, r, and labor, w, the cost minimizing choices of inputs solve the problem $min\ rK + wL$ subject to (1). Under the assumptions given the solution satisfies $rK = wL$. Using this to substitute for L in equation (1) yields the expression $K = \frac{1}{\theta}(\frac{w}{r})^{1/2} q$. Therefore the cost function is given as $C(r, w, q) = 2rK = \frac{2}{\theta}(rw)^{1/2} q$. The corresponding profit function is

$$\pi(r, w, q) = (a - q)q - C(r, w, q) = aq - q^2 - \frac{2}{\theta}(rw)^{1/2} q \tag{2}$$

Maximizing the bank's profit with respect to q given r and w yields the bank's profit maximizing output, $q^* = \frac{a}{2} - \frac{(rw)^{1/2}}{\theta}$, which will be positive if the size of the market, a, is sufficiently large relative to r and w. Inserting this into the expression for K above and into the profit function (2) we arrive at a simple expression for the optimal bank profit per unit of cost of capital:

$$\frac{\pi}{rK} = (\frac{a\theta}{2(rw)^{1/2}} - 1) \tag{3}$$

This corresponds to the bank investors' return as discussed above and as depicted in Figure 1. This is a decreasing function of w and an increasing function of the efficiency parameter θ. Also, using the optimal output we find the input costs are

$$wL = rK = \frac{(rw)^{1/2}}{\theta}(\frac{a}{2} - \frac{(rw)^{1/2}}{\theta}) \tag{4}$$

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The solution obtained so far is the result of a bank's profit maximizing choice in a single banking market where it exercises market power with respect to its clients and where it takes the cost of capital and the cost of labor as given. It may be that the given wage rate is a competitive wage rate w^c. Alternatively, it may be that the wage rate w is the result of a bargaining process between bankers and the bank but which leaves the bank free to choose the amount of labor it hires at that rate. When the competitive wage is sufficiently low relative to the scale of the market and to the cost of capital, bankers can increase the total wage bill wL by increasing w above w^c and thereby extract some of the rents for themselves. The maximum rents that can be extracted by bankers in bargaining with the bank are given by maximizing equation (4) with respect to w. The solution to this is the monopsony wage, $w^m = a^2\theta^2/16r$. Total bankers' rents relative to capital costs are given by the expression $\frac{wL - w^c L^c}{rK}$. Using this expression and the investors return expression (3) as the wage varies from between w^c and w^m bankers gives us the bank efficiency frontier, that is, the maximum bankers' rent as a function of investors' rent. We have plotted this for the case $a = 1$, $r = .1$ $\theta = 1$ and $w^c = .1$ as the innermost frontier in Figure 2.

We now introduce into this framework a source of efficiency gain which can affect the amount of rents generated by the bank and the bargaining of rents among stake holders. The source of efficiency gain we consider is replicating operations across many markets. Indeed, much of the consolidation of banking over the last 25 years appears to involve the creation of a large banking group that replicates the provision of banking services across a number of local banking markets using some shared common inputs (e.g., a common IT system or common treasury function for the group).

In adapting the model above to this context we suppose that bank faces a demand for banking services in each market of the form $p_i = a - q_i$ where p_i and q_i are the bank's price and quantity of banking services in market $i = 1, n$. The production technology is identical in each market and is of the form,

$$q_i = \theta_n K^{.5} L_i^{.5} \tag{5}$$

Here L_i is the amount of labor input allocated to market i. K is the amount of bank capital which is a common resource across the whole banking group. The efficiency parameter θ_n is the same in each banking market but it depends upon the number of markets the bank enters. This specification allows for a source of positive economies of scale (sharing capital across markets) and a source of diseconomies of scale (the possibility that the efficiency parameter may decrease with n reflecting the increased complexity of operating large organizations). Whether on balance for the banking group there are positive returns to scale realized by expanding into more markets will depend upon how θ_n varies with n.

For a banking group of given size n we will assume that the bank fixes K and L_i simultaneously and that the bank faces the same wage rate w in all markets. Then minimization of total cost $rK + w\sum_i^n L_i$ of producing a total amount $Q = \sum_i^n q_i$ of banking services leads to $L_1 = ... = L_n$. Furthermore, allocating that total amount of banking services so as to equalize marginal revenue in each market leads to $q_1 = ... = q_n = Q/n$. Cost minimization also implies $rK = nwL_1$. Substituting these results in the production function (5) yields an expression for optimal capital as function of total banking services $K = \frac{1}{n^{1/2}}\frac{1}{\theta_n}(\frac{w}{r})^{1/2}Q$. Thus the cost function of the bank is $C(r, w, Q) = 2rK = \frac{2}{n^{1/2}}\frac{1}{\theta_n}(rw)^{1/2}Q$. The total revenue for the bank is $n(a - \frac{Q}{n})\frac{Q}{n} = aQ - \frac{Q^2}{n}$. Equating marginal revenue and marginal cost yields the profit maximizing choice of total banking services for the group,

$$Q = \frac{na}{2} - n^{1/2}\frac{1}{\theta_n}(rw)^{1/2} \tag{6}$$

Inserting this into the total revenue and cost functions and the optimal choice of K, yields the following simple expression for total group profits per unit of cost of capital,

$$\frac{\pi}{rK} = \frac{an^{1/2}\theta_n}{2(rw)^{1/2}} - 1 \tag{7}$$

For a given wage rate w this is an increasing function of $n^{1/2}\theta_n$. This succinctly captures the trade-off between the benefits of spreading costs of a group level resource across a wider market and the complexity costs of operating a larger group. Suppose, for example, the efficiency parameter takes the form $\theta_n = \theta^{n-1}$. If $\theta = 0.8$ the rents per unit capital cost in equation (7) drop off after the group expands beyond two markets. If instead $\theta = 0.9$ they fall off after $n = 5$.

Of course, this discussion takes the bankers' wage rate as given. However, if bankers have bargaining power, as the group expands into a wider market, this can have an effect on the rate of compensation that will emerge from the bargain. If bankers try to extract additional rents by increasing the wage rate this will change the banking group's choice of capital. If the bankers operate as a monopsonist and fix w so as to maximize nwL_1 the resulting wage rate is $w^m = \frac{na^2\theta_n^2}{16r}$. For other forms of bargaining as the resulting wage rate is varied between the competitive rate w^c and w^m there will be a trade-off between rents obtained by investors given by equation (7) and rents achieved by bankers $\frac{nwL_1 - nw^c L_{1c}}{rK}$. In Figure 2 we have depicted this for a the case of two markets ($n = 2$). In the outermost curve we have assumed $\theta_2 = 1$. Measuring off the vertical axis, in this case an expansion of the bank from one market to two markets with no adverse effect on the efficiency parameter there is a 50% increase in total returns. Of course, depending upon how bargaining is affected by the expansion, the rents received by investors may increase by more or less than this rate. When expanding the bank's market involves some efficiency loss due to complexity, then the increase in total rents will be less. In the intermediate curve we have depicted the case of $n = 2$ and $\theta_2 = .8$. In that case, the expansion from $n = 1$ to $n = 2$ generates about a 20% increase in total returns that will be distributed somehow between investors and bankers.

The parametric example used in this discussion has been purposely chosen because of its analytical tractability. We can generalize it somewhat and still obtain a number of explicit expressions for a number of the variables of interest. For example, allowing for additional productive factors or a more general Cobb-Douglas which allows the factor shares to differ across inputs, results clumsier algebraic expressions but the same economic forces and trade-offs can still be seen explicitly. However, in simultaneously generalizing to nonlinear demands, richer production technologies, and allowing for strategic interactions, closed form solutions are typically not available, and the model can be analyzed only numerically. However, economic forces that are seen clearly in the simple model we have presented are likely to run through these more complicated and, perhaps, realistic settings. Namely if a bank can capture rents from clients because of a powerful position in banking product markets, these rents may be captured to some degree by powerful bankers. When technical efficiency gains can be obtained by expanding the scale of the firm by operating across a wider range of markets, either geographically or in product space, additional rents may be obtained. But in the process, the nature of bargaining between the bank shareholders and its bankers may change and some of the rents may be extracted through higher rates of compensation of bankers.

In our empirical analysis we will implement this framework with a model of the form,

total return=f(return to investors, return to bankers)

The function $f(.)$ could be derived from a structural model such as the rent extraction model based on linear demands and Cobb-Douglas technology above. A potential advantage of a structural approach is that we may be able to distinguish pure cost advantages of banks of different sizes or business mixes from other sources of returns. The disadvantage however is that our inferences may be sensitive to the choice of functional form for demand and cost and of the nature of product market competition and wage bargaining. A miss-specification of any of these could lead to a bias in estimating the structural parameters.

For this reason in most of our empirical analysis we rely on a reduced form approach. In particular, we consider regression models of the form,

$$return_{k,t} = \alpha_t + \beta X_{k,t} + \epsilon_{k,t} \tag{8}$$

where $return$ is a measure of bank returns, X is a vector of explanatory variables, k is the index of the bank, and t is the fiscal year. We implement this with measure of returns to investors, to bankers and to total returns for the bank. Our measurements these returns will be discussed in Section 4 after we describe our data set.

We have repeatedly suggested that a change in the size of the banking group and the scope of its operations could potentially affect its bargaining with bankers. In particular, we believe that in certain wholesale market activities such as global markets and investment banking senior bankers may be quite mobile and may possess greater bargaining power than in other banking businesses. The return regression analysis treating investor and banker returns separately implicitly will tell us something about how the bargaining power between bankers and investors is affected by scale and other explanatory variables. An alternative approach is to adopt a model of the sort used in studies of labor economics which estimate explicitly the share of rents accruing to unions or other powerful groups of employees.

We consider a variation of the model of the bargaining process adopted by Abowd and Lemieux (1993). We suppose that the negotiated wage, w_j in bank j follows,

$$w_j = \gamma_j QR_j + w_j^c \tag{9}$$

where w_j^c is the competitive wage for bank j, γ_j is a rent sharing parameter, and QR_j are quasi-rents produced by bank j. In the context of the model above QR_j is given by,

$$QR_j = \frac{P_j Q_j}{L_j} - w_j^c \tag{10}$$

where L_j is total labor input in bank j, Q_j is the quantity of banking services and P_j is the price.

The parameter of interest is the rent sharing parameter γ_j which in our view is likely to depend upon the particular banking businesses that the bank pursues. Specifically we suppose that there are two lines of business, commercial banking and investment banking. Let s_j be the share of business in investment banking. Then we write,

$$\gamma_j = \alpha + \beta s_j \tag{11}$$

We hypothesize that $\beta > 0$. Using equation 11 in equation 9 we have,

$$w_j = \alpha Q R_j + \beta s_j Q R_j + w_j^c \tag{12}$$

which will be the model we implement in order to estimate the rent sharing parameters α and β.

4 What determines returns to banking?

In this section we consider empirically the returns to banking allowing for the possibility that some of these returns are rents which bankers may be able to extract for themselves. Thus we measure returns to bank investors and to bankers separately and then combine the two. The theoretical development in Section 3 is based on the premise that efficiency benefits of size may generate extra-normal returns in some banking business lines at least up to some scale. So we start our exploration of determinants of returns by considering size as the primary determinant of returns. We document the fact that returns to investors and, particularly, to bankers do tend to increase with size. We then turn to additional explanatory factors that capture other important characteristics of a bank's business model. We show that funding efficiency, presence in wholesale banking activities and leverage account for a significant proportion of observed cross sectional variation in returns, although not always in the same direction for investors and bankers. That is, there is evidence that the bank's business model has an important effect upon bankers' ability to extract rents for themselves.

Our data set covers bank holding companies that are regulated in the US, covering 1990-2010. The data include all balance sheet and income statement variables reported in Compustat Bank Annual Fundamental File. Through the effects of IPOs and consolidation the number of banks in our sample varied significant over the years from 963 in 1993 to 611 in 2009. As will be explained below our proxy for return to bankers requires data on the total number of employees in the bank. This information is often not reported for observations prior to 1994 and for smaller banks. As a result we restrict our attention to 1994-2010 and the top 60% of banks by size. This data set is somewhat limited in detail that represents differences in the business lines pursued by the banks. In Section 4.3 we also consider a richer source of business line data contained in Federal Reserve regulatory filings made by most large banks in our sample.

4.1 Bank returns and scale

We start our empirical analysis by documenting the systematic relationship between returns to bank investors and to bankers and the scale of the bank's operations. As a measure of scale we use the bank's total assets, at. We take a bank's investors to be its shareholders because collectively they have active control rights in a going-concern bank and they are ultimately responsible for the bank's compensation policy. We represent shareholders return by return on equity ($niseq$), calculated as annual net income after tax (ni) divided by book equity (seq), i.e., $niseq = ni/seq$. Note that in using return on equity as our measure of benefits to shareholders we are taking a very inclusive view of possible gains to changing scale or other bank characteristics.

While measuring returns to bank investors is relatively straight forward, calculating returns to bankers' human capital is not. Many studies of banker compensation focus on pay of CEO's and other top management in the firm as reported in Execucomp. For several reasons, this is not the approach we take here. The most important reason is that compensation information is only reported for top managers. It therefore will not capture compensation to traders and others without top management status but who may have substantial performance-related pay. Second, compensation reporting standards for these top managers have varied over time. Third, compensation packages of bank employees will include salary, cash bonus, stock awards (current and deferred), stock options (current and deferred), pensions contributions, plus a variety of perquisites. These compensation practices can vary greatly across banks and over time, and not all these forms of compensation are included in reported earnings of top executives.

In light of these considerations we use a broader measure of return to bankers. We estimate rents earned by bankers in a given bank as the total amount employee compensation in excess of what we estimate to be the "competitive wage bill" of the bank. Specifically we proxy the negotiated wage rate in the bank, w, with staff costs per employee ($xlremp = xlr/emp$) where (xlr) is total staff cost and emp is total number of staff where the latter two variable are reported in Compustat. Our proxy for the competitive wage rate, w^c, is the average value of $xlremp$ in a given year for firms with at least 50 employees and total assets less than \$1 billion. In order to have a measure of bankers' return that is comparable to our measure of investor returns we use total rents normalized by the book value of equity. This is $mxlrrentseq = max(xlr - w^c * emp, 0)/seq$. In this we are taking our calculated w^c as the upper bound on the competitive compensation rate faced by the bank. We have also used a number of alternative measures of bankers' rents. One is the ratio of the firm's negotiated wage rate to the estimated competitive wage rate $w^* = w/w^c$. In Section 4.3 we also consider alternative benchmarks for the competitive wage rate including average w in banks with at least 50 employees and total assets less than \$2 billion, i.e., up to about the 75'th size percentile in our sample. The qualitative conclusions are quite similar for all these alternative measures of bankers' rents.

Table 1 presents descriptive statistics of the return on equity ($niseq$) for US listed bank holding companies from 1994 through 2010 by size decile of total assets (at). Comparing these indicators across size deciles provides some evidence that returns to investors tend to increase with bank size. This pattern is monotonic for the median and nearly so for the 25th and 75th percentiles. There is a wide dispersion of returns within a given size class. However, it does appear that the whole distribution of returns is translated to the right as size increases.

Table 2 reports summary statistics on our estimates of returns to bankers normalized by the book value of equity ($mxlrrentseq$) for the period 1994-2010 by size decile of total assets. By this measure of returns we also find evidence of economies of scale. The relatively large returns to bankers in the 10th size decile is particularly striking. In contrast, by this measure most banks within the bottom half of the size distribution do not pay rents on average to bankers.

Figure 3 summarizes the relation of returns to investors and size graphically. We have plotted the cumulative sample distribution of return on equity ($niseq$) for the fifth to tenth size deciles of banks. We see that the distribution for the largest banks lies strictly above those of the smaller banks, i.e., the tenth size decile dominates the others in the sense of first-order stochastic dominance. While the ordering is not strict for the smaller size deciles because some of the curves cross at the left tail of the return distributions, the size ordering does hold in the middle and in the right tail of the return distributions. That is, high investor returns are more frequent for banks in the ninth size decile as compared to the eighth size decile etc.

Figure 4 depicts the cumulative sample distributions of bankers' returns ($mxlrrentseq$) for banks segmented by size deciles. Similarly to Figure 3 the distributions tend to be ordered by size with the higher returns being associated with larger banks. However, the dominance of the largest 10% of the banks is even more dramatic when judged by returns to bankers. Thus even though there is a fair amount of dispersion in bankers' rents within this largest size class of banks, there is a clear tendency for the biggest rents to be paid out to bankers in the largest banks.

Combining results from Tables 1 and 2 we arrive a first important insight from the approach that incorporates bankers' return as well as investor return into the analysis: the evidence of increasing returns to scale are significantly greater when bankers' return is included than when it is not. For example if we compute total returns as the sum of returns to investors and to bankers, the median in the 10th decile exceeds that in the 9th decile by 3.56 per cent; whereas, for investor returns alone the difference is only 2.1 per cent.

While we have documented a tendency for returns to increase with bank size, we have also found that the cross sectional variation of returns within a given size decile is large. This suggests that large size in itself may not be the only or even the most important determinant of returns to investors and bankers. In the next subsection we explore other possible characteristics the bank's business model that may account for observed variations in returns.

4.2 What can account for economies of scale in banking?

In considering possible explanations for the pattern of returns to investors and bankers that we have documented in Section 4.1 we note that at least some of the largest banks differ from smaller banks by their presence in a variety of wholesale market services provided to very large non-financial corporations, smaller commercial banks and to non-bank financial intermediaries. We follow past studies of banking efficiency in using fee income as a proxy for the presence in these wholesale markets (see, e.g., Stiroh, 2004). Specifically, from bank income statements we calculate $niish$, the share of non-interest income in total revenues (non-interest income plus net interest income).

As is widely known, many of the largest banks attempt to combine their presence in a variety of wholesale market activities to deliver a package of services that would be very costly to reproduce with a series of stand-alone products delivered by specialist firms. For example, a bank providing prime brokerage services to hedge funds and other money managers will offer valuation, risk management, reporting, and custodial services as well as access to securities and derivatives markets either as a principal or as a broker. Simultaneous operation in all these lines of business adds considerably to the complexity of systems and organization within a bank. Thus non-interest income is natural proxy for complexity as featured explicitly in the model developed in Section 3.

To explore this empirically here we adapt the model used in that section to develop an estimable model for total rents that will reflect these factors. Specifically, from equation (7) we have the following expression for the logarithm of total return to investors,

$$ln(1+\frac{\pi}{rK}) = ln(an^{1/2}) + ln(\theta_n) - ln(2(rw^c)^{1/2}) - .5ln(w*) \tag{13}$$

where $w* = w/w^c$ is the ratio of the negotiated wage rate over the competitive wage. The first term on the right hand side of equation (13) captures the size of the market, and the second term captures the complexity of the operation. Our proxy for the first term is the logarithm of total assets. For the second term we use the share of non-interest income in total revenues, ($niish$). This leads to the following empirical model for total bank rents.

$$ln(1+niseq_{it}) + .5ln(w*) = \alpha_t + f(size_{it}) + g(niish_{it}) \tag{14}$$

The cost of capital and the competitive wage rate are allowed to vary over time and are captured by the time varying intercept, α_t. The general functions $f(.)$ and $g(.)$ allow for the possibility of non-monotonicities in the effects of size and complexity.

Based on equation (14), in Figure 5 we have calculated the mean total rents for our sample sorted by the top five size deciles (s6-s10) and complexity quintiles (n1-n5). The estimated rent varies greatly across firms of varying size and varying complexity. The F statistic testing the equality of mean across cells (but allowing varying time effects) is 8.6 which is significant at the 99.5% level. From Figure 5 we see that it is particularly the largest, most complex firms (s10, n5) that stand apart from the others, at least based on our estimate of total rent creation.

In estimating equation (14) we find that there was no simple monotonicity by either size or complexity alone. It may be that this reflects cross section variation in other factors beyond time, size and our proxy for complexity. We now expand the candidate explanatory variables to include proxies for the bank's risk taking and for funding efficiency. Following Hughes and Mester (2013) we proxy for risk using a measure of leverage, specifically the variable $ilev$ calculated as the ratio of book equity to total assets. To capture the effect of funding costs on return we include net interest margin, nim. To allow for the apparent non-linearity in the largest banks reflected in Figures 3 and 4 we include $at10$, a dummy variable equal to 1 if the bank is in the largest size decile and zero otherwise. As the largest banks may have a particular advantage in building systems to manage complex operations and also have access to alternative sources of funding through wholesale markets including derivatives, we include $nimat10$, an interaction term of nim and $at10$, and $niishat10$ the interaction of $niish$ and $at10$.

We use these explanatory variables in a regression of returns to investors, to bankers and to the two combined using regression analysis. We consider models of the form,

$$return_{it} = \alpha_t + \beta X_{it} + \epsilon_{it}$$

where $return$ is a measure of bank returns, X is a vector of explanatory variables, i is the index of the bank, t is the fiscal year, and ϵ is an error term. As measures of $return$ we use return on equity, $niseq$, and banker rents relative to equity, $mxlrrentseq$. As a measure of total returns to the bank we use $trentseq$ calculated using the equation

$$trentseq = ((1 + niseq)^2 + (1 + mxlrrentseq)^2)^{.5} \tag{15}$$

This functional form gives rise to downward sloping, concave total return curves as in Figure 1.

Table 3 presents summary statistics of the variable used in our regression analysis. Table 4 reports the simple correlation coefficients between these variable. There are significant positive pairwise correlations between investor returns and nim and between banker returns and $niish$ and both these explanatory variable are positively related to total bank returns. The pairwise correlations among our explanatory variables are all quite low suggesting that these variables are capturing distinct bank characteristics.

Our main regression results are reported in Table 5 based on annual data between 1999 and 2010. The equations for $niseq$ and $trentseq$ are estimated by OLS. To take into account left-censoring of our dependent variable we report Tobit regressions for $mxlrrentseq$. Given that it is implausible to expect that the large number of very small US banks would have significant presence in wholesale markets we confine our regressions to the size deciles 6 through 10. Also outliers are removed (if $trentseq > 2$, $niish < -2$ or $niish > 2$)). T-statistics based on standard errors clustered by bank (Compustat variable $gvkey$) are reported below coefficient estimates.

The first three columns of Table 5 report results based on the scale variables, at and $at10$ as well as yearly effects. The results are in line with our discussion in Section 4.1. The scale variable (at) enters with positive statistically significant coefficient to all three regressions. The dummy for the 10th size decile, $at10$ is as well positive and highly significant. So we find statistically significant scale economies for investors, for bankers and for banks overall. However, the economically significant scale effects are felt only at the 10th decile and principally because of the 10th decile dummy. For example, multiplying the coefficient of *at* in the first column by the mean bank size in the 9th decile ($ 5.5 billion) contributes less than 2 basis points to shareholder returns. When multiplied by the mean size in the 10th decile ($86 billion) it contribute 26 basis points to return. These are dominated by the pure 10th decile effect which accounts for 270 basis points of shareholder returns.

We now consider whether these strong scale effects persist when we introduce our additional explanatory variables into our regressions. In columns 4-6 of Table 5 we include our measures of funding efficiency, *nim*, and presence in wholesale banking, *niish* as well as these variables interacted with the 10th size decile dummy, $nimat10$ and $niishat10$. We see that these additional variables largely account for the pure scale effects. Total assets *at* is insignificant in all three regressions. And the 10th size decile dummy is now significant only in the combined rent regression, *trentseq*.

Focussing now on returns to investors, in column 4 of Table 5 we see the coefficient on *nim* is positive and significant. That is, the benefits of greater funding efficiency are passed on to investors in the form of higher return on equity. The coefficient on the interaction term $nimat10$ is negative and significant (at 10% level only). That is, for the largest banks, low relative funding cost is a less important determinant of returns to equity. The coefficient on *niish* is positive and significant at 10% level, implying that greater presence on wholesale markets is associated with higher returns on equity. However, this seems to apply equally to banks of all sizes, because the inter-action term $niishat10$ is positive but insignificant. Thus the estimates in column 4 give us a first, preliminary answer to the question "what are the returns to scale in wholesale banking". The answer is that we find positive but weak scale economies to wholesale banking when the performance metric is return on equity.

When we consider the role of the same explanatory variables in the determination of returns to bankers, Column 5 of Table 5, we find the coefficient of *nim* is positive and significant. That is, some of the advantage of greater funding efficiency accrues to bankers as well as to bank investors. However, the coefficient of $nimat10$ is significantly negative and larger in absolute value than the coefficient of *nim*. It is worth pausing to draw out the implications of this last result. If we combine the coefficients of *nim* and $nimat10$, we obtain a negative value that is statistically significant. That is, we find that a very large bank with high apparent funding efficiency pays out relatively little rent to its bankers. In contrast, a very large bank with *low* apparent funding efficiency pays out substantial rents to its bankers. As suggested in the introduction, one possible explanation of this finding relates to the way bankers gain bargaining power. It may be that large banks pursue growth through greater reliance on wholesale funding. This may result in narrower intermediation margins and furthermore depends upon bankers with specialist knowledge. The bankers involved may be difficult to replace and thus are able to extract very attractive compensation packages.

Our wholesale banking activity proxies, *niish* and *niishat*10 are both positive and significant in column 5 of Table 5. That is, greater presence in wholesale banking markets is associated with higher returns to bankers independently of scale and funding costs. This effect is even stronger for larger banks—the interaction term (*niishat*10) enters positively and is highly significant. For example, an increase in non-interest income share of 10 percentage points is associated with an increase in the bankers' rents of 140 basis points.

In column 6 of Table 5 where we combine returns to bankers and bank investors in the total rent measure, *trentseq*, we find some evidence of a pure scale effect operating for the 10th size decile. The funding efficiency variable, *nim* enters positively and is highly significant; however, the funding effect is diminished somewhat in the top size decile. The wholesale market presence measure, *niish* enters positively and is highly significant, and this effect is reinforced in the 10th size decile.

Columns 7 to 9 of Table 5 introduces the capital ratio, *ilev*, in addition to controls for scale, funding efficiency and presence in wholesale markets. *ilev* is very close to the inverse of the leverage ratio used by US bank regulators. Adding this control for risk taking leaves the qualitative results regarding *nim* and *niish* of columns 4-6 unchanged. Funding efficiency has a positive effect on returns to shareholders, bankers and the two combined, but this effect is diminished in the top size decile. Presence in wholesale banking enters with positive sign in all three regressions and this effect is increased in the largest size decile. Thus our measures of funding efficiency and investment banking activities are not simply capturing a leverage effect. The hypothesis that high returns to shareholders merely compensates for greater risk is not borne out by the results in column 7 where *ilev* enters with a positive coefficient and is statistically significant. That is, controlling for other factors, greater leverage is associated with *lower* return on equity. In the bankers' return and total return regression (columns 8 and 9) *ilev* enters with the expected negative sign and is statistically significant. Finally,when funding efficiency, wholesale banking and leverage are all included, the pure scale effects no longer appear to operate except in the top size decile for return on equity and combined shareholder/banker return.

To summarize, we have found evidence of positive economies of scale that are stronger when bankers' returns are taken into account than when they are not. However, differences in product mix, notably relative funding efficiency and presence in wholesale banking activities, largely account for the apparent positive association of bank size and bank returns. We have emphasized that modern banking products are diverse and this is particularly true of what may be considered wholesale banking activities, i.e., services and products that cater particularly to institutional clients. These include securities trading and lending, OTC market making, trusteeship activities, securities underwriting and other investment banking activities. The importance of wholesale banking in accounting for increasing returns to scale is apparent only when returns to bankers are taken into account either as a performance measure by itself or in combination with returns to shareholders. Our results also suggest that the use of wholesale funding to expand the scale of the banks operations can increase bank returns even if it squeezes the bank's average net interest margin. However, these increased returns accrue largely to bankers rather than bank shareholders.

4.3 Robustness

In order to assess the robustness of our findings we have experimented with a wide variety of alternative specifications. The striking feature that comes out of this exercise is that the main qualitative conclusions from Section 4.2 are very robust.

Table 6 reports the results of using alternative measures of returns to investors, bankers and the bank overall. The explanatory variables are as in Table 5 columns 7-9. Column 1 of Table 6 uses return on assets as a measure of return to investors. Comparing this to column 7 of Table 5 we find the pattern of signs are as when return on equity is used. The coefficients on nim, $niish$ and $ilev$ are all significant in both specifications. That is funding efficiency, presence in wholesale markets and leverage all are significant determinants of return to investors either measured as return on equity or return on assets. The coefficients of $at10$ and the interaction term $nimat10$ are no longer significant, and that of $niishat10$ now becomes marginally significant.

Columns 2 and 3 of Table 6 reports results for bankers' rents calculated as the excess of total compensation in excess of the competitive wage bill normalized by book equity but using alternative measures of the competitive wage rate. $mxlrrentseq2$ uses the average wage in larger firms, specifically, firms with at least 50 employees and total assets of less than \$2 billion. $mxlrrentseq3$ uses the average wage in banks in the same size decile as the bank being considered. The qualitative results for both of these measures are very close to those found in column 8 of Table 5. Funding efficiency (nim) is postive and significant but not for banks in the top size decile. Presence in wholesale banking is positive bankers but especially for banks in the top size decile.

Increased leverage is associated with higher returns to bankers.

Columns 4 and 5 of Table 6 report the results for two alternative measures of bank total returns. The $trentseq2$ differs from $trentseq$ by using $mxlrrentseq2$ rather than $mxlrrentseq$ in the calculation in equation (15). The results for $trentseq2$ are almost exactly the same as for $trentseq$ found in Table 5 column 9. The $trentseqsum$ is the sum of return on equity and return for bankers ($trentseqsum = niseq + mxlrrentseq$). The results for this variable are also very similar to those of $trentseq$. Funding efficiency (nim) has a positive effect on total returns that is diminished among the largest banks. Presence in wholesale banking has a positive effect on total returns which is reinforced in the largest banks. However, using $trentseqsum$ the capital ratio $ilev$ enters with a positive sign which is similar to its effect on investor returns ($niseq$) but in contrast with its effect in $trentseq$.

We also considered alternative specifications of the explanatory variables used in the return regressions. As an alternative proxy for the size of the firm we have used the natural logarithm of total assets, $lnat$. Using this variable rather than total assets in our return regressions leads to the results reported in Table 7. These are very close to those reported in Table 5 columns 7-9. In particular the pattern of signs and significance for funding efficiency, presence in wholesale markets, and leverage are the same with the exception of the fact that in the bankers' rent ($mxlrrentseq$) regression the coefficient on $niish$ is no longer significant. The main difference is that $lnat$ appears as significant in the bankers' return ($mxlrrentseq$) and total return ($trentseq$) regressions.

In the regressions considered so far, our main proxy for a bank's presence in wholesale and investment banking is the non-interest income share, $niish$. We have also considered more detailed information about banks' business lines contained in the regulatory filings to the Federal Reserve System, the so-called FRY9-c filings. Not all bank holding companies from our original sample were required to file these reports and if so they are absent from our merged sample. However, almost all of the large bank holding companies are included. Table 8 lists summary statistics for variables selected measured as stock outstanding at year end, all normalized by total assets.

In Table 9 we report the correlations among the main variables in the bank regulatory data set. A number of interesting relations are worth noticing. First, there is a relatively large, positive correlation between total assets, at and the amount of derivatives outstanding. Clearly it is the large banks that have a very active derivatives business. Second, net interest margin, nim, is negatively correlated with the use of repos and securities lending. This is supportive of our earlier interpretation of the results in Table 5 columns 4 and 5, namely that the reliance upon wholesale funding may come at the cost of reducing intermediation margins. This may be relatively disadvantageous for bank investors but not for bankers. Third, non-interest income share, *niish*, is positively correlated with repos, securities lending, and use of forward contracts. This is as we would expect, as these latter activities are all commonly used in supporting wholesale banking activities.

We have used each of the new wholesale indicators plus that variable interacted with the tenth size decile dummy, $at10$ as additional variables in regressions as in Table 5 columns 7-9. The main qualitative conclusions above are robust to their inclusion. That is, funding efficiency contributes positively to investor and banker returns but less so for the largest banks. Leverage contributes positively to banker returns but negatively to investors returns. Non-interest income share, *niish*, is positive and significant in the bankers' return equation but generally only for the largest banks. And there is little evidence of a significant pure size effect on returns once we control for the characteristics of the banks' business models.

The estimated coefficients that were obtained by introducing one at a time each of wholesale indicators plus that indicator interacted with $at10$ are reported in Table 10. Focussing on securities lending, forwards and OTC options a striking pattern is seen in comparing coefficients across rows and columns. In the return to bankers regressions (column 2) these variables enter with positive and statistically significant coefficients, but the effect is greatly reduced or even totally eliminated by a negative and significant effect for these variable when interacted with the top size decile dummy, $at10$. In contrast, these variables are mostly insignificant in the regressions on investor returns (column 1). That is, it looks like when smaller banks move into wholesale market activities like securities lending and OTC derivatives, it seems to boost earnings but these returns seem to accrue to bankers who are able bargain for enriched compensation contracts.

As an alternative approach is to allow the possible endogeneity of *niish* and to use the regulatory variables as instruments. In columns 4-6 of Table 11 we report the second stage estimates from an IV regression where we instrument for both *niish* and $niishat10$. Compared to the results of columns 7-9 of Table 5 the main change is that interaction term $niishat10$ is now no longer significant. The other main qualitative findings are very similar to our previous results. Funding efficiency, *nim* enters positively in all three regressions, but the interaction term, $nimat10$ enters negatively. The presence in wholesale banking *niish* is positive and highly significant. The capital ratio, *ilev*, enters positively in the shareholders' return regression and negatively in the bankers' return and total return regressions.

Also in Table 11 we allow for unobserved cross-sectional variation by introducing firm random effects. The results in columns 1-3 show that introducing pure firm effects has very little impact on the results. Funding efficiency, *nim* enters with positive sign in all three regressions, but when interacted with the top size decile dummy the effect is negative and significant. The wholesale market proxy, *niish*, is positive and significant and the effect is reinforced in the top size decile. The capital ratio, *ilev* enters positively in the equation for return on equity and negatively in the bankers' rent and total return equations. These panel estimations do produce somewhat different estimates of the pure scale effects. The top size decile dummy $at10$ enters positively and is significant in the regressions for return on equity and bankers' rent. Finally, *at* enters negatively in the model for bankers' rents.

The use of leverage as a control for bank risk taking is not the only approach that can be taken. We have also tried the alternative approach derived from observed stock returns. Specifically, rather than using leverage as a control we have used the standard deviation of bank assets return (*st_asset*). The results are reported in Table 12. The bank's assets return standard deviation is calculated as standard deviation of daily stock returns multiplied by capital ratio (*ilev*). Stock returns are obtained from the CRSP dataset. Since not all bank holding companies are actively traded on exchanges, the sample for this estimation is slightly smaller compared to Table 5. Comparing the results to columns 7-9 of Table 5 we find the main qualitative conclusions of our previous results continue to hold. Funding efficiency, *nim*, is positive and significant but its effect is diminished in the largest size decile. Presence in wholesale banking, *niish* enters positively and is highly significant for the largest firms in the bankers' return and total return regressions. The coefficient of asset volatility is negative and significant. That is, that the hypothesis that higher returns merely compensate for greater risk is not supported by the data.

Finally, some analysts have suggested that the emergence of very large banks may be driven by the advantage of perceived as being too-big-to-fail (TBTF). To verify whether our results can be attributed principally to TBTF, we did two robustness checks on our benchmark regression results (columns 7-9 of Table 5). In Table 13 columns 1-3 reproduces those regressions with the top 1% of banks excluded from the sample. The qualitative results are the same as in Table 5. In Table 13 columns 4-6 we rerun the models including a dummy variable *Too-big-to-fail* for those banks ranked within the top 20 systemically important institutions (SIFI) in 2007 using the measure of marginal expected short-fall (Acharya *et al*, 2012). Again, the same pattern of signs and significance are found for our benchmark explanatory variables and in this case, the dummy *Too-big-to-fail* is insignificant.

5 Bankers' bargaining power

As discussed in Section 1 the ability of bankers to extract rents is likely to vary across the particular lines of business that the bank pursues. In the return regression analysis of Section 4.2 the sharing of returns between bankers and shareholders was left implicit because the sensitivities to the explanatory variables were estimated independently in the equations for returns to investors, bankers and the bank overall. As described in Section 3 an alternative approach is to try to implement the bargaining model used in the labor markets literature to identify a rent sharing parameter. This gives rise to the wage equation (12).

We implement this model empirically as follows. The negotiated rate of compensation, w, is measured as total compensation costs over total head count, L. The share of the firm's activities in wholesale banking, s, is proxied by the non-interest income share, *niish*. Our measure of quasi-rents, QR, is earnings before taxes net of non-labor costs and estimated competitive labor costs normalized by head count. That is, $QR = \frac{EBIT}{L} + w - w^c$ where $EBIT$ is earnings before interest and taxes. The competitive wage rate, w^c is as defined in the construction of the bankers' rent measure, *xlrrentseq*. Substituting these proxies into equation (12), solving out for the negotiated wage and introducing a constant that will be allowed to vary with time in our regressions leads to,

$$w_{jt} = \delta_t + \frac{\alpha}{(1-(\alpha+\beta s_j))}\frac{EBIT_{jt}}{L_{jt}} + \frac{\beta}{(1-(\alpha+\beta s_{jt}))}\frac{s_{jt}EBIT_{jt}}{L_{jt}} + w^c_{jt} + \epsilon_{jt} \quad (16)$$

This specification is nonlinear in parameters and variables, and we estimate the parameters α, β and δ by nonlinear least squares. As a check on the possible restrictiveness of this functional form we also estimate a linearized version of this model,

$$w_{jt} = a_{0t} + a_1\frac{EBIT_{jt}}{L_{jt}} + a_2\frac{s_{jt}EBIT_{jt}}{L_{jt}} + a_3 w^c_{jt} + \epsilon_{jt} \quad (17)$$

In Table 14 we report estimates based on our sample of bank holding companies. The results of principal interest are those obtained by nonlinear least squares and are reported in column 2. The parameters of interest α and β are significantly different from zero. The rent sharing parameter for the firm with no presence in wholesale banking is $\alpha = 0.061$. The sensitivity of rent sharing to *niish* is $\beta = 0.224$. Using equation (11), this implies a rent share of 28.5% for a bank that derives all its income from non-interest sources. Within our sample the median value of *niish* is about 23%. Among the largest 10% of banks *niish* ranges from the 0.14 at the tenth percentile to 0.63 at the ninetieth percentile, implying an estimated rent share for bankers varying between about 9.2% and 20.2%.

By way of comparison the estimates in the linear version of the wage equation are reported in column 4 of Table 14. These estimates are obtained by OLS. All the coefficients are significant By these estimates we would predict a somewhat higher share of rents accrues to bankers. For example, for a bank with 14% of income from non-interest sources the bankers' rent share would be 10.4%; whereas, the bank with a 63% share of non-interest income the bankers' rent share would be 23.4%. Accepting the model developed in equation (12) as correct, then the OLS estimates of the sharing parameters are biased. So we see that the correction for this bias by non-linear estimation leads to lower estimates of the amount of rents that are paid out to bankers in banks with a large presence in wholesale banking. Judging by R-squared, the fit obtained with the nonlinear model is very close to that obtained with the linear model, thus reinforcing our view that the nonlinear model is the preferred specification.

6 Conclusion

In this paper we have studied the returns to scale in banking by combining returns to shareholders and bankers to obtain a measure of total bank returns. We have found evidence of positive economies of scale that are stronger when bankers' returns are taken into account than when they are not. We find that these economies of scale to a significant degree can be accounted for by a combination of funding efficiency, leverage and involvement in wholesale banking activities. Specifically, when we include net interest margin, the capital to asset ratio, and the share of non-interest income in total net income, the pure scale effects are insignificant except in the top size decile. And when we include a large range of detailed proxies for wholesale banking activities, pure scale effects disappear altogether. Our results also suggest that the use of wholesale funding to expand the scale of the banks operations can increase bank returns even if it squeezes the bank's average net interest margin. However, these increased returns accrue largely to bankers rather than bank shareholders. Finally we estimate bankers' share of rents under the assumption that bankers' bargaining power is increasing in the share of the banks' business that is in wholesale banking. We find that in the largest 10 per cent of banks, the bankers' share varies in the range of about 9% to 20%.

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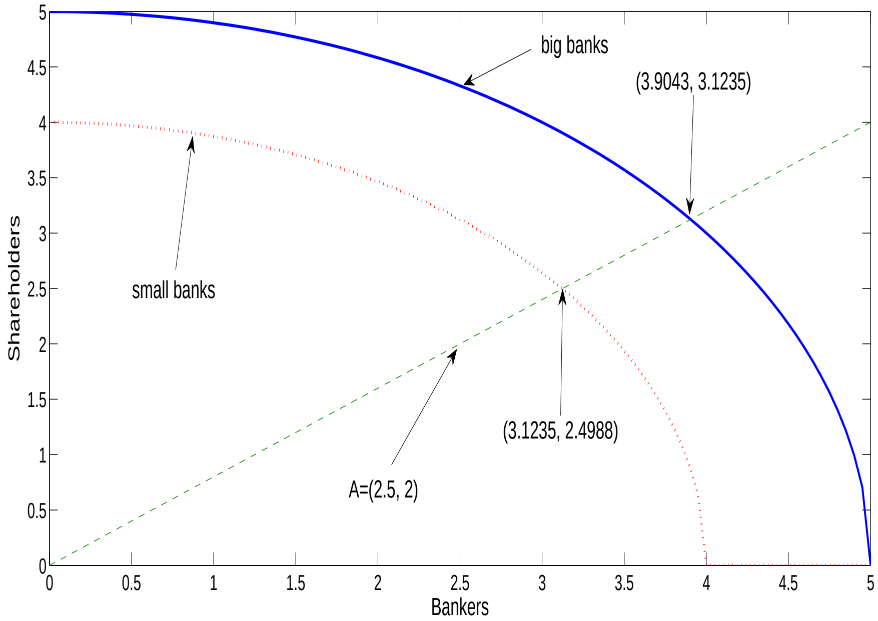

Figure 1: Measuring scale economies with two efficiency frontiers

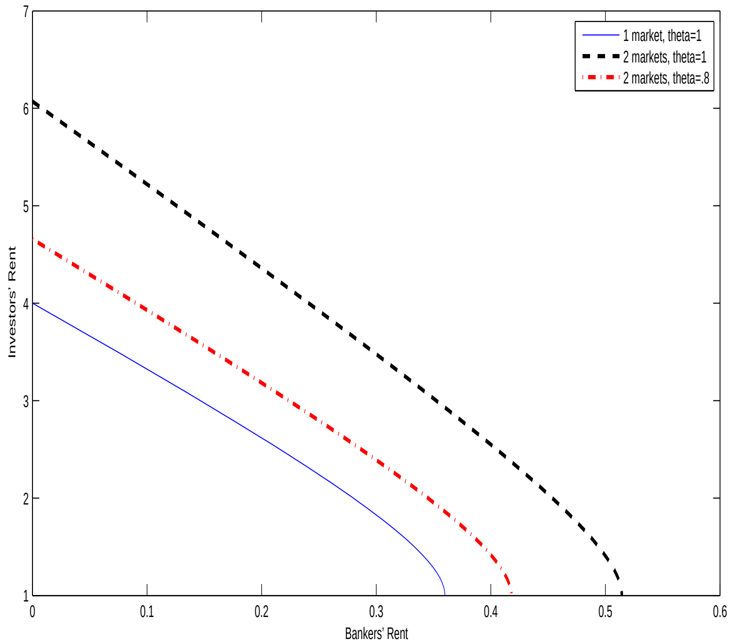

Figure 2: Efficiency frontiers with rent sharing through bargaining over wage rate
The figure is based on the model of the banking group that shares a common factor across banking markets as described in Section 3. $a = 1$, $r = .1$, $w^c = .1$.

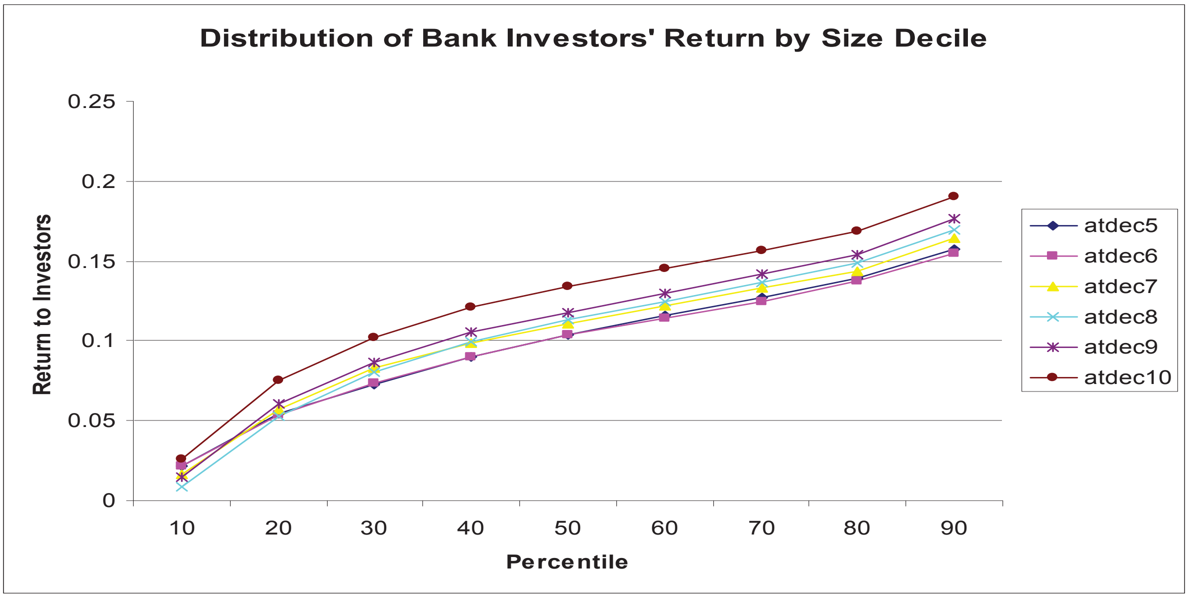

Figure 3: Cumulative Sample Distributions of Bank Investor Returns, Top Six Size Deciles

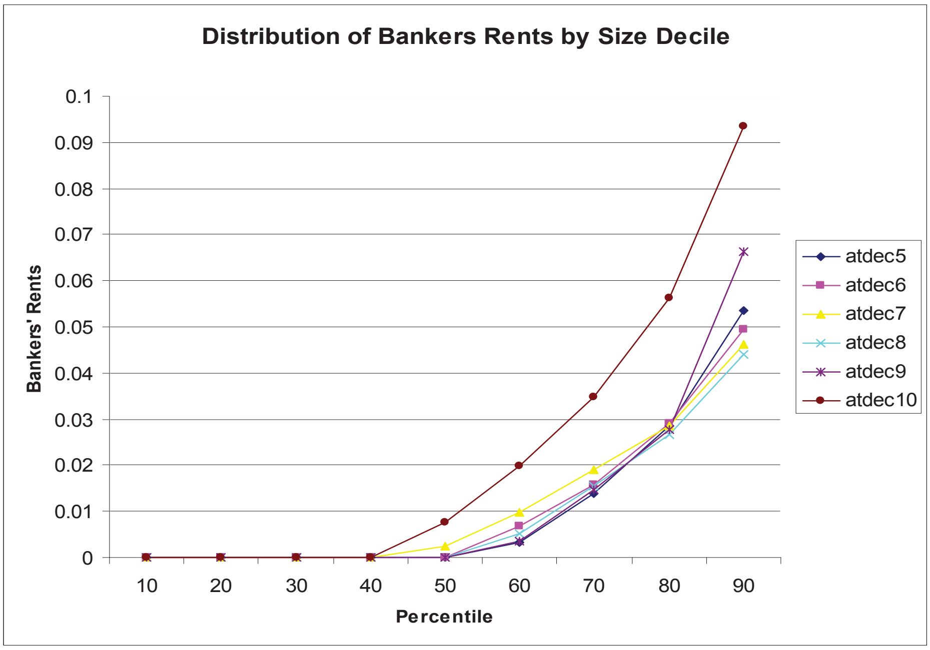

Figure 4: Cumulative Sample Distributions of Bankers' Returns, Top Six Size Deciles

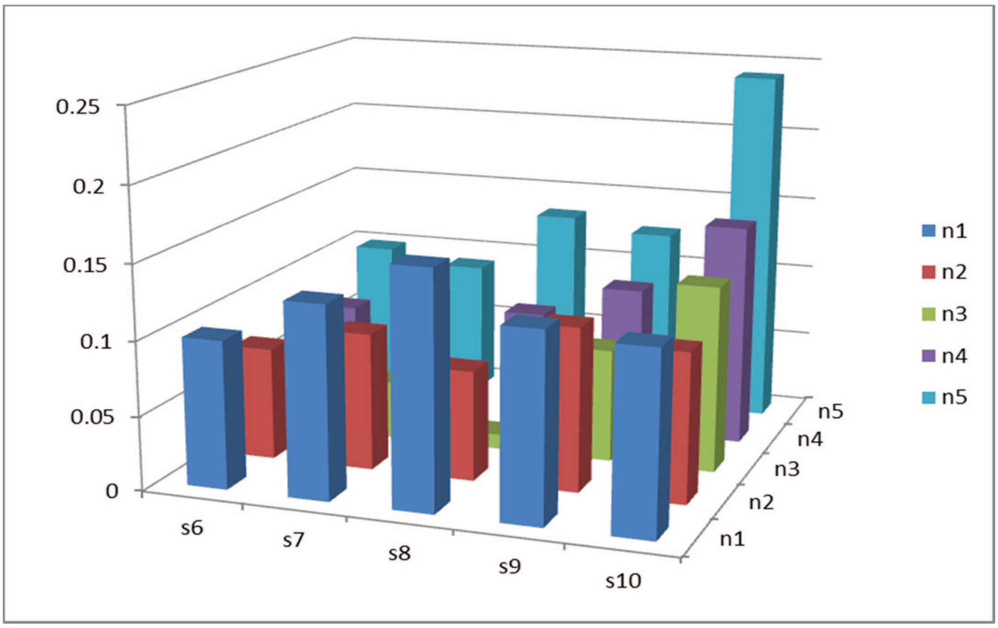

Figure 5: Total Returns by Size and Complexity

Table 1: Total Return to Investors, 1994-2010

	niseq				
Deciles of at	mean	25th tile	50th tile	75th tile	sd
1	-.021	.028	.056	.084	1.042
2	.058	.045	.076	.109	.268
3	.073	.054	.090	.119	.165
4	.081	.059	.098	.126	.116
5	.080	.062	.101	.131	.154
6	.042	.061	.101	.129	1.351
7	.067	.066	.107	.137	.367
8	.070	.067	.111	.143	.248
9	.060	.073	.115	.147	.393
10	.114	.095	.136	.164	.133

The return to investors (niseq) is defined as net income after tax divided by book equity.

Table 2: Returns to Bankers, mxlrrentseq, 1994-2010

	mxlrrentseq				
Deciles of at	mean	25th tile	50th tile	75th tile	sd
1	0.0142	0.0000	0.0000	0.0142	0.0729
2	.0.0186	0.0000	0.0000	0.0189	0.0552
3	.0.0142	0.0000	0.0000	0.0123	0.0356
4	.0.0165	0.0000	0.0000	0.0174	0.0403
5	.0.0171	0.0000	0.0000	0.0215	0.0367
6	.0.0159	0.0000	0.0000	0.0217	0.0284
7	.0.0170	0.0000	0.0038	0.0239	0.0295
8	.0.0171	0.0000	0.0022	0.0235	0.0366
9	.0.0290	0.0000	0.0011	0.0254	0.0824
10	.0.0347	0.0000	0.0157	0.0504	0.0495

The return to bankers (mxlrrentseq) is defined as maximum of (total staff cost - competitive staff compensation, 0)/ book equity.

Table 3: Summary statistics 1999-2010

	Mean	Median	St. dev.
niseq	0,085	0,113	0,165
mxlrrentseq	0,022	0,006	0,040
trentseq	1,498	1,505	0,081
at	19958	2160	109814
nim	3,759	3,740	0,904
niish	0,247	0,229	0,158
ilev	0,091	0,086	0,032

The dependent variables are return on equity (niseq), bankers' rent as a per cent of equity (mxlrrentseq), and total rent (trentseq). The explanatory variables are total assets (at) (expressed in millions of USDs), net interest margin (nim), per cent of non-interest income in total revenues (niish), and ratio of book equity to total assets (ilev).

Table 4: Correlations

	niseq	mxlrrentseq	trentseq	at	nim	niish	ilev
niseq	1						
mxlrrentseq	-0.02	1					
trentseq	0.71	0.37	1				
at	0.02	0.14	0.07	1			
nim	0.20	0.01	0.26	-0.07	1		
niish	0.13	0.37	0.30	0.22	-0.12	1	
ilev	0.02	-0.16	-0.14	-0.02	0.06	-0.06	1

The dependent variables are return on equity (niseq), bankers' rent as a per cent of equity (mxlrrentseq), and total rent (trentseq). The explanatory variables are total assets (at) (expressed in millions of USDs), net interest margin (nim), per cent of non-interest income in total revenues (niish), and ratio of book equity to total assets (ilev).

Table 5: Linear Models

Dependent variable	niseq	mxlrrentseq	trentseq	niseq	mxlrrentseq	trentseq	niseq	mxlrrentseq	trentseq
at	0.000**	0.000***	0.000***	0.000	0.000	0.000	0.000	0.000	0.000
	(2.18)	(3.46)	(3.89)	(1.35)	(1.40)	(0.70)	(1.52)	(1.30)	(0.57)
at10	0.027***	0.029***	0.029***	0.063	0.014	0.043**	0.076*	0.009	0.037*
	(3.28)	(4.28)	(4.67)	(1.56)	(0.80)	(1.97)	(1.88)	(0.49)	(1.67)
nim				0.036***	0.007**	0.025***	0.035***	0.007**	0.026***
				(8.03)	(2.29)	(11.46)	(7.61)	(2.34)	(11.98)
nimat10				-0.015*	-0.012***	-0.017***	-0.018**	-0.011**	-0.015***
				(-1.94)	(-2.66)	(-3.38)	(-2.30)	(-2.40)	(-3.08)
niish				0.077*	0.042*	0.084***	0.082*	0.039*	0.082***
				(1.84)	(1.88)	(4.28)	(1.93)	(1.79)	(4.25)
niishat10				0.045	0.144***	0.110***	0.036	0.148***	0.114***
				(0.85)	(4.34)	(3.34)	(0.67)	(4.52)	(3.47)
ilev							0.442***	-0.162***	-0.188***
							(2.83)	(-2.63)	(-3.88)
cons	0.133***	-0.002	1.525***	-0.030	-0.035**	1.403***	-0.064**	-0.016	1.418***
	(39.08)	(-0.25)	(541.22)	(-1.39)	(-2.47)	(137.38)	(-2.35)	(-1.06)	(125.76)
R-sq	0.200		0.285	0.230		0.383	0.236		0.388
Nobs	4077	4077	4077	4077	4077	4077	4077	4077	4077

The dependent variables are return on equity (niseq), bankers' rent as a per cent of equity (mxlrrentseq), and total rent (trentseq). The explanatory variables are total assets (at), a dummy variable if an observation is in the 10th size decile (at10), net interest margin (nim), nim interacted with at10 (nimat10), per cent of non-interest income in total revenues (niish), niish interacted with at10 (niishat10), ratio of book equity to total assets (ilev), and year dummies. The regressions of niseq and trentseq are estimated by OLS. The mxlrrentseq model is estimated by Tobit regression. T-ratios based on clustered standard errors are reported in parentheses. *, **, and *** indicates significant at the 10%, 5% and 1% levels respectively.

Table 6: Using alternative measures of bank returns

Dependent variable	*niat*	mxlrrentseq2	mxlrrentseq3	trentseq2	trentseqsum
at	0.000	0.000	0.000**	0.000	0.000*
	(0.51)	(1.43)	(2.41)	(0.61)	(1.76)
at10	0.002	0.007	-0.019	0.038*	0.083*
	(0.60)	(0.36)	(-0.79)	(1.70)	(1.94)
nim	0.003***	0.007**	0.006*	0.026***	0.041***
	(9.58)	(2.19)	(1.86)	(11.98)	(8.44)
nimat10	-0.001	-0.011**	-0.015***	-0.015***	-0.029***
	(-1.32)	(-2.31)	(-2.75)	(-3.10)	(-3.12)
niish	0.006*	0.036*	0.019	0.080***	0.124***
	(1.83)	(1.68)	(0.95)	(4.21)	(2.85)
niishat10	0.008*	0.152***	0.179***	0.113***	0.152**
	(1.83)	(4.64)	(5.22)	(3.44)	(2.48)
ilev	0.052***	-0.151**	-0.115*	-0.180***	0.273*
	(6.31)	(-2.44)	(-1.77)	(-3.72)	(1.87)
cons	-0.008***	-0.016	-0.033**	1.417***	-0.063**
	(-5.21)	(-1.04)	(-2.05)	(125.78)	(-2.28)
yr dummy	yes	yes	yes	yes	yes
R-sq	0.336			0.388	0.259
Nobs	4077	4077	4077	4077	4077

The dependent variables are defined as follows: niat is return on total assets; mxlrrentseq2 is bankers' rent as a per cent of equity where the competitive wage is based on banks with more than 50 employees and less than $2 billion in total assets; mxlrrentseq3 is bankers' rent as a per cent of equity where the competitive wage is based on size decile the bank belongs to; ; trentseq2 defined is the bank total return measure calculated as in equation (15) using the bankers' rent measure is mxlrrentseq2 rather than mxlrrentseq; and trentseqsum is the sum of niseq and mxlrrentseq. The explanatory variables are total assets (at), a dummy variable if an observation is in the 10th size decile (at10), net interest margin (nim), nim interacted with at10 (nimat10), per cent of non-interest income in total revenues (niish), niish interacted with at10 (niishat10), ratio of book equity to total assets (ilev), and year dummies. The mxlrrentseq, mxlrrentseq2 mxlrrentseq3 models are estimated by Tobit regressions. The regressions of trentseq and trentseq2 are estimated by OLS. T-ratios based on clustered standard errors are reported in parentheses. *, **, and *** indicates significant at the 10%, 5% and 1% levels respectively.

Table 7: Measuring size by the logarithm of total assets (*lnat*)

Dependent variable	niseq	mxlrrentseq	trentseq
lnat	0.000	0.007***	0.003*
	(0.08)	(3.07)	(1.89)
at10	0.076*	-0.009	0.028
	(1.76)	(-0.53)	(1.21)
nim	0.035***	0.007**	0.026***
	(7.61)	(2.36)	(12.05)
nimat10	-0.019**	-0.010**	-0.015***
	(-2.33)	(-2.29)	(-3.03)
niish	0.082*	0.033	0.079***
	(1.91)	(1.61)	(4.10)
niishat10	0.040	0.143***	0.111***
	(0.76)	(4.38)	(3.37)
ilev	0.441***	-0.162***	-0.188***
	(2.83)	(-2.61)	(-3.87)
cons	-0.066*	-0.066***	1.392***
	(-1.72)	(-2.82)	(81.59)
yr dummy	yes	yes	
R-sq	0.236		0.389
Nobs	4077	4077	4077

The dependent variables are return on equity (niseq), bankers' rent as a per cent of equity (mxlrrentseq), and total rent (trentseq). The explanatory variables are logarithm of total assets (lnat), a dummy variable if an observation is in the 10th size decile (at10), net interest margin (nim), nim interacted with at10 (nimat10), per cent of non-interest income in total revenues (niish), niish interacted with at10 (niishat10), ratio of book equity to total assets (ilev), and year dummies. The regressions of niseq and trentseq are estimated by OLS. The mxlrrentseq model is estimated by Tobit regression. T-ratios based on clustered standard errors are reported in parentheses. *, **, and *** indicates significant at the 10%, 5% and 1% levels respectively.

Table 8: Wholesale Bank Measures

Variable	Obs	Mean	Std. Dev.	Min	Max
repo	428	.056	.070	0	.460
sec lending	919	.123	.479	0	4.713
futures	791	.093	.276	0	2.193
forwards	791	.354	1.004	0	8.798
options	791	.078	.296	0	2.935
otc options	791	.280	.879	0	7.961
tier1 cap/ total assets	930	.087	.020	.043	.215

repo is the amount of repurchase agreements outstanding at year end net of reverse repurchase agreements. sec lending is the gross amount of securities lending. futures are gross nominal value of all exchange traded futures outstanding. forwards are gross nominal amounts of OTC forward contracts outstanding. options are gross nominal value of exchange traded options contracts written. OTC options are gross amount of over the counter options contract written. Tier1/at is Tier 1 capital ratio. All variables are scaled to total assets.

Table 9: Wholesale Measures Correlations

Variable	niseq	mxlrrentseq	trentseq	at	nim	niish	ilev	repo	sec lending	futures	forwards	options
niseq	1.0000											
mxlrrentseq	-0.0508	1.0000										
trentseq	0.6846	0.2831	1.0000									
at	0.0235	0.1480	0.0651	1.0000								
nim	0.2122	-0.0529	0.2503	-0.1223	1.0000							
niish	0.1063	0.3148	0.2231	0.2321	-0.1980	1.0000						
ilev	0.1324	-0.1497	-0.0288	0.0204	0.2725	0.0061	1.0000					
repo	0.0947	0.0875	0.1357	0.1133	-0.2930	0.2037	-0.1283	1.0000				
sec lending	0.0340	0.3794	0.1532	0.0718	-0.2814	0.3705	-0.0841	0.1960	1.0000			
futures	0.0226	0.2312	0.0899	0.5665	-0.0437	0.1737	-0.0270	0.0591	0.0292	1.0000		
forwards	0.0294	0.3569	0.1366	0.5418	-0.2604	0.3620	-0.0680	0.2032	0.7457	0.4507	1.0000	
options	0.0187	0.1738	0.0689	0.5163	-0.0611	0.1566	-0.0038	0.0701	0.0042	0.5727	0.2665	1.0000
otc options	0.0278	0.2140	0.0917	0.6752	-0.0769	0.1983	-0.0192	0.0664	0.0372	0.7741	0.4994	0.5992

niseq is return on equity. mxlrrentseq is bankers' rent as a per cent of equity. trentseq is total rent. at is total assets. nimis net interest margin. niish is per cent of non-interest income in total revenues. ilev is ratio of book equity to total assets. repo is the amount of repurchase agreements outstanding at year end net of reverse repurchase agreements. sec lending is the gross amount of securities lending. futures are gross nominal value of all exchange traded futures outstanding. forwards are gross nominal amounts of OTC forward contracts outstanding. options are gross nominal value of exchange traded options contracts written. OTC options are gross amount of over the counter options contract written. Tier1/at is Tier 1 capital ratio. All variables are scaled to total assets.

Table 10: Partial Correlations of Returns and Wholesale Indicators

Dependent variable	niseq	mxlrrentseq	trentseq
repo	0.340***	0.008	0.170***
	(4.47)	(0.12)	(3.92)
repoat10	-0.210*	-0.024	-0.026
	(-1.79)	(-0.24)	(-0.32)
sec lending	0.161*	0.295***	0.250***
	(1.70)	(10.40)	(6.58)
sec lending at10	-0.155	-0.271***	-0.227***
	(-1.63)	(-9.37)	(-5.78)
futures	-0.038**	0.090***	0.023***
	(-2.40)	(15.13)	(3.36)
futures at10	0.013	-0.054***	-0.018
	(0.36)	(-3.65)	(-1.11)
forwards	-0.105	0.468***	0.178
	(-0.52)	(4.10)	(1.62)
forwards at10	0.117	-0.451***	-0.160
	(0.58)	(-3.96)	(-1.44)
options	3.134**	0.107	0.584
	(2.54)	(0.30)	(1.00)
options at10	-3.175**	-0.071	-0.585
	(-2.57)	(-0.19)	(-1.00)
OTC options	-0.018	0.087***	0.036***
	(-0.87)	(9.63)	(3.47)
OTC opt at10	0.001	-0.069***	-0.036***
	(0.04)	(-4.97)	(-2.92)

The dependent variables are return on equity (niseq), return to total assets (niat). The explanatory variables are the amount of repurchase agreements outstanding at year end net of reverse repurchase agreements (repo), repo interacted with at10, the gross amount of securities lending (sec lending), sec lending interacted with at10, gross nominal value of all exchange traded futures outstanding (futures), futures interacted with at10, gross nominal amounts of OTC forward contracts outstanding (forwards), forwards interacted with at10, gross nominal value of exchange traded options contracts written (options), options interacted with at10, gross amount of over the counter options contract written (OTC options), OTC options interacted with at10. All those wholesale market indicators are scaled to total assets. The explanatory variables also controlled for but not reported in table are total assets (at), a dummy variable if an observation is in the 10th size decile (at10), net interest margin (nim), nim interacted with at10 (nimat10), per cent of non-interest income in total revenues (niish), niish interacted with at10 (niishat10), ratio of book equity to total assets (ilev), and year dummies. T-ratios based on clustered standard errors are reported in parentheses. *, **, and *** indicates significant at the 10%, 5% and 1% levels respectively.

Table 11: Panel and Instrumental Variables Estimation

	Random effect model of bank returns			IV regressions		
Dependent variable	niseq	mxlrrentseq	trentseq	niseq	mxlrrentseq	trentseq
at	0.000	-0.000***	0.000	-0.000	-0.000	-0.000
	(0.97)	(-4.05)	(0.04)	(-0.21)	(-0.99)	(-0.68)
at10	0.080**	0.015*	0.015	0.189**	0.012	0.070*
	(2.35)	(1.82)	(1.01)	(2.21)	(0.60)	(1.93)
nim	0.048***	0.006***	0.032***	0.032***	0.011***	0.031***
	(12.35)	(5.30)	(18.12)	(5.72)	(8.32)	(12.84)
nimat10	-0.021***	-0.005**	-0.009**	-0.027*	-0.011***	-0.015**
	(-2.66)	(-2.51)	(-2.45)	(-1.91)	(-3.48)	(-2.56)
niish	0.088***	0.037***	0.095***	0.306**	0.213***	0.293***
	(4.22)	(7.84)	(10.69)	(2.58)	(7.93)	(5.80)
niishat10	0.044	0.034***	0.097***	-0.227	0.051	-0.034
	(1.00)	(3.14)	(4.99)	(-1.45)	(1.43)	(-0.51)
ilev	0.838***	-0.216***	-0.042	1.115***	-0.337***	-0.263***
	(8.91)	(-9.08)	(-1.00)	(6.42)	(-8.58)	(-3.56)
cons	-0.268***	-0.004	1.309***	-0.289***	-0.044***	1.287***
	(-9.71)	(-0.67)	(112.73)	(-5.03)	(-3.36)	(52.70)
yr dummy	yes	yes	yes	yes	yes	yes
firm re	yes	yes	yes	no	no	no
iv for niish and niishat10	no	no	no	yes	yes	yes
R-sq (within)	0.298		0.406	0.237		0.293
Nobs	4077	4077	4077	2117	2117	2117

The dependent variables are return on equity (niseq), bankers' rent as a per cent of equity (mxlrrentseq), and total rent (trentseq). The explanatory variables are total assets (at), a dummy variable if an observation is in the 10th size decile (at10), net interest margin (nim), nim interacted with at10 (nimat10), per cent of non-interest income in total revenues (niish), niish interacted with at10 (niishat10), ratio of book equity to total assets (ilev), and year dummies. The regressions of niseq and trentseq are estimated by OLS. The mxlrrentseq model is estimated by Tobit regression. T-ratios are reported in parentheses. *, **, and *** indicates significant at the 10%, 5% and 1% levels respectively.

Table 12: Controlling for standard deviation of assets return

Dependent variable	niseq	mxlrrentseq	trentseq
at	0.000	0.000	0.000
	(1.60)	(1.61)	(1.42)
at10	0.047	0.017	0.051**
	(1.08)	(0.95)	(2.25)
nim	0.034***	0.007**	0.028***
	(8.43)	(2.08)	(10.83)
nimat10	-0.011	-0.012**	-0.016***
	(-1.28)	(-2.36)	(-2.93)
niish	0.054	0.036	0.081***
	(1.11)	(1.58)	(3.55)
niishat10	0.047	0.134***	0.089***
	(0.78)	(4.29)	(2.65)
sd_ asset	-12.224***	-2.204**	-14.737***
	(-3.21)	(-2.05)	(-8.82)
cons	0.006	-0.026*	1.421***
	(0.28)	(-1.78)	(118.67)
R-sq	0.256		0.423
Nobs	3277	3277	3277

The dependent variables are return on equity (niseq), bankers' rent as a per cent of equity (mxlrrentseq), and total rent (trentseq). The explanatory variables are logarithm of total assets (lnat), a dummy variable if an observation is in the 10th size decile (at10), net interest margin (nim), nim interacted with at10 (nimat10), per cent of non-interest income in total revenues (niish), niish interacted with at10 (niishat10), standard deviation of assets return (st_ assets) is calculated as standard deviation of daily stock returns multiplied by book equity to total assets (ilev), and year dummies. The regressions of niseq and trentseq are estimated by OLS. The mxlrrentseq model is estimated by Tobit regression. T-ratios based on clustered standard errors are reported in parentheses. *, **, and *** indicates significant at the 10%, 5% and 1% levels respectively.

Table 13: Sensitivity to too-big-to-fail

	Excluding top 1% of banks			SIFI dummy		
Dependent variable	niseq	mxlrrentseq	trentseq	niseq	mxlrrentseq	trentseq
at	0.000	0.000	-0.000	0.000	0.000	-0.000
	(0.04)	(1.60)	(-0.04)	(0.62)	(0.84)	(-0.17)
at10	0.078*	0.003	0.037	0.075*	0.009	0.036
	(1.81)	(0.14)	(1.57)	(1.85)	(0.49)	(1.62)
nim	0.035***	0.007**	0.026***	0.035***	0.007**	0.026***
	(7.58)	(2.37)	(11.98)	(7.61)	(2.34)	(11.98)
nimat10	-0.019**	-0.009*	-0.015***	-0.018**	-0.011**	-0.015***
	(-2.23)	(-1.94)	(-2.76)	(-2.25)	(-2.38)	(-2.97)
niish	0.081*	0.039*	0.082***	0.082*	0.039*	0.082***
	(1.93)	(1.80)	(4.25)	(1.94)	(1.79)	(4.25)
niishat10	0.039	0.137***	0.113***	0.036	0.148***	0.115***
	(0.72)	(3.88)	(3.20)	(0.68)	(4.52)	(3.46)
ilev	0.443***	-0.160***	-0.186***	0.442***	-0.162***	-0.188***
	(2.83)	(-2.59)	(-3.84)	(2.84)	(-2.63)	(-3.87)
Too-big-to-fail				0.011	-0.001	0.010
				(0.45)	(-0.04)	(1.10)
cons	-0.167***	-0.016	1.360***	-0.064**	-0.016	1.417***
	(-5.11)	(-1.07)	(94.44)	(-2.36)	(-1.06)	(125.66)
yr dummy	yes	yes	yes	yes	yes	yes
R-sq	0.236		0.383	0.236		0.388
Nobs	4014	4014	4014	4077	4077	4077

The dependent variables are return on equity (niseq), bankers' rent as a per cent of equity (mxlrrentseq), and total rent (trentseq). The explanatory variables are total assets (at), a dummy variable if an observation is in the 10th size decile (at10), net interest margin (nim), nim interacted with at10 (nimat10), per cent of non-interest income in total revenues (niish), niish interacted with at10 (niishat10), ratio of book equity to total assets (ilev), a dummy variable equal to one for Citi Group, JPMorganChase, Prudential Bancorp, Washington Mutual, Lincoln Financial and Bank of America (too-big-to-fail), and year dummies. The regressions of niseq and trentseq are estimated by OLS. The mxlrrentseq model is estimated by Tobit regression. T-ratios based on clustered standard errors are reported in parentheses. *, **, and *** indicates significant at the 10%, 5% and 1% levels respectively.

Table 14: The Wage Equation

Specification	nonlinear		linear
δ	-0.838	a0	-32.430***
	(-0.29)		(-3.94)
α	0.061***	a1	0.068***
	(4.18)		(4.20)
β	0.224***	a2	0.264***
	(5.54)		(4.75)
		a3	1.554***
			(9.65)
Year effects	Yes		Yes
R-sq	0.210		0.218
Nobs	3490		3490

The nonlinear specification is equation (16) in the text. The linear specification is equation (17) in the text. The dependent variables is real wage. The explanatory variables are real EBIT to number of employees ($EBIT/L$), per cent of non-interest income in total revenues ($niish$) interacted with real EBIT to number of employees ($EBIT/L$), and average yearly real wage ($mwage$) is based on banks with more than 50 employees and assets up to 1 billion dollars. T-ratios are reported in parentheses. All T-ratios have been calculated by using clustered standard errors. *, **, and *** indicates significant at the 10%, 5% and 1% levels respectively.