Bankers and bank investors: Understanding the performance of large, complex banks

Ronald W. Anderson*, and Karin Jõeveer†

September 29, 2017

Abstract

We study efficiency in banking recognizing that banks of different sizes operate in different banking markets and employ different business models. Banks with competitive advantage in some lines of business may generate rents, but some of these benefits may accrue to bankers. By combining returns to bank investors and to bankers we find efficiency benefits to large, complex banks. However, using observable proxies for banking scope, funding efficiency, presence in wholesale banking activities and risk taking we find most of the efficiency benefits of large banks are explained by differences in business models rather than pure size effects.

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

* *corresponding author* Department of Finance; London School of Economics; Houghton Street, London WC2A 2AE, +44 20 7955 6204; r.w.anderson@lse.ac.uk

†Tallinn University of Technology, karin.joeveer@ttu.ee

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 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 (Volcker Rule) or investment banking more generally (the "ring fencing" introduced in the UK following recommendations of the 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 now find themselves at a competitive disadvantage. Still further measures to rein-in big banks including the use of anti-trust remedies to break-up the biggest banks have been proposed (Reich, 2009), and these continue to attract some strong advocates.

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 very large banking remains open.

In our view, part of the difficulty in identifying potential efficiency gains to larger or more complex banks 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. Consequently, in this paper we adopt a methodology that can take this into account. Specifically, 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 data on returns to bankers' human capital and investors' financial capital we explore the determinants of banks' overall efficiency. Measured in this way we find evidence that bank efficiency can be accounted for by funding efficiency, presence in wholesale banking, the banks' risk tolerance and the bank's scope as measured by the diversity of its lines of business. Some of these factors, particularly banking scope, are themselves associated with larger size. However, taking these factors into account, pure size effects on overall banking efficiency are negligible.

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 our argument explicitly by reference to the literature on rent extraction which has been most widely used in labor economics and industrial organization. In an appendix this logic is illustrated in an analytical model of a multi-unit bank that trades off the potential efficiency gains from sharing common productive factors across multiple units against efficiency loss due to organizational complexity. Section 4 presents our empirical analysis using data on US bank holding companies. The main results are presented in Section 4.2 using regression analysis of returns on observable characteristics reflecting a bank's size and various attributes of its business model. Overall we find expected returns on banks are affected significantly by their funding efficiency, presence in wholesale banking, scope as measured by diversity of activity, and risk taking. Taking those factors into account, we find no significant pure size effects. In Section 4.3 we show that our qualitative conclusions are robust a wide variety of modifications of the model specification. In Section 5 we estimate the determinants of rent-sharing between shareholders and bankers. We find that the bankers' share tends be increasing in funding efficiency and scope. Our 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 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. The most general 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 the general framework just described. In the most constrained variant they

[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.

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 but 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 which may not be optimal. In these three alternative specifications, the scale efficiency coefficients are small or in some cases negative, i.e., there may be cost diseconomies of scale. The authors conclude that once one allows for managerial risk aversion and optimal choice of bank capital there is strong evidence of economies of scale in banking.

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 discuss in detail how we can allow for this possibility using a rent extraction framework.

3 The rent extraction view of banking

In the introduction we argued that in order to assess the efficiency of large, complex banks it is necessary to allow for the possibility that some of the benefits of efficiency gains from a particular banking organization might be captured by bankers rather than bank shareholders or consumers. In this section we develop this argument more explicitly and set out the framework for our empirical research.

A distinctive feature of the largest, most complex banks is that they operate in some lines of business where they compete with a large number of smaller banks in the provision of basic commercial banking services while at the same time they offer specialized wholesale and investment banking services to large clients in competition with a small number of rivals. The fact that the underwriting large-scale securities issues, market making in global capital markets, or provision of international clearing and settlement services are concentrated in the hands of a small number of very large banks is strongly suggestive that there may be significant scale economies in some of these lines of banking business. And the fact that many of the firms that compete in providing wholesale banking services are large, geographically diversified full service banks also suggests that there may be some potential scope economies that might give them a competitive advantage. Examples of possible sources of scope economies might be in sharing common IT systems across a wide range of operating units, the ability to mobilize collateral to support a variety of secured banking activities, or having access to stable sources of retail deposits to fund investment banking business lines.

If a bank succeeds in exploiting potential scale economies in some business lines and scope economies for the bank as a whole we might expect that this would endow the large banks with a degree of market power. However, even if these efficiency gains give rise to substantial rents, it does not follow that this will translate into highly profitable banks. If wholesale banking activities rely on special expertise or on strong client relationships, it may be that a large fraction of the benefits accrue to key bankers rather than to the banks that employ them. Indeed, it is often reported that experienced, successful bankers will move as a team from one bank to another one that seeks to build market presence and is willing to pay guaranteed bonuses or other inducements to attract the needed talent. Thus modern wholesale banking is an example of a knowledge based industry where substantial bargaining power is in the hands of managers. This has been described by Rajan and Zingales in their essay "The Governance of the New Enterprise". In their view the new enterprise is distinguished by a reduced importance of vertical integration and a shifting of power away from the headquarters. In their words,

> *But perhaps the most significant change has been to human capital. Recent changes in the nature of organizations, the extent and requirements of markets, and the availability of financing have made specialized human capital much more important, and also much more mobile. But human capital is inalienable, and power over it has to be obtained through mechanisms other than ownership. As the importance of human capital has grown, power has moved away from the top and is much more widely dispersed through the firm.*

In such an environment establishing appropriate compensation standards is no easy matter for a bank. Given the heterogeneous nature of different banking businesses it will be important to incentivize individual and small team efforts with compensation at least partially based on performance of individual business lines. However, these performance measures will be sensitive to allocation of capital and other resources shared across the bank. Furthermore, given that many banking activities involve a strong element of risk-taking, it difficult to determine how much of performance is attributable to skill or effort and how much is attributable to luck. As a result, determining compensation for many bank employees can involve a strong element of bargaining with the result that some bankers may succeed in extracting for themselves a share of rents earned by the bank.

Our approach is illustrated by Figure 1. If a bank adopts a given business model as reflected in the lines of business it enters, the systems it adopts, and its scale of operations, this will give rise to payoffs to both its shareholders and to its bankers. An efficient bank is one that provides the maximum payoff to shareholders for a given payoff to bankers. The bargaining process implicit in the bank's compensation framework will determine the relative sharing of total payoffs between these two groups of stake holders. For example, in Figure 1 the solid curve depicts the efficiency frontier for banks operating a business model of type 1, and point A on that curve indicates a particular sharing of total payoffs achieved by an efficient bank of this type, in this case paying bankers a payoff of 2 and shareholders a payoff of 3.464. The efficiency frontier is downward sloping and concave as a reflection of diminishing marginal returns to capital (e.g., investments in systems to replace traders in market making) or diminishing returns to incentivising managerial effort (as seen in many principal/agent models of managerial moral hazard, see eg., DeMarzo and Fishman, 2007). By changing its business model, for example, by investing in different IT systems, expanding the number of branches, or entering into new market segments, it will alter the opportunity set of payoffs to shareholders and bankers. In the Figure 1 we have supposed that banks of type 2 have an efficiency frontier as depicted in the dashed curve. From the figure we see that type 2 banks are potentially more efficient than type 1 banks because, for a given level of payoffs to bankers, type 2 banks can achieve a higher level of payoffs to shareholders. However, this does not mean that if a given bank adopts a more efficient business model shareholders will be made better off. For example, suppose that the hypothetical bank that was operating a type 1 bank at point A transforms itself into a type 2 bank it may end up at point B where bankers receive 3.9 and shareholders 3.12. The bank has made itself more efficient, but most of the efficiency gains have accrued to the bankers. And if we judge efficiency based on payoffs to shareholders alone we would mistakenly say that the bank has become less efficient. Taking both payoffs to bankers and shareholders into account type 2 banks are 25% more efficient than type 1 banks, as measured by the Euclidian distance between the frontiers (between points C to B).

We have purposely discussed the comparison of banks with different technologies as a comparison of general bank "types". For us, bank types can differ in many dimensions, and scale of operations as measured by total capital or total employees may be only one and not necessarily the most important. Thus if we find that one type of bank dominates another as in Figure 1 this may say nothing about economies of scale as discussed in the previous banking efficiency literature (e.g., as measured by differences in an average cost function for scalar changes in a vector of outputs).

While the approach we take may be unfamiliar in the banking efficiency literature, the reasoning we use can be found in a large number of models of rent extraction that are well-known in the industrial organization and labor markets literatures (see, e.g., Van Reenen, 1996). These models typically are based on a model of an oligopolistic or monopolistic firm in product markets using a labor input that is in somewhat inelastic supply. This framework has been used to study the implications of alternative structures of the labour markets (e.g., labor supplied by a monopolistic union or bargaining models for wage determination). The analysis is complicated by the fact that outcomes in the input market will have impact on the endogenously determined choice of other inputs and on the firm's output market supply choice. Assumptions about elasticities of substitution of inputs, scale economies and elasticities of demand in product markets all can affect the outcomes.

In order to help readers better understand the logic of this approach in Appendix A we have set out an explicit model of a multi-branch bank which operates as a monopolistic supplier in a number of regional banking markets. Each branch in isolation produces banking services using a Cobb-Douglas technology with two inputs-capital and labor. Thus each branch taken alone operates under constant returns to scale. However, for bank as a whole there may be efficiency gains to be obtained by operating a multi-branch system of banks. Specifically we assume that capital is shared as a common input in across all branches but that labor inputs are not shared. There may be efficiency gains to increasing the number of markets where the bank operates in the sense of a shifting out of the total payoffs to labor and capital as in Figure 1. But this will depend upon the trade-off of the benefits of sharing capital inputs and the countervailing complexity costs of operating across a larger number of branches.

4 Empirical analysis of 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. Then we combine the two to obtain a measure of total bank rents. We explore the determinants of these measures of bank returns by considering a number of observable variables meant to capture important aspects of a bank's business. These include scale as reflected in total assets, measures of bank risk taking as measured by leverage and asset volatility, a measure of funding efficiency in basic commercial banking, measures of the bank's presence in various categories of wholesale banking, and a measure of a bank's scope based on the dispersion of income earned across lines of business.

4.1 Data

Our data set covers bank holding companies that are regulated in the US. The data include all balance sheet and income statement variables reported in Compustat Bank Annual Fundamental File. Detailed information on banks' presence in various categories of wholesale banking are used for banks reporting to the Federal Reserve in the FRY9-c filings. We augment this with share price information obtained from CRSP and compensation information obtained from Execucomp.

As a measure of returns to bank investors we use return on equity. A bank's shareholders are taken to be the relevant investor class because collectively they have active control rights in a going-concern bank and they are ultimately responsible for the bank's compensation policy. Return on equity ($niseq$) is calculated as the ratio of the Compustat variables annual net income after tax (ni) and book equity (seq), i.e., $niseq = ni/seq$.

We estimate return to 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. Using Compustat data 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. We compare this to our estimate of the competitive wage, w^c adjusting for a proxy of the skill level given characteristics of the bank as explained below. 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.

In estimating the competitive wage appropriate for a bank with a given business model, we are challenged by the lack of data on the distribution of employee education, experience and employment history for the bank as whole. The best information that is available regularly is compensation information reported by Execucomp which gives salary, bonus and total compensation for a small number of top managers (between 1 and 14 managers for banks in our sample). We construct a proxy for the skill level required in a bank in a given year by using the average total compensation of managers reported by the bank in that year. Given that total compensation of a top manager can fluctuate significantly from year to year reflecting fluctuations in bank performance and the timing of deferred compensation awards, we estimate the expected total compensation of top managers using a linear regression of observed average total compensation upon bank income shares in five lines of business: commercial banking, investment banking, global markets, private banking and fund management. These income share categories are constructed by mapping detailed data on a wide range of activities from FRY9C filings. Using this estimated model we project the expected total compensation using observed values of a bank's income shares in the five business to obtain our proxy for the bank's required skill level in that year. In order to estimate the competitive wage rate for banks in a given skill class we sort banks into deciles based on our board compensation/skill level proxy. For banks in each skill decile we calculate the average of staff costs per employee (*xlremp*) and assign this as the competitive wage rate (w^c) to be used in the calculation of bankers' returns as described above.

We have used alternative methods in estimating competitive wage rate to determine whether our results are affected significantly. We find our results are quite robust to such variations. In the results below we report results on two of these variations. In one we proceed as just described using observed average top executive compensation but with a different structural model using the detailed FRY9C activity variables directly. The second alternative is to directly set the proxy for the competitive wage rate, w^c, as the average value of *xlremp* in a given year for firms with at least 50 employees and total assets less than \$1 billion.[2]

As a measure of total returns to the bank we use *trentseq* calculated using the equation

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

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

Turning to the explanatory variables, as a measure of bank size we use total assets (*at*) measured in 2002 USDs.

To capture the effect of funding costs on return, in common with earlier literature (see, e.g., Saunders and Schumacher, 2000) we use net interest margin, *nim*, which is calculated as interest earnings net of interest expense normalized by total interest earning assets. 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

[2]This corresponds roughly to the median bank in the Compustat files.

total revenues (non-interest income plus net interest income). Following Hughes and Mester (2013) we proxy for risk-taking using a measure of leverage, specifically the variable *ilev* calculated as the ratio of book equity to total assets. All these variables are derived from the Compustat data set.

As an additional measure of risk-taking we include the standard deviation of return on bank assets(*sd asset*). This is based on stock return data obtained from the CRSP data set. A bank's assets return standard deviation is calculated as standard deviation of its daily stock returns multiplied by capital ratio (*ilev*).

As a measure of scope we use a measure of the diversification of the bank's activities across different lines of business. Specifically in each year we calculate the bank's Herfindahl index (*cindx*) of income shares in five business lines (commercial banking, investment banking, global markets, private banking and fund management) based on income shares data from FRY9c filings. Note that *cindx* is increasing in the concentration of a bank's business and attains a value of 1 for a bank with all income derived in one business line. Thus scope is related inversely to *cindx*.

Finally, to allow for a possible non-linearity in relationship affecting the very largest banks we introduce a binary variable $at10$ which equals unity if the bank is in the largest decile by asset size in that year and zero otherwise. We also allow for time variation through the inclusion of year dummy variables. In the Compustat data set data on total number of employees are frequently missing in years prior to 1999, and for this reason we restrict our analysis to 1999-2009. Furthermore, managerial compensation data, daily stock returns and some accounting variables are often missing in smaller banks. For this reason we restrict our analysis to banks in the top 50 per cent of the size distribution.

Table 1 present summary statistics of our data set. In the top 50 per cent of banks by size and between 1999 and 2009, the average return on equity was 8.7 per cent whereas bankers' rents represented 1.7 per cent of total equity. In this sample total assets averaged about $23 billion whereas the median bank had $2.3 billion in total assets, reflecting the strong skew in the size distribution of banks. The average net interest margin among these banks is 3.9 per cent of total interest earning assets. The share of non-interest income was 26 per cent on average and the ratio of bank capital to total assets was 8.8 per cent. The average concentration index was 0.69 indicating that most banks are rather concentrated in one line of business, typically commercial banking. Table 2 reports the pairwise correlations among the variables.

4.2 Results

The results of regressions of total bank returns, returns to shareholders, and returns to bankers for our benchmark specification are reported in Table 3. Column 1 contains the results for our measure of overall returns in banking, *trentseq*. The proxy for funding efficiency, *nim*, enters positively and is highly significant. The interaction effect, $nimat10$, is negative and significant indicating that funding efficiency makes a smaller net contribution to total bank returns for the largest banks. The proxy for presence in wholesale banking, *niish*, is insignificant. However, the coefficient of the interaction term $niishat10$ is positive and highly significant indicating that presence in wholesale banking is particularly productive when operated at a large scale. Regarding the effect of risk taking, total returns vary negatively with the volatility of asset returns while the bank's capital ratio is insignificant.

The measure of a bank's diversity of business lines, *cindx*, enters negatively and is highly significant. At the same time, the measures of bank size, *lnat*, and the tenth decile dummy, $at10$, are both insignificant. Thus, having controlled for funding efficiency, risk-taking, presence in wholesale banking, and scope of operations, we find no significant benefits to large size.

The results of the separate regressions for shareholder returns, *niseq*, and banker returns *mxlrrentseq*, are presented in columns 2 and 3 of Table 3. These suggest that changes in business models can have important consequences for the distribution of bank returns between investors and bankers. The effect of increased risk taking tends to be positive for bankers' returns as indicated by the significant negative coefficient of the banks capital ratio and the positive coefficient of asset volatility. In contrast, shareholder returns are increasing in the capital ratio (decreased leverage) and decreasing in asset return volatility. This is consistent with the view sometimes expressed that higher investment returns to more aggressive investments may flow largely to the experienced bankers required to effectively manage the risk that these strategies entail.

The benefits to entering wholesale banking appear to accrue largely to bankers in the largest banks as indicated by the significant coefficient of the interaction of non-interest income share and the 10th size decile dummy in the bankers' return regression. For smaller banks, the non-interest income share variable is insignificant in the bankers' return regression. In the shareholder return regression the non-interest income share variable is insignificant either by itself or when interacted with the top size dummy.

The benefits of funding efficiency are shared between shareholders and bankers in smaller and medium sized banks. Specifically the net interest margin variable is positive and statistically significant for both investor returns and banker returns. However, the coefficient is larger by a factor of 4 in the investor return regression. When the net interest margin variable is interacted with the top size decile dummy it enters with a significant, negative sign in the banker return regressions. Thus on balance it appears that the benefits of achieving funding efficiency through increasing its network of retail branches accrue largely to shareholders.

The pure size effects, $lnat$ and $at10$ are statistically insignificant in both the shareholder return and banker return regressions. In contrast, the business line concentration measure, $cindx$ is negative and significant in both the shareholder return and banker return regression. That is, controlling for other factors it seems that the benefits of broader scope accrue to both shareholders and bankers and that neither stakeholder group enjoys any particular benefit from large size *per se*.

To summarize, we find that total bank returns depend importantly on funding efficiency, the diversity of a banks' lines of business and, for the largest banks, presence in wholesale banking. The benefits of funding efficiency accrue largely to shareholders. The benefits of being present in wholesale banking are enjoyed largely by bankers in large banks. However, the benefits of increased scope as measured by diversity of business lines are enjoyed by both shareholders and bankers.

4.3 Robustness

In order to assess the robustness of the findings in section 4.2 we have experimented with a wide variety of alternative specifications. We first consider alternative approaches to defining the competitive wage rate used to calculate bankers' rents and thus total bank returns. The first alternative follows the methodology described in section 4.1 for calculating bankers' rents, $mxlrrent$. That is, we take the competitive wage to be the average of mean compensation in banks within the skill class decile where skill class is measured by expected average total compensation of top management as reported by Execucomp. The only difference is that we use an alternative structural model in the estimation of expected total manager compensation. Rather than regressing average manager compensation on income shares in five business lines, instead we regress average manager compensation on activity measures taken from the detailed information available FRY9C reports, namely, positions outstanding in futures, forwards, options, repurchase agreements. The alternative measure of return to bankers based on this competitive wage is denoted $renta$. Results of regressing this on the same explanatory variables as in our benchmark regressions in Table 3 are reported in column 2 of Table 4. By using $renta$ rather than $mxlrrentseq$ in equation (1) yields the alternative total bank return measure denoted $trenta$. This gives rise to regression results as reported in column 1 of Table 4. A second alternative bankers' rent measure is based on a competitive wage rate calculated as the average employee compensation in banks which may be viewed as medium sized retail banks, namely, banks with a minimum of 50 employees and total assets no greater than $1 billion. The bankers' rent measure based on this competitive wage proxy is *rentb* and the corresponding total bank return measure is *trentb*. Regression results with these alternative return measures are reported in columns 3 and 4 of Table 4.

From Table 4 we see using these alternative rent measures results in exactly the same pattern of sign and significance as in the benchmark regressions in Table 3. That is, for alternative bankers' rent measures *renta* and *rentb* funding efficiency *nim* is positive and significant but the interaction term $nimat10$ is significant with a negative coefficient which implies that funding efficiency has no net benefit to bankers' returns in the largest banks. Presence in wholesale banking as measured by non-interest income share *niish* is insignificant but becomes positive and significant when interacted with $at10$. Asset volatility, *sdasset*, is positive and significant while capital ratio, *ilev*, is negative and significant, indicating that risk taking contributes positively to bankers' returns. The Herfindahl index of banking activity enter negatively and is significant. Pure size effects, *lnat* and $at10$, are insignificant.

Similarly, the results for alternative total bank returns measures, *trenta* and *trentb*, are qualitatively the same as in our benchmark regression. Funding efficiency contributes positively to total bank returns, but the effect is diminished in the largest banks. Presence in wholesale banking contributes positively to total returns in the biggest banks but not in smaller banks. Risk taking as indicated by asset volatility contributes negatively to total bank returns, but the capital ratio is insignificant. Diversification of income across business lines contributes positively to total returns as indicated by the significant negative coefficient of *cindx*. And, finally, pure size effects, *lnat* and $at10$ are insignificant.

We have experimented with still other alternative measures of the competitive wage to calculate bankers' rents and total bank returns. These include using alternative specifications of explanatory variables in estimating expected top management compensation used to define skill classes as in the calculation of *mxlrrentseq* or *renta*. We have also judged skill class based solely on CEO compensation rather than average compensation of all managers reported in Execucomp. All these variations give rise to very similar qualitative conclusions when regressed on the explanatory variables used in Tables 3 and 4.

We have found that pure size effects measured by *lnat* or the tenth decile dummy *at*10 are insignificant once we take into account other bank characteristics including funding efficiency, presence in wholesale banking, diversity of business lines and proxies for risk taking. This is true both in our benchmark regressions, Table 3, and in the regressions using alternative measures of bankers' rents, Table 4. This runs counter to the view that often expressed that the largest banks derived significant advantage from being "too-big-to-fail" (TBTF). However, it may be that a TBTF effect may be reflected indirectly through the controls we have used for other bank characteristics.

To explore this issue we consider two alternative approaches to control for TBTF explicitly. First, we rerun our benchmark regressions omitting the top 1 per cent of the banks as measured by total assets. Results are given in Table 5, columns 1-3. Under this modification almost all of the qualitative findings from our benchmark regressions remain valid. Funding efficiency enters positively for all three returns; however for the top size decile the effect is reduced in the total bank return regression (column 1) and disappears entirely in the bankers' rent regression (column 3). Presence in wholesale banking measured by *niish* contributes positively to total bank returns and bankers' returns in the top size decile but is insignificant elsewhere. Asset volatility contributes positively to bankers' returns but enters negatively in the shareholder returns and total bank returns regressions. The bank's capital ratio enters positively in shareholder returns, negatively in banker returns, and is insignificant in the total return regression. Increased scope contributes positively to all three return measures as indicated by a significant negative sign on the coefficient of *cindx*. Pure size effects (*lnat* and *at*10) remain insignificant in the total return and shareholder return regressions. The only difference relative to the benchmark results is that *lnat* now becomes marginally significant in the bankers' return regression.

The second approach we take to controlling for TBTF is to introduce a too-big-to-fail dummy variable ($toobig2f$) which is assigned a value of 1 to those banks which ranked within the top 20 systemically important institutions in 2007 using the measure of marginal expected short-fall (Acharya *et al*, 2012). The results are reported in columns 4-6 of Table 5. The variable $toobig2f$ is insignificant in all three return regressions. Otherwise the pattern of sign and significance of all the business model effects associated with funding efficiency, wholesale banking, risk taking and scope is exactly the same as we found in the benchmark regressions.

We have also extended our basic econometric specification to take into account alternative bank business characteristics that can be observed in detailed FRY9C reports to the Federal Reserve. Table 6 reports results where we have included measures of notional values of positions outstanding in securities lent, exchange traded futures, OTC forward contracts, exchange traded options and OTC options in addition the regressors of our benchmark results in Table 3. Including these additional control results in very little difference in the point estimates and the T-statistics of the coefficients of the benchmark regressors. Thus our main findings concerning the influence of funding efficiency, presence in wholesale banking, risk taking and diversification of business lines are robust to these modifications. And the lack of any evidence of positive pure size effects continues to hold. Regarding the additional detailed line of business variables, securities lending enters with a significant negative coefficient in the shareholder return regression and with a significant positive sign in the bankers return regression. The same remark holds for exchange traded options. Forward contracts enter positively in the shareholder return regression. Otherwise, the additional line of business controls are insignificant.

Finally, we consider two alternative estimation methods. First, in order to capture other sources of variation beyond the size, business model variables and time effects included in our benchmark results we allow for random firm effects. The results are in Table 7 columns 1-3. The main qualitative effects found in our benchmark regressions carry over to this alternative estimation. Pure size effects are negligible in the bank total return and shareholder return regressions and are insignificant at the 95 % level in the banker return regression. Funding efficiency captured by *nim* contributes positively to returns, but the effect is less in banks in the top size decile. Presence in wholesale banking (*niish*) contributes positively to returns but only for banks in the top size decile. Risk taking tends to contribute to banker returns but harms shareholder returns. Increased scope tends to contribute positively to returns as indicated by the negative significant effect of *cindx*.

The second alternative estimation method is to introduce instruments for the non-interest income share variables (*niish* and *niishat*10). As instruments we use holdings of repo contracts, forwards, futures, and options obtained from the FRY9C data set. The results are reported in columns 4-6 of Table 7. Even allowing for endogeneity of non-interest income in this way, the effect of the proxy for wholesale banking is positive and significant in the bankers return regression but only for the largest banks. This is in line with our benchmark results. Also we find *nim* enters positively in all return regressions but has a somewhat reduced effect in the largest banks. The results provide evidence that risk taking tends to contribute positively to banker returns but negatively to shareholder returns. There is no evidence of positive pure size effects on returns to shareholders, bankers or banks overall. The main difference in these IV regression as compared to the benchmark regressions is that the scope proxy, *cindx*, loses significance in the shareholder return and total bank return regressions.

5 Bankers' bargaining power

Our results so far show that changes in a bank's business model can have a significant effect on its overall returns, taking into account returns to both shareholders and to bankers. Furthermore, we have found evidence that changes that improve total returns may not necessarily benefit both shareholders and bankers equally. In this section we explore in more detail how changes in returns are shared across bankers and shareholders. To do so, we consider a variation of the model of the bargaining process within the firm that has been used by Abowd and Lemieux (1993). We suppose that the negotiated wage, w_j in bank j follows,

$$w_j = \gamma_j QR_j + w_j^c \tag{2}$$

where w_j^c is the competitive wage for bank j, γ_j is a rent sharing parameter, and QR_j are quasi-rents per employee produced by bank j which can be written as,

$$QR_j = \frac{P_j Q_j}{L_j} - w_j^c \tag{3}$$

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 the bankers' share of rents is a linear function of vector of bank characteristics, x_j. That is,

$$\gamma_j = \alpha + \beta x_j \tag{4}$$

where β is a vector of parameters capturing the marginal contributions of the various bank characteristics to the bankers' share of surplus. Using equation 4 in equation 2 we have,

$$w_j = \alpha QR_j + \beta x_j QR_j + w_j^c \tag{5}$$

.

To implement this model empirically we proceed as follows. The negotiated rate of compensation, w, is measured as total compensation costs over total head count, L. 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*, which controls for possible skill differences across banks with different business models. Substituting these proxies into equation (5), solving out for the negotiated wage and introducing a constant that will be allowed to vary with time in our regressions leads to,

$$w_{jt} = \delta_t + \frac{\alpha}{(1-(\alpha+\beta x_j))}\frac{EBIT_{jt}}{L_{jt}} + \frac{\beta}{(1-(\alpha+\beta x_{jt}))}x_{jt}\frac{EBIT_{jt}}{L_{jt}} + w^c_{jt} + \epsilon_{jt} \qquad (6)$$

To implement this model we specify the x_{jt} using proxies for the main contributing factors to total return variations, namely, presence in wholesale banking, *niish*, funding efficiency, *nim*, bank riskiness, *sdasset* and *ilev*, and bank scope, *cindx*. This specification is nonlinear in parameters and variables, and we estimate the parameters α, β, and δ by nonlinear least squares. We estimate three specifications of this model: without the additive constant and year dummies as in the theoretical specification, with an additive constant but no year dummies and with both the additive constant and year dummies. The results are presented in Table 8.

The point estimates of the sensitivities with respect to scope and funding efficiency are quite similar across the three specifications and both are statistically significant. They are economically significant as well. Using the estimated coefficients in the third column we would predict that one standard deviation increase in *cindx* and *nim* (as given in Table 1) would be associated with a change in the bankers' share of -1.7 and 2 percentage points respectively. In contrast the estimated sensitivities to the risk proxies, *sd asset* and *ilev* vary across the three specifications and are not statistically significant in some cases.

As a check on the possible restrictiveness of this functional form we also estimate a linearized version of this model. The results are reported in Table 9. We consider two specifications: with and without year dummies. Estimation is by OLS. The coefficient estimates of the interaction terms with *niish*, *cindx*, and *nim* are similar in the two specifications and are close to the point estimates of the corresponding sensitivities in the nonlinear version of the model. Again we find that estimates of sensitivities with respect to asset volatility and capital ratio vary greatly depending upon whether time fixed effects are included. One possible reason for this is that asset volatilities across banks are driven by a common macro volatility factor which is captured to a degree by year dummies. If for that reason we consider the specification with year dummies as more reliable, our results suggest that bankers' share tends to be decreased by increases in idiosyncratic asset volatility.

To summarize, our estimates of the way that changes in bank business models affect bankers' bargaining power suggest that bankers' share of surplus is increased by increased diversity of banks' business lines and increased funding efficiency.

6 Conclusion

In this paper we have studied efficiency in banks varying in size and in the business models they use by combining returns to shareholders and bankers to obtain a measure of total bank returns. We have found evidence that returns to bank shareholders and to bankers depend importantly upon the characteristics of the banks' business model. Once we control for these bank characteristics we find no significant pure size effects on returns. We find that total bank returns depend importantly on funding efficiency, the diversity of a banks' lines of business and, for the largest banks, presence in wholesale banking. We explore the robustness of these conclusions by considering alternative model specifications. These include using different ways of controlling for bankers' skill levels, controlling for too-big-to-fail advantages, incorporating alternative measures of wholesale banking activity, and allowing for endogeneity of presence in wholesale banking. Our main conclusions are robust to these variations. We then explore directly how the overall bank returns are shared between shareholders and bankers. We find clear evidence that increases in bank scope (measured by dispersion of income across five main business lines) and funding efficiency are associated with bankers receiving a larger share of overall returns.

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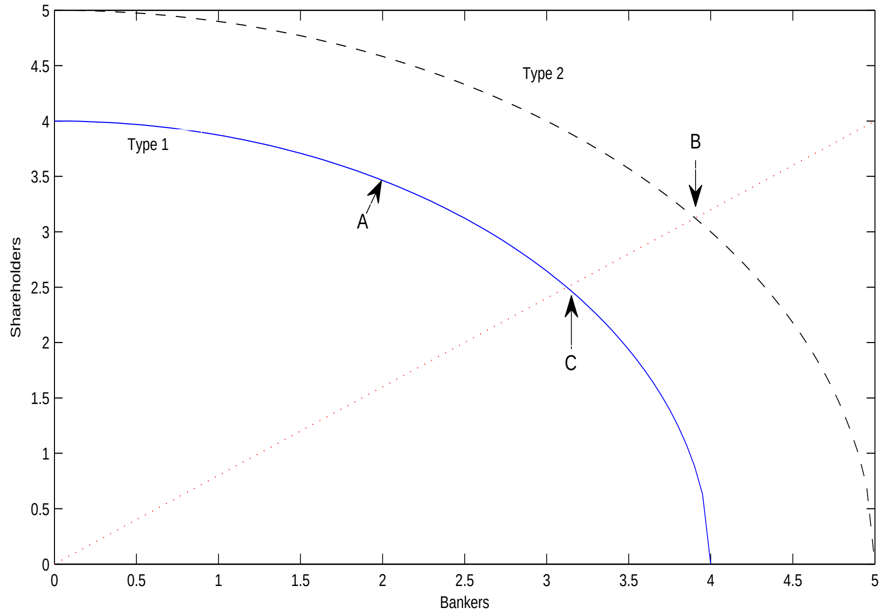

Figure 1: Measuring scale economies with two efficiency frontiers

Table 1: Summary statistics 1999-2009

	Mean	Median	St. dev.	Nobs
niseq	.087	.119	.176	2721
mxlrrentseq	.0174	0	.0306	2721
trentseq	1.5	1.51	.0805	2721
at	23.8	2.31	116.8	2721
nim	3.91	3.89	.796	2721
niish	.265	.248	.148	2721
sd asset	.00467	.00361	.00338	2326
ilev	.0882	.0861	.0216	2721
cindx	.692	.695	.135	1810

The sample covers the top 5 size deciles annually 1999-2009. The dependent variables are defined as follows: niseq is return on equity, mxlrrentseq is bankers' rent as a per cent of equity where the competitive wage is based on banks in the same managerial skill class as measured by average board compensation, and trentseq defined is the bank total return measure calculated as in equation (1) using mxlrrentseq. The explanatory variables are total assets (at) (in billions) measured in 2002 USDs, net interest margin (nim) as a per cent of total interest earning assets, per cent of non-interest income in total revenues (niish), ratio of book equity to total assets (ilev), standard deviation of asset return (sdasset), and the Herfindahl concentration index of share of net income in five lines of business (cindx).

Table 2: Correlations

	niseq	mxlrrentseq	trentseq	at	nim	niish	ilev	sdasset	cindx
niseq	1.000								
mxlrrentseq	-0.119	1.000							
trentseq	0.779	0.140	1.000						
at	0.030	0.117	0.056	1.000					
nim	0.213	-0.035	0.269	-0.133	1.000				
niish	0.083	0.201	0.177	0.264	-0.214	1.000			
ilev	-0.351	0.051	-0.466	0.043	-0.049	-0.058	1.000		
sdasset	0.143	-0.122	0.017	-0.006	0.244	0.002	0.381	1.000	
cindx	-0.159	-0.182	-0.197	-0.259	0.378	-0.410	0.123	0.012	1.0000

The sample covers the top 5 size deciles annually 1999-2009. The dependent variables are defined as follows: niseq is return on equity, mxlrrentseq is bankers' rent as a per cent of equity where the competitive wage is based on banks in the same managerial skill class as measured by average board compensation, and trentseq defined is the bank total return measure calculated as in equation (1) using mxlrrentseq. The explanatory variables are total assets (at) (in billions) measured in 2002 USDs, net interest margin (nim) as a per cent of total interest earning assets, per cent of non-interest income in total revenues (niish), ratio of book equity to total assets (ilev), standard deviation of asset return (sdasset), and the Herfindahl concentration index of share of net income in five lines of business (cindx).

Table 3: Benchmark Results

Dependent variable	trentseq	niseq	mxlrrentseq
lnat	0.001	-0.006	0.004
	(0.34)	(-0.95)	(1.42)
at10	0.042	0.057	0.039
	(1.22)	(0.75)	(1.47)
nim	0.040***	0.049***	0.011**
	(8.71)	(4.66)	(2.10)
nimat10	-0.017**	-0.020	-0.016**
	(-2.47)	(-1.25)	(-2.46)
niish	0.016	-0.042	-0.022
	(0.40)	(-0.45)	(-0.99)
niishat10	0.112**	0.165	0.088***
	(2.46)	(1.61)	(2.73)
sd asset	-6.547***	-10.801***	1.307**
	(-5.77)	(-5.00)	(2.31)
ilev	0.229	1.748***	-0.429***
	(1.52)	(3.95)	(-3.40)
cindx	-0.130***	-0.238***	-0.052*
	(-5.61)	(-4.13)	(-1.93)
cons	1.394***	-0.055	0.017
	(40.80)	(-0.75)	(0.66)
year dummies	yes	yes	yes
sigma			0.042***
cons			(12.85)
R-sq	0.427	0.308	
Nobs	1638	1638	1638

The dependent variables are defined as follows: niseq is return on equity, mxlrrentseq is bankers' rent as a per cent of equity where the competitive wage is based on banks in the same managerial skill class as measured by average board compensation, and trentseq defined is the bank total return measure calculated as in equation (1) using mxlrrentseq. The explanatory variables are natural logarithm of real total assets measured in $ thousands (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), the standard deviation of total asset returns (sd asset), the ratio of book equity to total assets (ilev), the Herfindahl concentration index of share of net income in five lines of business (cindx), and year dummies. The mxlrrentseq model is estimated by Tobit regressions. The regressions of niseq and trentseq 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 4: Using alternative measures of bankers' rents

	Skill class based on wholesale market activity		Skill class based on size decile	
	trenta	renta	trentb	rentb
lnat	-0.000	0.000	0.000	0.002
	(-0.06)	(0.14)	(0.17)	(0.75)
at10	0.034	0.028	0.041	-0.019
	(1.01)	(0.98)	(1.13)	(-0.55)
nim	0.041***	0.014***	0.041***	0.015**
	(8.93)	(2.75)	(8.78)	(2.33)
nimat10	-0.016**	-0.015**	-0.019***	-0.014*
	(-2.35)	(-2.15)	(-2.62)	(-1.86)
niish	0.014	-0.019	0.019	-0.029
	(0.36)	(-0.88)	(0.46)	(-1.22)
niishat10	0.123***	0.098***	0.118**	0.181***
	(2.74)	(2.94)	(2.52)	(4.52)
sd asset	-6.437***	1.516***	-6.662***	1.753**
	(-5.71)	(2.67)	(-5.78)	(2.43)
ilev	0.172	-0.509***	0.260*	-0.529***
	(1.15)	(-3.98)	(1.69)	(-3.62)
cindx	-0.143***	-0.079***	-0.142***	-0.100***
	(-6.21)	(-3.05)	(-6.12)	(-3.00)
cons	1.416***	0.067**	1.391***	0.028
	(41.03)	(2.48)	(40.64)	(0.85)
yr dummies	yes	yes	yes	yes
sig		0.042***		0.047***
cons		(14.19)		(11.37)
R-sq	0.428		0.446	
Nobs	1638	1638	1638	1638

renta is calculated in the same manner as mxlrrentseq but with the competitive wage based on an alternative indicator of skill class as discussed in the text. trenta is the bank total return measure calculated as in equation (1) using renta as the bankers' rent measure. The variable *rentb* is calculated in the same manner as mxlrrentseq but with a competitive wage equal to the average wage based on banks with more than 50 employees and less than $2 billion in total assets. The variable *trentb* is caclulated as in equation (1) using rentb as the bankers' rent measure. The explanatory variables are natural logarithm of real total assets measured in $ thousands (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), the standard deviation of total asset returns (sd asset), the ratio of book equity to total assets (ilev), the Herfindahl concentration index of share of net income in five lines of business (cindx), and year dummies. The renta and rentb models are estimated by Tobit regressions. The trenta and trentb models 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 5: Sensitivity to Too-big-to-fail

	Excluding top 1% of banks			SIFI dummy		
	trentseq	niseq	mxlrrentseq	trentseq	niseq	mxlrrentseq
lnat	0.002	-0.008	0.006*	0.001	-0.006	0.004
	(0.70)	(-0.92)	(1.76)	(0.37)	(-0.88)	(1.33)
at10	0.045	0.080	0.032	0.042	0.057	0.039
	(1.22)	(0.99)	(1.11)	(1.22)	(0.75)	(1.47)
nim	0.040***	0.049***	0.012**	0.040***	0.049***	0.011**
	(8.66)	(4.58)	(2.16)	(8.69)	(4.63)	(2.10)
nimat10	-0.019**	-0.025	-0.015**	-0.018**	-0.020	-0.016**
	(-2.53)	(-1.49)	(-2.18)	(-2.52)	(-1.23)	(-2.49)
niish	0.014	-0.042	-0.025	0.016	-0.042	-0.022
	(0.34)	(-0.43)	(-1.11)	(0.39)	(-0.44)	(-1.01)
niishat10	0.113**	0.159	0.090***	0.114**	0.163	0.089***
	(2.46)	(1.53)	(2.81)	(2.41)	(1.54)	(2.83)
sdasset	-6.855***	-11.364***	1.324**	-6.550***	-10.796***	1.304**
	(-5.87)	(-5.12)	(2.26)	(-5.77)	(-4.99)	(2.31)
ilev	0.239	1.805***	-0.451***	0.228	1.750***	-0.431***
	(1.55)	(3.98)	(-3.48)	(1.50)	(3.94)	(-3.39)
cindx	-0.131***	-0.238***	-0.053*	-0.130***	-0.238***	-0.052*
	(-5.62)	(-4.11)	(-1.94)	(-5.60)	(-4.12)	(-1.92)
toobig2f				-0.004	0.005	-0.003
				(-0.32)	(0.17)	(-0.23)
cons	1.384***	-0.045	0.003	1.392***	-0.053	0.016
	(38.27)	(-0.58)	(0.10)	(39.49)	(-0.70)	(0.59)
yr dummy	yes	yes	yes	yes	yes	yes
sigma			0.042***			0.042***
cons			(12.82)			(12.85)
R-sq	0.428	0.310		0.427	0.308	
Nobs	1610	1610	1610	1638	1638	1638

The variable toobig2f is a binary variable taking the value of 1 if the bank is considered systemic significant as explained in the text. The dependent variables are defined as follows: niseq is return on equity, mxlrrentseq is bankers' rent as a per cent of equity where the competitive wage is based on banks in the same managerial skill class as measured by average board compensation, and trentseq defined is the bank total return measure calculated as in equation (1) using mxlrrentseq. The remaining explanatory variables are natural logarithm of real total assets measured in $ thousands (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), the ratio of book equity to total assets (ilev), the Herfindahl concentration index of share of net income in five lines of business (cindx), and year dummies. The mxlrrentseq model is estimated by Tobit regressions. The regressions of niseq and trentseq 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 6: With Detailed Wholesale Market Activity

Dependent variable	trentseq	niseq	mxlrrentseq
lnat	0.002	-0.006	0.004
	(0.58)	(-0.82)	(1.39)
at10	0.031	0.068	0.021
	(0.90)	(0.88)	(0.73)
nim	0.040***	0.049***	0.011**
	(8.63)	(4.60)	(2.07)
nimat10	-0.014*	-0.024	-0.009
	(-1.86)	(-1.44)	(-1.24)
niish	0.015	-0.044	-0.022
	(0.36)	(-0.46)	(-0.99)
niishat10	0.101**	0.185*	0.062*
	(2.12)	(1.71)	(1.83)
sd asset	-6.593***	-11.063***	1.410**
	(-5.79)	(-5.12)	(2.53)
ilev2	0.233	1.775***	-0.434***
	(1.52)	(3.95)	(-3.41)
cindx	-0.129***	-0.241***	-0.048*
	(-5.49)	(-4.12)	(-1.74)
sec lending	3.180	-27.600**	16.600***
	(0.48)	(-2.17)	(3.05)
futures	-16.900	10.800	-28.800*
	(-0.78)	(0.31)	(-1.93)
forwards	10.200*	24.900**	0.893
	(1.94)	(2.28)	(0.33)
options	-10.600	-46.900**	24.200***
	(-0.76)	(-2.32)	(3.10)
otc options	-2.030	-8.240	0.758
	(-0.33)	(-0.91)	(0.34)
cons	1.387***	-0.054	0.012
	(39.14)	(-0.71)	(0.45)
year dummies	yes	yes	yes
sigma			0.041***
cons			(12.55)
R-sq	0.429	0.310	
Nobs	1638	1638	1638

The dependent variables are defined as follows: niseq is return on equity, mxlrrentseq is bankers' rent as a per cent of equity where the competitive wage is based on banks in the same managerial skill class as measured by average board compensation, and trentseq defined is the bank total return measure calculated as in equation (1) using mxlrrentseq. The explanatory variables are natural logarithm of real total assets measured in $ thousands (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), the standard deviation of total asset returns (sd asset), the ratio of book equity to total assets (ilev), the Herfindahl concentration index of share of net income in five lines of business (cindx), securities lending, futures, forwards, options, OTC options, and year dummies. The securities lending and derivatives positions are measured in billion USD. The mxlrrentseq model is estimated by Tobit regressions. The regressions of niseq and trentseq 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: Panel and instrumental variables estimation

	Random Effects			IV regressions		
	trentseq	niseq	mxlrrentseq	trentseq	niseq	mxlrrentseq
lnat	-0.001	-0.009	0.001	-0.010*	-0.025*	-0.000
	(-0.19)	(-1.21)	(0.74)	(-1.80)	(-1.94)	(-0.24)
at10	0.047	0.081	0.027*	0.103	0.289	-0.074***
	(1.21)	(0.96)	(1.95)	(1.26)	(1.58)	(-2.59)
nim	0.042***	0.055***	0.006**	0.038***	0.046***	0.008***
	(8.47)	(5.06)	(2.14)	(10.38)	(5.68)	(6.51)
nimat10	-0.020**	-0.028	-0.010**	-0.013	-0.030	0.000
	(-2.54)	(-1.62)	(-2.49)	(-0.94)	(-1.02)	(0.09)
niish	0.015	-0.066	0.008	0.388*	0.513	-0.014
	(0.30)	(-0.63)	(1.02)	(1.93)	(1.14)	(-0.20)
niishat10	0.134**	0.205*	0.032**	-0.128	-0.368	0.218***
	(2.48)	(1.81)	(2.06)	(-0.75)	(-0.96)	(3.60)
sdasset	-6.512***	-9.731***	-0.057	-4.771***	-8.399***	1.090***
	(-6.02)	(-4.60)	(-0.30)	(-4.57)	(-3.60)	(2.96)
ilev	0.597***	2.236***	-0.211***	0.202*	1.799***	-0.290***
	(3.42)	(4.55)	(-4.49)	(1.72)	(6.83)	(-7.00)
cindx	-0.125***	-0.249***	-0.022*	-0.062	-0.170	-0.036**
	(-5.08)	(-4.13)	(-1.76)	(-1.35)	(-1.64)	(-2.22)
cons	1.350***	-0.111	0.028*	1.337***	-0.111	0.043**
	(38.25)	(-1.45)	(1.69)	(22.64)	(-0.84)	(2.04)
yr dummy	yes	yes	yes	yes	yes	yes
R-sq				0.199	0.203	0.029
Nobs	1638	1638	1638	1331	1331	1331

The dependent variables are niseq, mxlrrentseq and trentseq as in the benchmark regression Table 3. The explanatory variables are natural logarithm of total assets (lnat) measured in 2002 USDs, 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), standard deviation of asset return (sdasset), the Herfindahl concentration index of share of net income in five lines of business (cindx), 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 8: Bankers' Share Equation

α	0.042	0.068	0.098*
	(0.70)	(1.36)	(1.93)
β_1 (niish)	0.024	0.023	0.021
	(0.46)	(0.40)	(0.41)
β_2 (cindx)	-0.177**	-0.156***	-0.124***
	(-2.44)	(-2.84)	(-2.74)
β_3 (sd asset)	4.668***	1.195	-3.984*
	(2.64)	(0.69)	(-1.73)
β_4 (ilev)	0.009	0.327	0.311
	(0.03)	(1.17)	(1.09)
β_5 (nim)	0.029***	0.026***	0.026***
	(3.07)	(4.39)	(5.61)
Additive constant	No	Yes	Yes
Year effects	No	No	Yes
R-sq	0.1990	0.2510	0.3756
Nobs	1973	1973	1973

The nonlinear specification is given by equation (6) in the text. The dependent variable is real wage, *wage* (measured in 2002 USDs) in excess of the skill-adjusted competitive wage as described in the text. The explanatory variables are the ratio of real EBIT to number of employees ($EBIT/L$), the ratio of non-interest income to total revenues (*niish*), net interest margin (nim), the standard deviation of total asset returns (sd asset), the ratio of book equity to total assets (ilev), and the Herfindahl concentration index of share of net income in five lines of business (cindx). Estimation is by nonlinear least squares. 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.

Table 9: Linearized Bankers' Share Equation

EBIT/L	0.067	0.108*
	(1.14)	(1.74)
EBIT/L*niish	0.035	0.029
	(0.60)	(0.52)
EBIT/L*cindx	-0.184***	-0.164***
	(-2.63)	(-2.68)
EBIT/L*sd asset	1.170	-4.865*
	(0.53)	(-1.79)
EBIT/L*ilev	0.450	0.392
	(1.32)	(1.06)
EBIT/L*nim	0.032***	0.035***
	(3.61)	(4.90)
constant	-7.040***	-1.607
	(-6.02)	(-0.45)
Year effects	No	Yes
R-sq	0.250	0.376
Nobs	1973	1973

The dependent variable is real wage, *wage* (measured in 2002 USDs) in excess of the skill-adjusted competitive wage as described in the text. The explanatory variables are the ratio of real EBIT to number of employees ($EBIT/L$), the ratio of non-interest income to total revenues (*niish*), net interest margin (nim), the standard deviation of total asset returns (sd asset), the ratio of book equity to total assets (ilev), and the Herfindahl concentration index of share of net income in five lines of business (cindx). Estimation is by OLS. 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.

A Appendix

In this appendix we provide an example of a rent extraction model described informally in Section 3 which motivates the empirical framework used in Section 4. In line with other such models we assume the firm has some market power in the product market and that that there is some form of bargaining in the labor market. In particular, we suppose that the bank can operate as a monopoly supplier on a number of regional banking markets. The bank can hire labor in its branches in any amount at a given wage rate which will be determined through some form of bargaining which may include competitive labor supply as a special case. Capital is an input that can be shared across branches and thus may be a source of efficiency gains. However, increasing the number of branches will incur an increased complexity cost which may off-set partially or wholly the benefits of sharing capital across branches.

The steps of the analysis are as follows. First, we solve the case of a bank with a single branch facing a given wage rate and a given cost of capital. Assuming a linear demand for banking services we solve first for the cost minimizing mix of labor and capital needed to produce a given level of output. Then we solve for the profit maximizing level of output. Then we consider the trade-off between payoffs to capital and to labor as we vary the wage rate from a competitive wage to the wage rate that would maximize the payoff to labor. This produces a downward sloping efficiency frontier as in Figure 1. Given these results we then extend the model by increasing the number of branches the bank operates where each branch operates a monopolist in its regional market and where all branches have identical production technologies and face identical linear product demand curves. Capital is shared across all branches. However, the bank incurs an additional complexity cost as the number of branches is increased. We can see at what point efficiency gains are off-set by complexity cost by comparing frontiers as the number of branches increases.

Turning to the analysis of the bank operating in a single market, 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 the following Cobb-Douglas production function.

$$q = \theta K^{.5} L^{.5} \tag{7}$$

where L is the amount of labor input purchased, K is the amount of capital provided by bank investors, and θ is an efficiency parameter. The choice of input share weights is for analytical convenience and allows us to avoid very complicated algebraic expressions.

Given the input prices of capital, r, and labor, w, the cost minimizing choices of inputs solve the problem $min\ rK + wL$ subject to (7). Under the assumptions given the solution satisfies $rK = wL$. Using this to substitute for L in equation (7) 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

$$\pi(r, w, q) = (a - q)q - C(r, w, q) = aq - q^2 - \frac{2}{\theta}(rw)^{1/2}q \tag{8}$$

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 (8) we arrive at a simple expression for the optimal bank profit per unit of cost of capital:

$$\frac{\pi}{rK} = (\frac{a\theta}{2(rw)^{1/2}} - 1) \tag{9}$$

This corresponds to the bank investors' return as used in Section 4 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

$$wL = rK = \frac{(rw)^{1/2}}{\theta}(\frac{a}{2} - \frac{(rw)^{1/2}}{\theta}) \tag{10}$$

.

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 (10) 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 $\frac{wL - w^cL^c}{rK}$. Using this expression and the investors return expression (9), varying the wage 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 consider a bank which can operate many branches and can share capital across these. This will be the source of efficiency gains which can affect the amount of rents generated by the bank. 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,

$$q_i = \theta_n K^{.5} L_i^{.5} \tag{11}$$

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. For the bank as a whole, 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, $(i = 1, .., n)$, 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 the total amount of banking services produced across banking markets 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 (11) 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,

$$Q = \frac{na}{2} - n^{1/2}\frac{1}{\theta_n}(rw)^{1/2} \tag{12}$$

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,

$$\frac{\pi}{rK} = \frac{an^{1/2}\theta_n}{2(rw)^{1/2}} - 1 \tag{13}$$

Equation 13 demonstrates a key feature of our model. For a given wage rate w, the total return 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 $\theta_n = \theta^{n-1}$ where θ is a positive constant. If $\theta = 1$ then return to capital rises proportionately to the square root of the number of branches. If $\theta < 1$ the total return on capital first rises and then falls with increases in n. If $\theta = 0.8$ the rents per unit capital cost in equation (13) 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 (13) and rents achieved by bankers $\frac{nwL_1 - nw^cL_{1c}}{rK}$. 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.

To summarize, we have used this analytical model of a multi-branch bank to show how total rents accruing to investors and to bankers change as the number of branches increase. Total rents can increase with the total number of branches so long as the complexity costs do not rise so rapidly as to outweigh the benefits of from sharing common inputs across branches. However, to judge whether this is the case we need to take account of both payoffs to investors and to bankers, as the expansion of the bank into more markets may affect the allocation of total rents between the two.

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 in 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 generate rents, these 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 regression analyses of the form,

$$return_{k,t} = \alpha_t + \beta X_{k,t} + \epsilon_{k,t} \tag{14}$$

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, returns to bankers and total returns. Total bank returns will reflect the trade-off between returns to investors and to bankers as in Figures 1 and 2. Our measurements these returns will be discussed in Section 4 after we describe our data set.

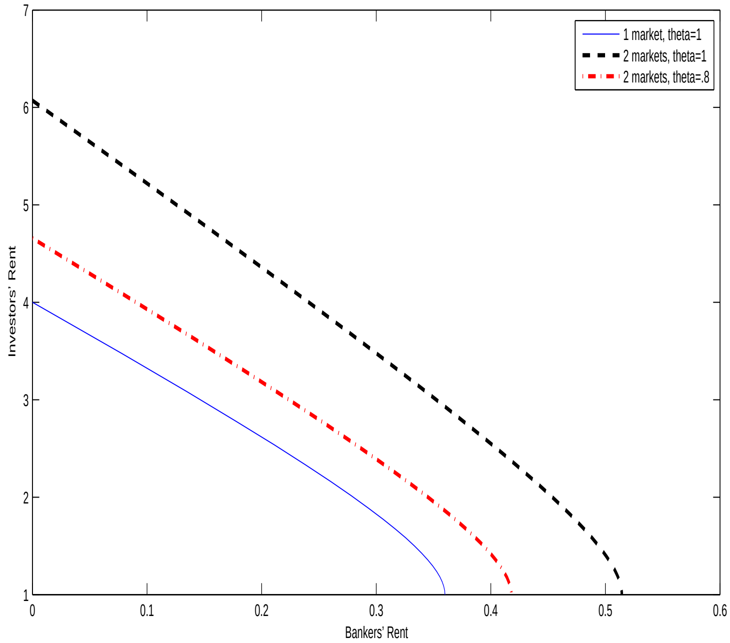

Figure 2: Efficiency frontiers with rent sharing through bargaining over wage rate
The figure is based on the model of the banking group that shares a common factor across banking markets as described in Section 3. $a = 1$, $r = .1$, $w^c = .1$.