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**Anticipating the financial crisis: evidence
from insider trading in banks**

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Anticipating the Financial Crisis: Evidence from Insider Trading in Banks

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Abstract

Banking crises are recurrent phenomena, often induced by excessive bank risk-taking, which may be due to behavioural reasons (over-optimistic banks neglecting risks) and to conflicts of interest between bank shareholders/managers and debtholders/taxpayers (banks exploiting moral hazard). We test whether US banks' stock returns in the 2007-08 financial crisis are associated with bank insiders' sales of their own bank's shares in the period prior to 2006Q2 (the peak and reversal in real estate prices). We find that top-five executives' sales of shares predict bank performance during the crisis. Interestingly, effects are insignificant for the sales of independent directors and other officers. Moreover, the top-five executives' impact is stronger for banks with higher exposure to the real estate bubble, where a one standard deviation increase of insider sales is associated with a 13.33 percentage point drop in stock returns during the crisis period. Finally, even though bankers in riskier banks sold more shares (furthering their own interests), they did not change their bank's policies, e.g. by reducing bank-level exposure to real estate. The informational content of bank insider trading before the crisis suggests that insiders knew that their banks were taking excessive risks, which has important implications for theory, public policy, and the understanding of crises, as well as a supervisory tool for early warning signals.

JEL Codes: G01, G02, G21, G28.

Keywords: Financial crises, insider trading, banking, risk-taking, principal-agent problems.

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1. INTRODUCTION

In 2007-2008 the US was overwhelmed by a financial (banking) crisis, which was followed by a severe economic recession. Banking crises are recurring phenomena and often trigger deep and long-lasting recessions (Reinhart and Rogoff, 2009). Importantly, banking crises are not externally-caused events, but regularly follow periods of strong bank credit growth and risk-taking, and are especially associated with real-estate bubbles (Kindleberger, 1978; Schularick and Taylor, 2012; Jorda et al., 2015). The recent crisis was similar, with banks also taking high risks in the run-up of the bubble (Brunnermeier, 2009; Rajan, 2010; Calomiris, 2009; Acharya et al., 2010).

A key question for policy and for the academic literature is why banks take excessive risks. There are two (non-mutually-exclusive) views (Freixas, Laeven and Peydró, 2015). First, the moral hazard view implies that conflicts of interest (agency problems) between bank shareholders/managers and bank debt-holders/taxpayers make it rational for banks to take on excessive risk (for example, greater leverage), because of explicit and implicit bank guarantees such as deposit insurance, central bank liquidity, and government bail-outs (see, for example, Allen and Gale, 2007; Freixas and Rochet, 2008; Admati and Hellwig, 2013). Consistent with this view, bankers understand the risks involved but find it optimal to take excessive risks. Moreover, bankers' incentives are affected by bonuses, which typically are tied to the short-term rather than long-term profitability of their bets (Acharya et al., 2010). Therefore, bank insiders such as the CEO, CFO, or Chairman of the Board contribute to the standard agency problem when acting on behalf of shareholders, but also when acting in their own interests and,

in this case, against the interests of shareholders, bondholders, and taxpayers.¹ Agency problems are at the heart of modern corporate finance theories (see, e.g., Myers, 1977; Tirole, 2006), but for banks, agency problems may be more important than for non-financial firms since banks are more leveraged and have stronger explicit and implicit guarantees. Second, the behavioural view states that banks take excessive risks because they neglect the possibility of extreme events (unlikely tail risks) or have over-optimistic beliefs (Akerlof and Shiller, 2010; Gennaioli et al., 2012; Kahneman, 2011).² In the extreme end of this view, banks were not aware of their excessive risk-taking prior to the crisis.

Though the 2007-08 financial crisis greatly affected the banking system (average bank returns were very poor during the crisis), there was substantial cross-sectional variation in bank performance (some banks even failed) as high risk-taking was not uniformly spread across banks (Beltratti and Stulz, 2012). If bank insiders understood the risks they were taking, and did not reduce the bank's risk exposure, we should find that bank insiders in the riskier banks (the ones with the more negative expected returns before the crisis given the insiders' private information and with the worse returns during the crisis) should have sold more shares prior to the public bad news in the real estate sector (the peak and reversal in real estate prices that became publicly observed in 2006Q2), compared to bank insiders in less risky banks.³

¹ In the case of insider trading by executives, we are in the presence of an additional conflict of interest to the one mentioned before between bank shareholders and bank debt-holders/taxpayers. Given the ability to trade on their own account (sell), bank executives may choose a bank's risk exposure that is not optimal even for shareholders.

² A related argument is based on the idea that given the long-term upward trend in house prices, bank executives did not believe that they were taking on excessive risk. Foote et al. (2012) and Gerardi et al. (2009) argue that analysts' reports before the downturn show that market participants understood that a fall in house prices would lead to a huge increase in foreclosures, but thought that the probability of this event was very low. Hence, the crisis was a realization of an extreme event and was just very bad luck.

³ Importantly, as we will see later on, real estate related defaults already started in 2006 (Mian and Sufi, 2011) and soon would be incorporated in banks' accounting information. This suggests the ceasing of the increase in insider trading to avoid prosecution early in 2006. Moreover, once the real estate market starts falling, given the spillover effects on the rest of the economy, even insiders in banks with low risk-taking may want to sell their shares due to the feedback effects between the aggregate economy and banks.

Moreover, this effect should be stronger both with the degree of bank exposure to the real estate sector prior to the crisis and with the amount and quality of information that insiders have (top-five executives such as the CEO and CFO versus independent directors and other officers). This is the main hypothesis we test in this paper.

The three predictions about insider sales in the previous paragraphs - insider sales being larger for insiders in banks with worse returns during the crisis, for insiders in banks with greater exposure to real estate, and for better-informed insiders - are shared by all models of asset trading with asymmetric information and (noisy) rational expectations, where insider selling is larger the more negative the expected return is (the more overpriced the stock is perceived) and the more precise the insiders' information is. It is also true in models such as that of Marin and Olivier (2008), where insider trading is subject to trading constraints and can be illegal. Note that larger sales by insiders in the riskier banks does not presume that insiders in these banks have any special prediction talents compared to insiders in other banks, or that the relatively low (perhaps even insignificant) sales in less risky banks imply no anticipation of the crisis by these insiders. These larger or smaller sales are fully consistent with anticipation, and are just the consequence of these banks being more or less exposed to real estate and, consequently, more or less overpriced.

We analyse bank stock returns in the crisis (July 2007-December 2008) based on bank insiders' sales during 2005Q1-2006Q1, controlling for other important bank characteristics.⁴ Following Fahlenbrach and Stulz (2011) and Fahlenbrach et al. (2012), we set the start of the

⁴ For example, pre-crisis bank leverage, size, and stock performance. To check the robustness of our results, we also include bank profits and credit growth. We define the peak as 2006Q2, and the reversal in the Case-Shiller 20-city composite home price index as the major public event in the real estate market (see Figure A1 in the Appendix).

financial crisis in July 2007 and analyse the crisis until December 2008. As Fahlenbrach and Stulz (2011) argue: "Admittedly, the crisis did not end in December 2008. Bank stocks lost substantial ground in the first quarter of 2009. However, during the period we consider the banking sector suffered losses not observed since the Great Depression. The subsequent losses were at least partly affected by uncertainty about whether banks would be nationalized. Because it is not clear how the impact on bank stocks of the threat of nationalisation would be affected by the incentives of CEOs before the crisis, it could well be that it is better to evaluate returns only until the end of 2008." For robustness, we study other time periods for the financial crisis.

The choice of 2005Q1-2006Q1 as the measurement period for insider trading is based on economic reasoning and recent literature that models insider trading prior to crisis periods (periods of large price corrections or crashes). In particular, in Marin and Olivier (2008), insiders face trading constraints,⁵ and are aware that insider trading is illegal when done in possession of non-public material information. In equilibrium, a large price correction is preceded by large sales in a period relatively far in the past and no sales in the period immediately prior to the crash. The theory does not predict a specific fixed length for this period, but it is clear on the conditions that must hold during this period: insiders refrain from selling extra shares because: 1) selling more shares would be incompatible with incentives in their compensation packages, alert other members of the firm (such as the Board of Directors), or involve short selling, and/or 2) selling more shares would easily be identified as based on non-public material information and, hence, prosecuted by regulators.

⁵ These constraints are both explicit, such as the no short sales constraint, and implicit, such as not selling beyond some point that could be perceived as misaligning the insider's incentives or that could alert other members of the firm, such as the Board.

In our case, given that the real estate market peaked in 2006Q2 and that real-estate-related defaults started in 2006 (Mian and Sufi, 2011), it seems reasonable to assume that 2006Q2 was the starting point of the “no-unusual-selling” activity. So, based on Marin and Olivier (2008), we conjecture that under the hypothesis of anticipating bank insiders, we should expect unusually high sales in the period immediately preceding 2006Q2 and no unusual sales between this point and the start of the financial crisis.⁶ We test this hypothesis in the Appendix, and in the main text we focus on insiders’ selling activity during 2005Q1-2006Q1, ignoring sales during 2006Q2-2007Q2.

Implicit in the main hypothesis that we test is the assumption that riskier banks did not significantly reduce overall bank risk exposure. Therefore, we also test whether riskier banks reduced their risk-taking (e.g. overall bank leverage and real estate exposure) or their payout policies (e.g. dividends) before the crisis. In a frictionless world without conflicts of interest (agency problems), we should expect insiders with executive powers in high-risk banks (who anticipated that their excessive bank risk would materialize) to decrease bank risk exposure in general, particularly to the real estate sector, and also reduce payouts to shareholders for precautionary reasons. However, in a world with conflicts of interest (a key feature of the banking sector),⁷ this reaction at the bank level may not take place. Other reasons include a strong bank culture of risk-taking (the risk culture hypothesis in Fahlenbrach et al. (2012)), top executives not being powerful enough to change the bank’s stated course (Adams et al., 2005), or the prevalence of relative performance evaluation in compensation packages, which leads to

⁶ Notice that this equilibrium is consistent with insiders leaving a substantial number of shares unsold (so insiders leave a lot of money on the table), because of the trading constraints and the risk of prosecution.

⁷ For example, agency problems arise from bank bailout guarantees (Acharya et al. ,2016; Farhi and Tirole, 2012; Ratnovski, 2009).

bank investments being correlated with their peers' investments (Albuquerque et al., 2017). Hence, either because managers do not have an incentive to reduce risk and dividends, or because managers are unable to influence other executives and directors, top executives may not react at the bank level but instead trade on their account, pursuing their own personal interests.

Our key variable in this paper is bank insider trading, i.e., the selling and buying of shares of their own bank. We obtain insider trades from the Thomson Financial Insider Filings database, which provides detailed information on each trade by insiders and the roles of insiders in their firms. Based on their roles and their differential access to private information about bank operations, we classify insiders into three categories: top-five executives (the CEO, CFO, and other top-executives), middle-officers, and independent directors.⁸

For our analysis, we follow the approach suggested in the insider trading literature, which focuses on insiders' use of non-public information in their trades. Since we do not have data on their private information or any variable that is perfectly related to it, we use forward-looking variables. To the extent that insider trades are based on private information about their company (not just the insiders' needs for cash), these trades will have a predictive power of the firm's future performance, such as the return in the next periods.⁹ Our empirical methodology relies on the same idea. In a cross-sectional analysis, we predict crisis period bank returns (2007Q3-

⁸ It is important to note that our variable does not include insider trading in instruments that are related to the underlying risk of the bank, but not issued by the bank (for instance, credit default swaps on subprime indexes), so our analysis may underestimate the economic effects of our results.

⁹ The insider trading literature provides evidence on insiders' ability to predict future price changes in their own firm's stocks (see, e.g., Cohen et al., 2012; Huddart et al., 2007; Lakonishok and Lee, 2001; Seyhun, 1986, 1992b).

2008Q4) based on the insider selling measures before the public bad news about the real estate sector from 2006Q2 onwards.

We find that top-five executives' sales of shares in the period prior to the peak and reversal in housing prices predict bank performance during the financial crisis. A one standard deviation increase in top-five executives' sales predicts a 7.33 percentage point drop in returns during the banking crisis. All the results that we present still hold when we control for bank characteristics that have been associated with banking crisis performance (Fahlenbrach et al., 2012; Fahlenbrach and Stulz, 2011). Banking crisis period returns are buy-and-hold returns from July 2007 to December 2008. In the main analysis we include banks that are delisted during the 2007-08 crisis period, but results are also significant if we only consider banks that survive.¹⁰

The results also hold (and become even stronger) when we exclude insider sales related to options exercise or control for compensation, so our results are not driven by the increase in compensation during the run-up to the real estate bubble, which particularly affected banks that were highly exposed to the real estate sector. In addition, we check that our results are robust to several other factors. For example, we verify that our results are not sensitive to the definition of the crisis period (such as January 2007-December 2008 or July 2007-September 2008).¹¹ In addition, our results are not sensitive to the choice of insider trading measure (in changes or in levels, in gross or net sales, and in volumes or the number of transactions). All in all, we find robust evidence that top-five executives' sales of shares predict bank returns during the crisis.

¹⁰ If banks delist or merge prior to December 2008, we put the proceeds in a cash account until December 2008 to compute crisis period returns (Fahlenbrach and Stulz, 2011; Fahlenbrach et al., 2012). See section 2.2 for the details of the bank performance measure.

¹¹ Interestingly, the insider sales before the peak in real estate prices do not predict the immediate bank returns after the peak in 2006Q2 and the start of the financial crisis in 2007, but only predict bank returns during the financial crisis.

If bank insiders understood the risks they were taking, not only should we find that bank insiders in the riskier banks sell more shares, but effects should be stronger both with higher bank exposure to the real estate sector prior to the crisis and with insiders who have better information. We indeed find that the effects are insignificant for independent directors' and middle-officers' sales of shares, in contrast to the top-five executives, for which the estimated effect is significant both statistically and economically.¹²

One can argue that staff directly responsible for real estate lending should be even more knowledgeable than top-five executives. While we do not have the identity or the trading data of the staff directly involved in real estate lending, we do not even expect this group to trade in the same way as top-five managers prior to the crisis, for several reasons. First, their compensation packages would be less sensitive to share granting than that of top-five managers, so they may hold smaller amounts of bank shares to start with. Second, and more importantly, the key factors for trading bank shares are the expectation and risk of the bank share price, which depends on many aspects, not just real estate lending. The staff directly involved in real estate lending most likely are not fully aware of the amount of hedging of real estate risk that the bank is doing or plans to do using off-balance instruments (such as derivatives), or the amount of securitization (which takes real estate risk off the bank's balance sheet), or other lines of business the bank is involved or plans to get involved in the future. In other words, the staff directly involved in real estate lending may be well aware of the risks in pure real estate lending activities, but extremely uncertain about the evolution of the bank share price in the

¹² In the finance and economics literature, the top-five management has received more attention due to their importance. For example, in crucial papers in the literature, Bertrand and Schoar (2003) and Malmendier and Tate (2005) focus on CEOs rather than mid-level managers since CEOs' opinions are more likely to be relevant for firm policies (see also Ma, 2015).

future. In these conditions of high uncertainty about the bank's future stock price, we should not expect them to engage in heavy or unusual selling in the period we analyze. However, notice that this is not the case for the top-five managers, who are fully aware of all the above-mentioned issues (including derivatives, securitization, and other lines of business). We do not have data on loan officers, but our insignificant results for non-top-five insiders and independent directors suggest that our results would be robust to loan officers.

We also find that the impact of pre-crisis top-five executives' sales on bank performance during the crisis is stronger for banks with higher pre-crisis exposure to the real estate sector. In particular, for banks with higher-than-average real estate exposure, we find that an increase of one standard deviation of insider sales leads to a 13.33 percentage point drop in stock returns during the crisis period, which accounts for almost one-third (32%) of the total drop in the return of these banks. Our results are not only driven by overall measures of exposure to real estate, but also to real estate in the areas with higher real estate growth (i.e., in bubbly areas).

Finally, we further investigate the link between bank insiders' sales before April 2006, and bank-level risk-taking (leverage and real estate exposure) and payout policy (dividends) immediately after the real estate price peak. We find no reaction in any of these variables, even when controlling for variation in insider sales across banks, which suggests that the insiders of riskier banks (as executives in their banks) did not react differently to the insiders of the other banks in terms of risk-taking and payout policy. The documented lack of distinctive reaction may be due to: 1) inertia in the risk measures considered - reducing leverage and real estate exposure takes time given the prevailing contractual arrangements of the banks - and the pervasive signalling implicit in dividend reductions, 2) the prevalence of an equilibrium in which no bank manager has an incentive to unilaterally deviate and reduce risk and dividends

(for instance, relative performance evaluation in compensation packages may result in highly-correlated investments, as in Albuquerque et al. (2017)) , 3) persistency in banks' risk culture (Fahlenbrach et al., 2012), or 4) lack of managerial power (Adams et al., 2005). Overall results suggest that even though bankers in pre-crisis riskier banks sold more shares (acting in their own interest), they did not change their banks' policies (acting in the banks' interest, such as reducing bank exposure to real estate).

In summary, this paper provides robust evidence that insider sales by bank insiders with access to more precise information on their own bank's risk-taking and with executive responsibilities (top-five executives) predict future bank returns during the crisis. The results are consistent with those bank insiders being aware of the high risks their banks were taking (and selling before the crisis).

The main contribution of this paper is the following: there is anecdotal evidence that some insiders of a few banks that performed badly in the crisis sold a significant part of their shares before the crisis hit; however, whether this behaviour happened across the banking sector still remains a topic for investigation. Our paper provides sector-wide cross-sectional analysis of bank insider trading just before the peak and reversal in housing prices and bank returns during the crisis. Bebhuk et al. (2010) provide a case study of compensation in Bear Stearns and Lehman Brothers during 2000-2008 and document that both the CEO and top-five executives in these banks significantly sold their own shares during this period.¹³ A paper close to ours is Cziraki (2018), which analyses insider trading in US banks around the crisis period. This paper

¹³ The authors show that during the years 2000-2008, in total Lehman's CEO took home about \$461 million and Bear Stearn's CEO took home \$289 million. The huge jump in Lehman CEO's sell from 2004 to 2005 is especially striking: the amount he obtained from selling Lehman's shares was \$20 million in 2004 and it jumped to \$98 million in 2005. Other top executives in Lehman also increased their sales from \$62 million to \$71 million. See also Bhagat and Bolton (2014).

finds no differential effects in insider trading in 2005 and bank returns in the crisis, while we find that insider trading before the peak and reversal of real estate prices predicts the cross-section of bank returns during the crisis. The difference in results is explained by the use of a different sample of banks, choice of insiders, and empirical methodology.¹⁴

Fahlenbrach and Stulz (2011) state that "bank CEOs did not reduce their holdings of shares in anticipation of the crisis or during the crisis", but this statement does not contradict the results in this paper. Fahlenbrach and Stulz (2011) look at insider selling activity immediately prior to or during the banking crisis (January 2007 to December 2008), the period where unusual selling should not take place, even if insiders were anticipating the crisis. However, we look at insider selling activity in periods prior to the real estate crisis (2005Q1 to 2006Q1), which are relatively far away from the banking crisis. As previously argued by Marin and Olivier (2008), we should expect unusual trading activity only in the period analysed in this paper, so our findings and Fahlenbrach and Stulz's (2011) findings are exactly what Marin and Olivier (2008) predicts. To check this consistency, in our analysis we document that while sales from July 2006 to June 2007 do not predict banking crisis returns (consistent with the results of Fahlenbrach and Stulz (2011)), sales from January 2005 to March 2006 do predict crisis returns (our result).

The remainder of the paper is organized as follows. Section 2 provides details of data sources, and our empirical strategy. In section 3, we present and discuss the results, including robustness tests. In section 4, we conclude and discuss the policy implications of our findings.

¹⁴ For example, we have double the number of banks. Also, Cziraki (2018) divides insiders into three sub-categories such as officers, independent directors, and CEOs. But we focus on top-five executives' trading, which includes the CEO and other top-executives as well. Finally, Cziraki (2018) classifies banks into just two groups (high and low exposure banks) and analyzes the returns of these two groups, while we look at the full cross-section of bank returns.

2. DATA AND EMPIRICAL STRATEGY

In this section we first explain the data and sample construction, then describe the empirical methodology, including the bank performance and insider trading measures we use.

2.1.Data

The data used in this paper come from several sources. The corporate insider transactions data comes from Thomson Financial Insider Filings Database (TFN), which collects all insider trades reported to the SEC.¹⁵ Accounting data are from Compustat and Tier 1, and non-performing loans data are from Compustat Bank. We obtain real estate loans data from FR_Y-9 statements in the Wharton Research Data Services (WRDS) Bank Regulatory Database. Price and shares outstanding data come from CRSP Monthly and Daily Stock Files.

Our initial sample is from Fahlenbrach et al. (2012). Their sample includes 347 publicly listed US firms from the banking industry. We focus on firms in which there was at least one open market sell transaction by any top-five executive in the period 2005Q1 to 2006Q1.¹⁶ Our final sample is based on 170 firms with (i) stock return data in CRSP, (ii) financial data in Compustat, and (iii) insider transactions data in Thomson Financial Insider Filings.

The insider trading records that Thomson Financial Insider Filing database provides are the transactions of persons subject to the disclosure requirements of Section 16(a) of the Securities and Exchange Act of 1934 reported on SEC Forms 3, 4, 5, and 144. We focus on transactions

¹⁵ According to Section 16(a) of the Securities and Exchange Act of 1934, corporate insiders (corporate officers, directors and large shareholders (who own more than 10 percent of the firm's stock)) are required to report their trades by the 10th day of the month that follows the trading month. Reporting requirements tightened in 2002 as the Sarbanes-Oxley Act requires reporting to the SEC within two business days following the insider's transaction date. See, Seyhun (1992a), Bainbridge (2007), and Crimmins (2013) for details on insider trading regulations.

¹⁶ In unreported results, we verify that results do not change significantly (all insider sales related variables have the right signs and are significant at high confidence levels) in the absence of this filter.

in Form 4, which is filled when insider's ownership position changes. The information includes: name and address of the corporate insider, issuer name of the security, relationship of insider to the issuer (the insider's position in the firm), whether it is an acquisition or disposition, the transaction code which describes the nature of the transaction, the transaction date, amount transacted, and price. The transaction reported in Form 4 could be any transaction that causes a change in ownership position. Among these transactions, we focus on insiders' open market purchases and sales.¹⁷ All other types of transactions, such as grants and awards or exercise of derivatives, are excluded.¹⁸

Following Lakonishok and Lee (2001), before merging insider transaction data with other databases, we first identify and eliminate non-meaningful records in the insider trading database. We exclude amended records, filings marked as inaccurate or incomplete by the Thomson database, small transactions (less than 100 shares were traded), and trades for which we do not have the insider's transaction price or the closing price of the stock.¹⁹ Additionally, problematic records are removed (filings in which the reported transaction price is not within 20% of the CRSP closing price on that day or those that involve more than 20% of the number of shares outstanding are eliminated).

Depending on their position in the firm, insiders may have different access to firm-specific information (Lin and Howe, 1990; Piotroski and Roulstone, 2005; Ravina and Sapienza, 2010;

¹⁷ Thomson Financial Insider Filings database provides a data field which gives information on the nature of each transaction. We keep only transactions with codes "S" and "P", which stand for open market sale, and purchase, respectively.

¹⁸ Note, however, that the sales of stocks acquired through the exercise of a derivative are counted as an open market sale ("S") and are therefore included in our sample. We have verified that our results are not driven by insiders' sales related to options exercise.

¹⁹ Thomson Financial Insider Filings database provides the eight-digit CUSIP number as a unique ID for each security. We merge the insider trading information of each security on each date with the CRSP daily stock file, using CUSIP to obtain the closing price of the stock and the number of shares outstanding on each transaction date.

Seyhun, 1986). One of the main trader characteristics that Thomson Financial Insider Filings database provides is the role rank of insiders in their firm, which enables us to identify the insider's position in their bank (e.g. officer, director, chairman of the board, large shareholder). Based on their differential access to private information about firm operations, we classify insiders into three categories: top-five executives, officers other than top-five (middle-officers), and independent directors. In our analysis, we mainly focus our attention on the trades of top-five executives: the firm's Chairman of the Board, CEO, CFO, COO, and President.²⁰ This group of insiders has access to better information than insiders in the other categories (Beneish and Vargus, 2002; Core et al., 2006). Moreover, we also provide results with middle-officers and independent directors of those firms.²¹

2.2. Methodology and estimation

We follow the approach suggested in the insider trading literature, which uses forward-looking variables because insiders' private information is not observable. To the extent that insiders' trades are based on private information about their company and not just reasons unrelated to private information,²² these trades will have predictive power of the firm's future

²⁰ The corresponding relationship codes in Thomson Financial Insider Filings database are "CB", "CEO", "CFO", "CO", and "P", respectively.

²¹ Executives may hold more than one title in the bank. Thomson Financial Insider Filings database provides up to 4 different titles. An executive is included in our middle-officer sample as long as he reports one of his titles as an officer (excluding top-five executive titles). In our independent director sample, we include only non-employee members of the board of directors. We exclude large shareholders who own more than 10 percent of the firm's stock unless they report any other title (such as officer or director).

²² Insiders have many motives to trade, which include reasons unrelated to information, such as hedging, diversification, or liquidity needs. Therefore, investors never know if insider sales are due to privately-learned bad news or other unrelated reasons, so insiders' true information is not perfectly revealed. Hence, the result in our paper does not require more than what is already known about financial markets, namely that financial markets are not efficient according to the strong form of market efficiency (i.e. prices do not reveal all private information in the market). Further, it has been documented elsewhere that strategies that mimic insider trades (which are public with a small delay due to disclosure requirements) obtain abnormal returns (see for example Bettis et al., 1997). This is evidence of lack of market efficiency in the semi-strong form (i.e. prices do not reveal all public information in the market).

performance, such as the return in the next period. Following Marin and Olivier (2008), we use the following equation to formally test the relationship between insider selling during the period just before the real estate price peak in 2006Q2, and firm returns during the 2007Q3-2008Q4 financial crisis:

$$Crisis\ return_i = \beta_0 + \beta_1 \Delta Sell_{i,2005Q1-2006Q2} + \gamma Controls_{i,2004} + \varepsilon_i \quad (1)$$

where subscript i denotes the individual bank, and the control variables (bank characteristics) are measured at the end of the 2004 fiscal year.

We now discuss the variables included in equation (1) and interpret the summary statistics presented in Table 1.²³ The dependent variable, *Crisis return_i*, is the annualized buy-and-hold return on bank i stock during the crisis period (Fahlenbrach et al., 2012; Fahlenbrach and Stulz, 2011).²⁴ If a bank is delisted during the crisis period, we put the proceeds into a cash account.²⁵ Not surprisingly, in our final sample of 170 banks, the average bank return during the crisis period is large and negative, with an average loss of 28%, a median loss of 27%, and a standard deviation of 35%. We compute the banks' buy-and-hold return for two alternative crisis periods as well: from January 2007 to December 2008, and from July 2007 to September 2008.²⁶ As with our main performance measure, the summary statistics of these two stock performance

²³ In Table A2 in the Appendix we report summary statistics of other variables used in robustness tests.

²⁴ For each bank, buy-and-hold return is computed as the product of one plus each month's return, minus one. Monthly returns are directly obtained from the CRSP Monthly Stock File.

²⁵ If banks delist or merge prior to December 2008, we put proceeds in a cash account until December 2008 (Fahlenbrach et al., 2012; Fahlenbrach and Stulz, 2011). In order to deal with the delisting month return, we do the following: For the banks that were delisted due to bankruptcy we replaced return in the delisting month with -1. In other delisting cases, such as mergers, we keep the return reported in CRSP in the delisting month. In case the return in the delisting month is missing, we use the delisting return if it is available in CRSP.

²⁶ Our choice of alternative crisis periods follows Erken et al. (2012). The first alternative includes the beginning of 2007 as it has been argued that the very first signals of the crisis were observed in the first half of 2007, and the second measure excludes 2008Q4 in order to eliminate the effect of government intervention.

measures indicate negative bank performance, with the median bank returns of -24% for January 2007-December 2008 and -18% for July 2007-September 2008.²⁷

The other main variable in equation (1) is the insider trading measure, $\Delta Sell_i$.²⁸ The literature uses several measures for insider trading, the most common ones being the number of insiders who did a transaction in a given period, the number of shares sold (purchased) in a period, the dollar value of sell transactions (purchases), and the number of transactions (or considering the number of sell and buy transactions separately). We follow Marin and Olivier (2008) and use the dollar value of sell transactions normalized by market capitalisation as our leading measure of insider trading. For each bank, we find all open market sell transactions from that bank in each day during the period 2005Q1-2006Q1, compute the dollar value of each transaction (number of shares sold $\times$ transaction price), and divide it by the market capitalisation (the market value of the bank's outstanding shares) on the day of that transaction.²⁹ Then we sum the value of sell transactions for each group of bank insiders. Market capitalisation is calculated by multiplying the bank's share price by the number of shares outstanding (obtained from CRSP's daily stock file). In the main analysis, we use two different variables: (1) $\Delta Sell_i$, the total value of sell transactions during the period 2005Q1-2006Q1 (before the real estate price peak in 2006Q2) minus the sales in the preceding 12 months (taken to be sales in 2004), and (2) $Sell_i$, the total value of sell transactions during the period 2005Q1-2006Q1.³⁰ For simplicity, in the tables we use the variable $\Delta Sell$ (change or level) without indicating the exact period.

²⁷ See Table A2 in the Appendix for the summary statistics of stock performance measures computed over alternative periods.

²⁸ Our main measure of insider selling activity in anticipation of the burst of the real estate bubble is in changes as the dependent variable is the change in stock prices (returns). To check the robustness of our results, we also use the level of sales ($Sell_i$).

²⁹ The specific days in the period 2005Q1-2006Q1 are January 3rd 2005 to March 31st 2006.

³⁰ For further details on how these variables were calculated, see Table A1 in the Appendix.

These two variables are our main variables of interest, and we use equation (1) to analyse the relationship between these two insider trading measures and bank returns in the financial crisis.

The first variable of interest is ΔSell_i . The mean of this variable, 0.04, indicates that on average top-five executives sold 0.04 more (as a percentage of market capitalisation) in the crisis anticipation period (2005Q1-2006Q1) compared to 2004. Moreover, out of the 170 banks in our sample, 120 banks (71% of our sample) have a positive value for ΔSell_i , indicating an increase in selling. The second variable of interest is Sell_i , the total value of each sell transaction (after adjusting it by market capitalisation on the transaction day) that was held during 2005Q1-2006Q1. Top-five executives in the median bank sold in total 0.12% of the company during the sample period, and the average is 0.29%, with a standard deviation of 0.43%.³¹

[Table 1 around here]

In our robustness analysis, we use alternative insider trading measures.³² For instance, we compute the change in the number of sell transactions relative to 2004 ($\Delta\#\text{Sell}_i$), as well as the number of sell transactions ($\#\text{Sell}_i$) in the anticipating period. Summary statistics show that the median number of sell transactions is 3 in 2005Q1-2006Q1 and the difference in the number of sell transactions is 1. We also compute net sell value (NetSell_i) by subtracting the total value of insider purchases from sales, and compute the change in net sell value, $\Delta\text{NetSell}_i$. The summary statistics of net sell value are close to raw sell value, thus indicating that the volume of buy

³¹ We also compute our main insider trading measures (ΔSell_i and Sell_i) for the middle-officers' and independent directors' transactions. If we compare median sell value across the three groups, we observe that the top-five executives' selling transactions are substantially higher than those of the other two groups. The median sell is 0.03% for independent directors and 0.04% for middle-officers, compared to 0.12% for the top-five executives.

³² See Table A1 for computational details and Table A2 in the Appendix for the summary statistics of these alternative insider trading measures.

transactions is very low. After subtracting the total value of buy transactions, the median sell represents 0.11% of the company and the average sell is 0.26%.

In our analysis, we include several control variables, in line with the insider trading literature and the recent literature on financial crises. All the control variables are measured at the end of the 2004 fiscal year.³³ Our sample of banks has an average of \$33 billion in assets, with a large standard deviation indicating large variation in terms of size, and the median bank has \$2.2 billion in assets. For total liabilities, the median value is \$1.98 billion, and the average is \$30 billion. The market capitalisation of the median bank is \$429 million whereas the mean is \$5 billion. The median book-to-market ratio is 0.48. The average buy-and-hold stock return of our sample banks from January to December 2004 is 16%.

As a measure of bank riskiness, we calculate its beta from a weekly market model of daily returns from January 2002 to December 2004, where the market is represented by a value-weighted CRSP index obtained from the CRSP daily data. The average beta is 0.79, indicating the banks' stocks are less risky than the market's, with a standard deviation of 0.48. Both the mean and the median bank leverage ratios are above 60%. The median bank distributes 0.38% of its total assets as dividends, whereas the average is 0.42% with a standard deviation of 0.29%. The real estate exposure of each bank is measured by the loans backed by real estate as of 2004 (adjusted by total assets). The median (and also the mean) bank has 48% of its total assets in real estate loans.

³³ We choose the end of 2004 as the last available data point prior to the beginning of the insider selling period. However, in supplementary analysis (not reported here), we verify that our results hold even when measuring the control variables at the end of 2005 or 2006.

We also analyze how the relationship in equation (1) varies across subgroups of our data. If bank insiders understood the risks they were taking, not only should we find that bank insiders in the riskiest banks (the ones with lower returns during the crisis) should have sold more shares prior to the public bad news in the real estate sector (the peak and posterior reversal in real estate prices), but also that this effect should be stronger for banks with greater exposure to the real estate bubble and for insiders with more information (top-five executives such as CEO and CFO versus independent directors and middle-officers). Therefore, we also analyze equation (1) separately for banks whose exposure to the real estate sector in 2004 was higher (and lower) than the median. Moreover, we analyze sales (ΔSell_i and Sell_i) not only for top-five executives, but also for middle-officers and for independent directors. Finally, we use a cross-sectional analysis to investigate whether the insiders' sales of shares in 2005Q1- 2006Q1 were associated with bank-level risk measures in the following period.

3. RESULTS

3.1. Main results

This section presents and discusses the main results of the paper. We start by analyzing the impact of the top-five executives' sales of their own bank shares on bank returns during the crisis. Column 1 of Table 2 presents results from cross-sectional regressions of bank returns in the financial crisis on top-five executives' sell transactions, with our main variable ΔSell_i , which measures the change in insider sales before the peak and reversal in house prices (2005Q1-2006Q1) relative to 2004. That is, we analyze the correlation between changes in stock prices of banks during the crisis period and pre-crisis changes in insider trading. The

coefficient is negative (-0.163), and is both statistically and economically significant:³⁴ a one standard deviation increase of the insider trading measure reduces bank returns in the crisis by 7.33 percentage points.³⁵

[Table 2 around here]

In columns 2 to 4, we add different bank control variables (measured at the end of 2004) and find a similar relationship between pre-crisis insider trading on bank crisis returns. Fahlenbrach and Stulz (2011) document a negative relationship between bank crisis period performance and bank characteristics such as returns, book-to-market, and size (measured at the end of 2006). We find the same results with a larger sample. The negative coefficients for returns, book-to-market ratio, and market capitalisation in 2004 suggests that larger banks and banks with relatively higher returns in 2004 performed relatively worse in the financial crisis. Bank equity beta and leverage are statistically insignificant.

In columns 5 through 8 of Table 2 we present the results with our second measure of insider trading, *Selli*, which measures the level of insider trading before the peak and reversal in house prices (2005Q1-2006Q1). Columns 5 to 8 show that the increase in insider sales predicts a lower bank return in the crisis period. Results are both statistically and economically significant. In addition, the control variables have the same signs as in the previous columns. Overall, our results in Table 2 show that banks in which top-five executives sold more shares before the real

³⁴ ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

³⁵ We would like to emphasize that our insider trading measures are computed as a percentage of market capitalization. In Table 1 in the paper we can see that median value of *sell* is 0.12, which should be interpreted as 0.12% of market capitalization. Certainly, the numbers would be higher if we computed them as a percentage of the insiders' share ownership. However, the point of our paper is to show the predictive power (and not necessarily the magnitude) of a bank's top-five insider trading on that bank's crisis returns, making it useful as a leading indicator for policy-makers.

estate price peak (both in raw value and compared to 2004) performed significantly worse during the 2007-08 crisis period.

Table 3 shows how the results vary with real estate exposure. We divide the banks into two groups according to their real estate exposure at the end of the 2004 fiscal year (above or below the median). For our main insider trading variable (ΔSell_i), columns 1 and 2 of Table 3 show results for banks with high exposure (above-median real estate exposure) and columns 3-4 show results for banks with low exposure (below-median real estate exposure). Columns 5 to 8 do the same for our second insider trading measure (Sell_i).

[Table 3 around here]

Our findings are only statistically and economically significant for banks with a higher level of real estate exposure. In column 1, the coefficient on top-five executives' sale is negative (-0.303) and statistically significant at the 1% level. In terms of economic magnitude, the effect is stronger than that of the average bank in Table 2: a one standard deviation increase in insider sales leads to a 13.33 percentage point drop in stock returns during the crisis period, which accounts for approximately 32% of fall in bank returns during the crisis for banks with above-average exposure to real estate (see also Table 1). Finally, results in columns 2, 5, and 6 are qualitatively similar i.e. statistically and economically significant correlations for banks with high real estate exposure, but there are insignificant effects for banks with low real estate exposure (columns 3, 4, 7, and 8). All in all, the top-five significant impact that we find in Table 2 is stronger for banks with higher pre-crisis exposure to the real estate bubble.³⁶

³⁶ To check the robustness of our results to alternative real estate exposure measures, we use a house price index for each state and analyze its relationship with bank profits during the boom. To obtain a bank's exposure to house price changes, we focus our attention on states that experienced the strongest house price growth during the boom

In Table 4 we explore the relationship between insider sales before the real estate price peak/reversal and crisis-period bank returns across different insider groups, depending on their level of information about the bank. We re-run the regression that we report in Table 2, using our main measure of insider trading but using independent directors instead of top-five executives (column 3 and 4 of Table 4) and middle-officers' trades instead of top-five executives' trades (column 5 and 6 of Table 4). To facilitate comparisons with the results for top-five executives, Columns 1 and 2 of Table 4 are identical to columns 1 and 4 in Table 2.

[Table 4 around here]

Results are only statistically and economically significant for top-five executives, with positive but imprecisely-estimated coefficients for insider sales in the other two groups (0.026 and 0.007, respectively). We find identical results (not reported here) if we use our second measure of insider trading (i.e., results are only significant for top-five executives).

In Table 4, we wanted to understand further heterogeneous effects of the main hypothesis tested in this paper. If bank insiders understood the risks they were taking, not only should we find that bank insiders in the riskier banks sell more shares, but the effects should be stronger the better the information that insiders have. We indeed find that the effects are insignificant for independent directors' and middle-officers' sales of shares – contrary to our results for top-five executives, in which the estimated coefficient is statistically and economically significant.³⁷

period (2002-2005), as defined by Mian and Sufi (2009). Results are similarly strong for our main sales variable and high exposure banks compared with the simpler measure of real estate loans over total assets. Table A1 explains the computational details and Table A13 presents results with real estate exposure measures computed in several alternative ways.

³⁷ There could be unobserved differential motives of diversification across different banks and within the same bank, that are present exactly when the theory of insider trading predicts that insiders will trade due to private

3.2. Robustness tests

We perform several robustness tests. For example, in Table 5 we do a placebo test analyzing the impact of top-five executives' sales on bank returns during the period immediately after the peak in real estate prices and before the beginning of the crisis (2006Q2-2006Q4). As expected, results on top-five executives' trading are insignificant.

[Table 5 around here]

In the Appendix we report many other robustness checks.³⁸ In Table A3, we test for the sensitivity of our results to alternative crisis period definitions. The crisis period is either defined as January 2007 to December 2008 or as July 2007 to September 2008. We compute the buy-and-hold return of each bank stock for these two alternative periods and re-run our main regression (in Table 2). The results remain very similar. In Table A4, we use four alternative measures of insider trading: columns 1 and 2 use the difference in the number of sell transactions between 2005Q1-2006Q1 and 2004, and columns 3 and 4 present results with the raw number of transactions instead of the volume. Again, our results are similar to those in Table 2. We also use the net value of sales instead of sales. Columns 5 and 6 present results with the difference in the net value of sales between the period 2005Q1-2006Q1 and 2004, and columns 7 and 8 use the net value of sales in 2005Q1-2006Q1. We also find similar results as in the benchmark regressions with the volume of sales (Table 2).

In Table A5, we replicate our main result in Table 2 with other bank controls and for different samples of banks. In all columns, we observe that our main finding of insider trading on bank

information, but not before or after. We do not have the portfolio of assets of each banker, but we do not think that our results are driven by diversification motives.

³⁸ Summary statistics of the additional control variables that are only used in robustness tests are reported in Table A2 in the Appendix. Table A9 uses a restricted merged sample and includes its own summary statistics.

returns during the crisis is robust to all of these variations. Columns 1-5 present results using the full sample of 170 banks. Following Fahlenbrach et al. (2012), in column 1 we replace our leverage measure with market-based leverage measure of Acharya et al. (2010), and in columns 2 and 3 we replace leverage with the tangible common equity (TCE) ratio and Tier 1 capital ratio, respectively.³⁹ Similar to Fahlenbrach et al. (2012), the coefficient on leverage is negative and statistically significant, indicating that highly-leveraged banks in 2004 performed worse during the crisis. We also find a positive and statistically significant coefficient on the Tier 1 capital ratio, but a negative and not statistically significant coefficient on the tangible common equity ratio.⁴⁰ Finally in columns 4 and 5, we control for non-performing loans and liquidity, respectively. The coefficients on these two additional control variables are not economically or statistically significant. Furthermore, in columns 6-10 we replicate the analysis in columns 1-5, for the subsample of 125 bank holding companies that filed Y-9 reports with the Federal Reserve in 2004. In terms of both the sign and significance, we find similar results for all new control variables. The only exception is the leverage measure of Acharya et al. (2010) in column 6, which has a negative coefficient but it is not statistically significant. Importantly, in all columns, we observe that our main finding is robust to all these new control variables. As a final robustness check, we replicate our main analysis with only the banks that survived until December 2008 (Table A6), and our results are very similar.

In Table A7, we explicitly test for the predictions of Marin and Olivier (2008). Consistent with their paper, we find that crisis returns are positively related (a negative coefficient on our

³⁹ Note that column 1 of Table A5 replicates column 4 of our main analysis in Table 2 by replacing the leverage measure with Acharya et al. (2010) measure.

⁴⁰ Both Fahlenbrach and Stulz (2011) and Fahlenbrach et al. (2012) document a positive relationship between the Tier 1 capital ratio (at the end of 2006) and performance during the banking crisis. Additionally, Fahlenbrach et al. (2012) include tangible common equity ratio in the equation, but similar to us, do not find a statistically significant relationship between the tangible common equity ratio and performance during the banking crisis.

sell variable) to insider sales in the first period (2005Q1-2006Q1) and not significantly related to insider sales in the second period (2006Q2-2007Q2). Also, as previously stated, the result that insider sales during the 12-month period immediately prior to the bank crisis (July 2006 to June 2007) do not predict returns in the banking crisis period is consistent with those of Fahlenbrach and Stulz (2011).

In Tables A8 and A9 we show that our results are not driven by the increase in compensation during the run-up to the real estate bubble. First, with the full sample used in all the previous robustness checks, in Table A8 we analyze whether or not the main result is driven by trading related to options exercise. We find that when we exclude all sales related to options exercise, the results are even stronger, with the relevant coefficient increasing (in absolute value) from -0.163 (all sales) to -0.192 (only sales not related to options exercise). Additionally, columns 5 to 8 show that sales related to options exercise are not predictive of the returns during the banking crisis.⁴¹ Second, we explicitly control for compensation, with data obtained from the ExecuComp database. When compensation data is matched with all the other datasets used (Thomson, Compustat, CRSP), we end up with 44 banks with complete data, with larger banks being over-represented. For comparisons, in column 1 we report our main result (column 4 of Table 2), and in column 2 we replicate our main regression with the subsample we matched with the ExecuComp database. In column 3, we add our measure of compensation total direct compensation (TDC1) as an additional control variable, and in column 4 we control for only stock-based compensation (SBC), which is the sum of the value of restricted grants and options granted during that year. Our results hold when controlling for compensation, even in this

⁴¹ Thomson Financial Insider Filings database provides a data field which gives information whether the sale transaction is related to an option exercise. In this exercise, we eliminate all sales transactions where this data field is "A" or "P" (which stands for all, and partial, respectively).

subsample of relatively larger banks, whose insiders are more closely monitored and consequently more reluctant to trade on private information.⁴² Finally, in Table 6 we analyze whether differential insider trading before the peak and reversal in real estate prices implies different bank-level risk taking in the period after the peak in real estate prices. We test whether riskier banks reduce their risk exposure (overall bank leverage and real estate exposure) or their payout (dividends) before the crisis, in particular by the end of 2006.

As stated in the introduction, in a frictionless world without agency problems, we should expect insiders with executive powers in high risk banks (who anticipated the real estate crash) to decrease risk exposure to the real estate sector in particular, and perhaps also reduce bank risk exposure in general, consistent with the increase in their (insider) sales. Furthermore, and along the same lines, we should also expect those insiders to reduce dividend payments to shareholders for precautionary reasons. However, in a world in which conflict of interests (moral hazard) prevail, as in the banking sector, such reactions at the bank level may not take place.

[Table 6 around here]

We find no reaction in any of the bank variables (leverage, real estate exposure, and dividends) in 2006, either at the aggregate level, or conditional on insider sales in the cross-section of banks, which means that the insiders of riskier banks reacted similarly to insiders of other banks in terms of bank-level risk-taking and payout policies. We find very similar results in Table

⁴² Although we do not have executive compensation data for the full sample, we control for loan growth and profit changes over the boom period for further robustness. Results are presented in Table A12. We provide results based on different timing (over several different periods) of the controls: (1) 2001–2005; (2) 2002–2005, the boom period defined by Mian and Sufi (2009); (3) and 2001–2004 instead of 2005 (our benchmark). Our results are robust to profit changes and loan growth.

A10 for bank risk measures in 2007 and, in Table A11, for different groups of insiders. As stated in the introduction, the documented lack of a distinctive reaction may be due to inertia in the risk measures considered, as reducing leverage and real estate exposure takes time given the prevailing contractual arrangements of the banks, the pervasive signalling implicit in dividend reductions, or the prevalence of an equilibrium in which no bank manager has an incentive to unilaterally deviate and reduce risk and dividends.

4. CONCLUSION

Agency problems are at the heart of modern corporate finance theories (for example, see Myers, 1977; Tirole, 2006). For banks, agency problems may be more important than for non-financial firms since banks are typically more leveraged and have explicit and implicit guarantees such as deposit insurance, central bank liquidity, and bail-outs (see Allen and Gale, 2007; Freixas and Rochet, 2008; Admati and Hellwig, 2013). Therefore, bankers may rationally take on excessive risks due to incentives and not just pure behavioural reasons such as over-optimism and neglecting extreme risks.

One empirical way to analyse these issues is to document what insiders were doing before the crisis. In particular, we test whether US banks' performance in the 2007-08 crisis is related to bank insiders' sales of their own bank shares in the period prior to the peak and reversal in house prices in 2006Q2. We find robust evidence that top-five executives' pre-crisis sales of their own bank shares predict worse bank returns during the crisis. Moreover, we find that the impact for top-five executives' sales is stronger for banks with higher pre-crisis exposure to the real estate market. A one standard deviation increase in top-five executive sales is associated with a 13.33 percentage point drop in stock returns during the crisis period, which accounts for

approximately 32% percent of the total decrease in returns of banks with above-average exposure to real estate. All in all, given the informational content of bank insider trading before the real estate crisis, our results suggest that insiders were not simply overoptimistic: they understood the large risks their banks were undertaking, so insiders in the riskier banks sold more before the crisis. Finally, top-five insiders sold their own shares but did not reduce the bank-level overall risk (by reducing leverage or real estate).

From a supervisory point of view, our results suggest that supervisors and policy-makers should use the sales of top-management in banks as an early warning signal of potential excessive risk-taking in banks. However, once bankers are aware that this measure is being used, it may lose its predictive power. These results also have public policy implications, especially for the recent prudential policy measures on both sides of the Atlantic. Our evidence is consistent with agency problems in the banking industry being an important driver of risk-taking, and therefore the recent policy initiatives requiring higher bank capital (including Basel III) or macroprudential policies around the world (Freixas et al., 2015; Jiménez et al., 2017) may be useful for limiting excessive bank risk-taking. If high risk-taking in banks was exclusively due to behavioural reasons, then some of the new prudential policies providing better pre-crisis incentives for bankers would not matter at all (only capital would be useful as a post-crisis buffer).

Moreover, our results may also yield policy implications for insider trading regulation in banking institutions, particularly the FSB-developed Principles of Sound Compensation Practices and Implementation as well as several proposals on board oversight, variable vs. fixed salary schemes, and stock options. The ability to engage in insider trading (selling shares of their own bank when they anticipate that their excessive risk-taking may materialise) may

exacerbate conflicts of interest. Banning trading by bank insiders may result in less risk-taking by banks and operate as a (partial) substitute for bank capital regulation or macroprudential policies. However, banning trading by bank insiders on these grounds would not be fully justified, as there are many other important costs and benefits to consider.

Finally, our result that bankers did something in their interest (sell shares), but did not do anything in the bank's interest (did not reduce bank exposure to real estate), also has policy implications. In the paper we give several explanations for this finding, but ultimately the result is that no banker has an incentive to deviate from his current behaviour, as the costs of calling the market too early – which perhaps even include the firing of the banker and the end of his career as a banker– seem to outweigh the benefits associated with correctly timing the market (a salary increase in the current and some future years). In this context, reports issued by the Central Banks and other agencies on building up risks and vulnerabilities in the financial system may play a key role, as they will serve as a justification for the deviation of some bankers at an early stage. Other bankers may follow, which will drastically ameliorate the severity of the crisis on the banking system.

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TABLES

TABLE 1

SUMMARY STATISTICS

	Obs.	25% quantile	Median	75% quantile	Mean	Std. Dev.
Crisis return	170	-0.54	-0.27	-0.00	-0.28	0.35
ΔSell	170	-0.01	0.03	0.17	0.04	0.45
Sell	170	0.04	0.12	0.34	0.29	0.43
ΔSell_Independent Directors	170	-0.02	0.00	0.03	0.00	0.45
Sell_Independent Directors	170	0.00	0.03	0.15	0.18	0.52
ΔSell_Middle Officers	170	-0.03	0.00	0.05	-0.00	0.19
Sell_Middle Officers	170	0.00	0.04	0.16	0.11	0.14
Total assets	170	829.33	2195.39	6419.05	32984.58	139382.83
Total liabilities	170	766.75	1981.78	5887.51	30452.56	129376.53
Market value	170	143.64	429.84	1252.04	5431.59	22858.20
Book-to-market	170	0.39	0.48	0.60	0.51	0.16
Return _{2006:M04-2006:M12}	170	-0.02	0.05	0.14	0.07	0.14
Return	170	0.07	0.15	0.26	0.16	0.16
Beta	170	0.46	0.80	1.14	0.79	0.48
Leverage	170	0.49	0.64	0.74	0.61	0.18
Dividend	170	0.25	0.38	0.54	0.42	0.29
Real Estate Exposure	125	38.60	48.23	60.29	48.01	15.90

This table shows descriptive statistics of key variables. All variables are defined in Table A1 in the Appendix. Accounting variables are measured at the 2004 fiscal-year-end. Real Estate Exposure is available only for bank holding companies that filed Y-9 reports with the Federal Reserve in 2004.

TABLE 2

BANK RETURNS IN THE FINANCIAL CRISIS AND TOP-FIVE EXECUTIVE TRADING IN THE REAL ESTATE BOOM

VARIABLES	(1) Crisis return	(2) Crisis return	(3) Crisis return	(4) Crisis return	(5) Crisis return	(6) Crisis return	(7) Crisis return	(8) Crisis return
ΔSell	-0.163*** (0.053)	-0.149*** (0.050)	-0.136*** (0.051)	-0.131** (0.052)				
Sell					-0.041** (0.018)	-0.051*** (0.017)	-0.049*** (0.017)	-0.046*** (0.017)
Return		-0.416** (0.161)	-0.424*** (0.155)	-0.428*** (0.156)		-0.358** (0.163)	-0.368** (0.156)	-0.375** (0.156)
Book-to-market		-0.713*** (0.180)	-0.636*** (0.187)	-0.585*** (0.191)		-0.728*** (0.177)	-0.639*** (0.183)	-0.600*** (0.189)
Log(market value)		-0.043*** (0.013)	-0.050*** (0.014)	-0.043*** (0.015)		-0.056*** (0.014)	-0.064*** (0.015)	-0.057*** (0.016)
Beta			0.091 (0.062)	0.091 (0.062)			0.102* (0.058)	0.102* (0.058)
Leverage				-0.196 (0.142)				-0.152 (0.136)
Observations	170	170	170	170	170	170	170	170
R-squared	0.045	0.147	0.159	0.168	0.039	0.160	0.174	0.179

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measures. All variables are defined in Table A1 in the Appendix. In columns 1-4 the main variable of interest is $\Delta Sell$, which is the value of top-five executives' sell transactions that were held before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. In columns 5-8 the main variable of interest is $Sell$, which is the sum of top-five executives' dollar value of sell transactions in the period 2005Q1-2006Q1 (in logs). Accounting control variables are measured at the end of the 2004 fiscal year end. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE 3

HETEROGENEOUS EFFECTS I: REAL ESTATE EXPOSURE

VARIABLES	High Exposure (1) Crisis return	High Exposure (2) Crisis return	Low Exposure (3) Crisis return	Low Exposure (4) Crisis return	High Exposure (5) Crisis return	High Exposure (6) Crisis return	Low Exposure (7) Crisis return	Low Exposure (8) Crisis return
$\Delta Sell$	-0.303*** (0.077)	-0.224*** (0.083)	-0.087 (0.103)	-0.090 (0.095)				
Sell					-0.067** (0.026)	-0.062*** (0.023)	0.020 (0.027)	0.007 (0.026)
Log(market value)		-0.054** (0.025)		-0.048* (0.026)		-0.078*** (0.024)		-0.045 (0.028)
Book-to-market		-0.870*** (0.301)		-0.089 (0.375)		-0.970*** (0.310)		-0.072 (0.407)
Return		-0.223 (0.214)		0.055 (0.293)		-0.154 (0.220)		0.015 (0.291)
Beta		-0.074 (0.086)		0.199** (0.092)		-0.084 (0.083)		0.211** (0.095)
Real Estate Exposure		-0.015*** (0.004)		-0.001 (0.005)		-0.016*** (0.004)		-0.001 (0.005)
Leverage		0.079 (0.255)		-0.119 (0.193)		0.094 (0.242)		-0.134 (0.192)
Observations	63	63	62	62	63	63	62	62
R-squared	0.162	0.338	0.007	0.177	0.104	0.326	0.013	0.171

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measures, grouped by real estate exposure. All variables are defined in Table A1 in the Appendix. The dependent variable is the annualized buy-and-hold returns from July 2007 to December 2008. In columns 1-4 the main variable of interest is $\Delta Sell$, which is the value of top-five executives' sell transactions that were held before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. In columns 5-8 the main variable of interest is $Sell$, which is the sum of top-five executives' dollar value of sell transactions in the period of 2005Q1-2006Q1 (in logs). The Real Estate Exposure of each bank is measured with the ratio of loans backed by real estate (obtained through FR-Y9C filings) to total assets. Columns 1-2 and 5-6 present results for banks with above-median real estate exposure and columns 3-4 and 7-8 show results for banks with below-median real estate exposure measure. Accounting control variables are measured at the end of the 2004 fiscal year end. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE 4
HETEROGENEOUS EFFECTS II: INFORMATION HIERARCHY

VARIABLES	(1) Crisis Return	(2) Crisis Return	(3) Crisis Return	(4) Crisis Return	(5) Crisis Return	(6) Crisis Return
$\Delta Sell$	-0.163*** (0.053)	-0.131** (0.052)				
$\Delta Sell_Independent\ Directors$			0.026 (0.035)	0.006 (0.040)		
$\Delta Sell_Middle\ Officers$					0.007 (0.157)	-0.019 (0.152)
Observations	170	170	170	170	170	170
R-squared	0.045	0.168	0.001	0.140	0.000	0.140
Bank Controls	NO	YES	NO	YES	NO	YES

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measure. All variables are defined in Table A1 in the Appendix. In columns 1-2 the main variable of interest is $\Delta Sell$, which is the value of top-five executives' sell transactions that were held before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. In columns 3-4 we use the same measure computed for independent directors ($\Delta Sell_Independent\ Directors$) and in columns 5-6 we use the measure computed for middle-officers ($\Delta Sell_Middle\ Officers$). Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE 5

PLACEBO TEST: PREDICT NEXT PERIOD RETURN

VARIABLES	(1) Return _{2006:M04-2006:M12}	(2) Return _{2006:M04-2006:M12}	(3) Return _{2006:M04-2006:M12}	(4) Return _{2006:M04-2006:M12}
ΔSell	-0.064 (0.048)	-0.067 (0.050)		
Sell			0.002 (0.007)	0.004 (0.007)
Return		0.160* (0.095)		0.135 (0.085)
Book-to-market		0.114 (0.077)		0.109 (0.078)
Log(market value)		0.011 (0.007)		0.013* (0.007)
Beta		-0.002 (0.037)		0.010 (0.040)
Leverage		0.006 (0.074)		-0.013 (0.082)
Observations	170	170	170	170
R-squared	0.040	0.081	0.001	0.042

This table shows results from cross-sectional regressions of buy-and-hold return from April to December 2006 on insider trading measure. All variables are defined in Table A1 in the Appendix. In columns 1-2 the main variable of interest is $\Delta Sell$, which is the value of top-five executives' sell transactions that were held before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. In columns 3-4 the main variable of interest is $Sell$, which is the sum of top-five executives' dollar value of sell transactions in the period of 2005Q1-2006Q1 (in logs). Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE 6

RISK EXPOSURE AND DIVIDEND REDUCTION: DID BANKS REDUCE RISK EXPOSURE AND PAYOUT?

VARIABLES	(1) Leverage ₂₀₀₆	(2) Dividend ₂₀₀₆	(3) Real Estate Exposure ₂₀₀₆	(4) Leverage ₂₀₀₆	(5) Dividend ₂₀₀₆	(6) Real Estate Exposure ₂₀₀₆
ΔSell	0.017 (0.015)	-0.008 (0.020)	-0.382 (1.088)			
Sell				0.007 (0.005)	-0.009 (0.008)	-0.317 (0.289)
Return	0.020 (0.075)	-0.060 (0.107)	1.321 (4.139)	0.012 (0.073)	-0.047 (0.104)	1.726 (4.110)
Book-to-market	0.083 (0.076)	0.010 (0.199)	3.807 (4.916)	0.086 (0.075)	0.011 (0.199)	3.276 (4.979)
log(market value)	0.014** (0.005)	0.015* (0.008)	-0.183 (0.395)	0.016*** (0.006)	0.012 (0.008)	-0.277 (0.391)
Beta	-0.014 (0.021)	0.031 (0.043)	0.624 (0.966)	-0.015 (0.021)	0.030 (0.043)	0.515 (0.998)
Leverage	0.768*** (0.056)			0.761*** (0.057)		
Dividend		0.718*** (0.105)			0.712*** (0.105)	
RE Exposure			0.939*** (0.028)			0.941*** (0.028)
Observations	170	170	121	170	170	121
R-squared	0.703	0.675	0.913	0.705	0.678	0.914

This table shows results from cross-sectional regressions of Leverage (columns 1 and 4), Dividend (columns 2 and 5) and Real Estate Exposure (columns 3 and 6) measured at the end of the 2006 fiscal year on insider trading measures. All variables are defined in Table A1 in the Appendix. In columns 1-3 the main variable of interest is Δ*Sell*, which is the value of top-five executives' sell transactions that were held before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. In columns 4-6 the main variable of interest is *Sell*, which is the sum of top-five executives' dollar value of sell transactions in the period of 2005Q1-2006Q1 (in logs). Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

APPENDIX

TABLE A1

DEFINITION OF VARIABLES

Variable	Calculation	Sources
Crisis return	The annualized buy-and-hold returns from July 2007 to December 2008.	CRSP Monthly Stock File
Crisis return(Jan07-Dec08)	The annualized buy-and-hold returns from January 2007 to December 2008.	CRSP Monthly Stock File
Crisis return(July07-Sept08)	The annualized buy-and-hold returns from July 2007 to September 2008.	CRSP Monthly Stock File
$Sell_i^{43}$	<p>The total value of top-five executives' sell transactions (as % of market capitalization) before the peak of the real estate prices in April 2006 (2005Q1-2006Q1).</p> $\sum_{t \in [2005:Q1-2006:Q1]} \frac{\$Sell_{i,t,k}}{Market\ capitalization_{i,t}} \times 100$ <p>where $\\$Sell_{i,t,k}$ is the value of each sell transaction (transaction price $\times$ number of shares sold) that were held on transaction day t by any top-five executives k of bank i and $Market\ capitalization_{i,t}$ is the market capitalization of bank i on transaction day t (price $\times$ shares outstanding). The period 2005Q1-2006Q1 refers to the period of January 3rd 2005 to March 31st 2006.</p>	Thomson Financial Insider Filings and CRSP Daily Stock file

⁴³ $Sell_Independent\ Directors$ and $Sell_Middle\ Officers$ are computed in the same way but using transactions of Independent Directors and Middle Officers, respectively.

$\Delta Sell_i^{44}$	<p>The total value of top-five executives' sell transactions (as % of market capitalization) before the peak of the real estate prices in April 2006 (2005Q1-2006Q1) minus the sales in the previous year of 2004.</p> $\sum_{t \in [2005:Q1-2006:Q1]} \frac{\$Sell_{i,t,k}}{Market\ capitalization_{i,t}} \times 100 - \sum_{t \in [2004:Q1-2004:Q4]} \frac{\$Sell_{i,t,k}}{Market\ capitalization_{i,t}} \times 100$ <p>where $\\$Sell_{i,t,k}$ is the value of each sell transaction (transaction price $\times$ number of shares sold) that were held on transaction day t by top-five executive k of bank i, and $Market\ capitalization_{i,t}$ is the market capitalization of bank i on transaction day t (price $\times$ shares outstanding). The period 2005Q1-2006Q1 refers to the period of January 3rd 2005 to March 31st 2006 and 2004Q1-2004Q4 refers to calendar year 2004.</p>	Thomson Financial Insider Filings and CRSP Daily Stock file
$\#Sell_i$	<p>The total number of top-five executives' sell transactions before the peak of the real estate prices in April 2006 (2005Q1-2006Q1).</p> $\sum_{t \in [2005:Q1-2006:Q1]} \#Sell_{i,t,k}$ <p>where $\#Sell_{i,t,k}$ is the number of sell transactions that took place on transaction day t by top-five executive k of bank i. The period 2005Q1-2006Q1 refers to the period of January 3rd 2005 to March 31st 2006.</p>	Thomson Financial Insider Filings
$\Delta \#Sell_i$	<p>The total number of top-five executives' sell transactions before the peak of the real estate prices in April 2006 (2005Q1-2006Q1) minus the total number of sell transactions in the previous year of 2004.</p> $\sum_{t \in [2005:Q1-2006:Q1]} \#Sell_{i,t,k} - \sum_{t \in [2004:Q1-2004:Q4]} \#Sell_{i,t,k}$ <p>where $\#Sell_{i,t,k}$ is the number of sell transactions that took place on transaction day t by top-five executive k of bank i. The period 2005Q1-2006Q1 refers to the period of January 3rd 2005 to March 31st 2006 and 2004Q1-2004Q4 refers to calendar year 2004.</p>	Thomson Financial Insider Filings
$Net\ Sell_i$	<p>The net value of top-five executives' sell transactions (as % of market capitalization) before the peak of the real estate prices in April 2006 (2005Q1-2006Q1).</p>	Thomson Financial Insider Filings and CRSP Daily Stock file

⁴⁴ $\Delta Sell_Independent\ directors$ and $\Delta Sell_Middle\ Officers$ are computed in the same way but using transactions of Independent Directors and Middle Officers, respectively.

	$\sum_{t \in [2005:Q1-2006:Q1]} \frac{\$Sell_{i,t,k} - \$Buy_{i,t,k}}{Market\ capitalization_{i,t}} \times 100$ <p>where $\\$Sell_{i,t,k}$ is the value of each sell transaction (transaction price $\times$ number of shares sold) that took place on transaction day t by top-five executive k of bank i. $\\$Buy_{i,t,k}$ is the value of each buy transaction (transaction price $\times$ number of shares purchased) that took place on transaction day t by top-five executive k of bank i. Market capitalization$_{i,t}$ is the market capitalization of bank i on transaction day t (price $\times$ shares outstanding). The period 2005Q1-2006Q1 refers to the period of January 3rd 2005 to March 31st 2006 and 2004Q1-2004Q4 refers to calendar year 2004.</p>	
$\Delta NetSell_i$	<p>The net value of top-five executives' sell transactions (as % of market capitalization) before the peak of the real estate prices in April 2006 (2005Q1-2006Q1) minus the net sales in the previous year of 2004.</p> $\sum_{t \in [2005:Q1-2006:Q1]} \frac{\$Sell_{i,t,k} - \$Buy_{i,t,k}}{Market\ capitalization_{i,t}} \times 100$ <p style="text-align: center;">-</p> $\sum_{t \in [2004:Q1-2004:Q4]} \frac{\$Sell_{i,t,k} - \$Buy_{i,t,k}}{Market\ capitalization_{i,t}} \times 100$ <p>where $\\$Sell_{i,t,k}$ is the value of each sell transaction (transaction price $\times$ number of shares sold) that took place on transaction day t by top-five executive k of bank i. $\\$Buy_{i,t,k}$ is the value of each buy transaction (transaction price $\times$ number of shares purchased) that took place on transaction day t by top-five executive k of bank i. Market capitalization$_{i,t}$ is the market capitalization of bank i on transaction day t (price $\times$ shares outstanding). The period 2005Q1-2006Q1 refers to the period of January 3rd 2005 to March 31st 2006 and 2004Q1-2004Q4 refers to calendar year 2004.</p>	Thomson Financial Insider Filings and CRSP Daily Stock file
$\Delta Sell_{option}$	<p>The total value of top-five executives' sell transactions (as % of market capitalization) related to options exercise before the peak of the real estate prices in April 2006 (2005Q1-2006Q1) minus the sales related to option exercise in 2004.</p> $\sum_{t \in [2005:Q1-2006:Q1]} \frac{\$Sell_{option\ i,t,k}}{Market\ capitalization_{i,t}} \times 100 - \sum_{t \in [2004:Q1-2004:Q4]} \frac{\$Sell_{option\ i,t,k}}{Market\ capitalization_{i,t}} \times 100$ <p>where $\\$Sell_{option\ i,t,k}$ is the value of each sell transaction (transaction price $\times$ number of shares sold) related to options exercise that took place on transaction day t by top-five executive k of bank i, and Market capitalization$_{i,t}$ is the market</p>	Thomson Financial Insider Filings and CRSP Daily Stock file

	capitalization of bank i on transaction day t (price $\times$ shares outstanding). The period 2005Q1-2006Q1 refers to the period of January 3rd 2005 to March 31st 2006 and 2004Q1-2004Q4 refers to calendar year 2004.	
$\Delta Sell_{non-option}$	<p>The total value of top-five executives' sell transactions (as % of market capitalization) not related to options exercise before the peak of the real estate prices in April 2006 (2005Q1-2006Q1) minus the sales not related to option exercise in the previous year of 2004.</p> $\sum_{t \in [2005:Q1-2006:Q1]} \frac{\$Sell_{non-option_{i,t,k}}}{Market\ capitalization_{i,t}} \times 100 - \sum_{t \in [2004:Q1-2004:Q4]} \frac{\$Sell_{non-option_{i,t,k}}}{Market\ capitalization_{i,t}} \times 100$ <p>where $\\$Sell_{non-option_{i,t,k}}$ is the value of each sell transaction (transaction price $\times$ number of shares sold) not related to options exercise that took place on transaction day t by top-five executive k of bank i and $Market\ capitalization_{i,t}$ is the market capitalization of bank i on transaction day t (price $\times$ shares outstanding). The period 2005Q1-2006Q1 refers to the period of January 3rd 2005 to March 31st 2006 and 2004Q1-2004Q4 refers to calendar year 2004.</p>	Thomson Financial Insider Filings and CRSP Daily Stock file
Beta	Bank's equity beta is obtained from a weekly market model of daily returns from January 2003 to December 2004, where the market is represented by a value-weighted CRSP index.	CRSP Daily Stock file
Book-to-market	<p>The ratio of equity book value to equity market value.</p> $\frac{Equity\ book\ value\ (ceq)}{Equity\ market\ value} \times 100$ <p>Market value of common equity is equal to ($prcc_f \times csho$), where $prcc_f$ is the close price for the fiscal year and $csho$ is the common shares outstanding at the end of fiscal year (in million \$).</p>	Compustat
Dividend	<p>The ratio of total dividends (common and preferred) to total assets.</p> $\frac{Common\ dividends\ (dvc) + Preferred\ dividends\ (dvp)}{Total\ assets\ (at)} \times 100$	Compustat
Leverage	The ratio of long term debt and debt in current liabilities to stockholders' equity, long term debt, and debt in current liabilities.	Compustat

	$\frac{\text{Long term debt}(dltt) + \text{Debt in current liabilities}(dlc)}{\text{Long term debt}(dltt) + \text{Debt in current liabilities}(dlc) + \text{Shareholders' equity}(seq)} \times 100$	
Leverage (Acharya et al., 2010)	<p>Quasi-market value of assets divided by the market value of equity.</p> $\frac{\text{Asset book value}(at) - \text{Equity book value}(ceq) + \text{Equity market value}}{\text{Equity market value}} \times 100$ <p>Equity market value is equal to (prcc_f × csho), where prcc_f is the close price for the fiscal year and csho is the common shares outstanding at the end of fiscal year (in million\$).</p>	Compustat
Liquidity	<p>The ratio of cash to total assets.</p> $\frac{\text{Cash and short term investments}(che)}{\text{Total assets}(at)} \times 100$	Compustat
Loan growth ⁴⁵	Annualized growth rate of total loans (lntal).	Compustat Bank Fundamentals
Market value	Equity market value is equal to (prcc_f × csho), where prcc_f is the close price for the fiscal year and csho is the common shares outstanding at the end of fiscal year (in million\$).	Compustat
NPL	<p>Non-performing loans is defined as the ratio of non-performing loans to total assets (total loans net of total allowance for loan losses).</p> $\frac{\text{Non performing loans}(npat)}{\text{Loans net of total allowance for loan losses}(lntal)} \times 100$	Compustat Bank Fundamentals
RE Beta ₂₅	RE Beta ₂₅ is computed for each bank by running separate OLS regressions of ROA changes on house price growth in each state, using house price increases in the 25 states that experienced the most severe house price growth during the boom period (2002-2005). The average of the coefficients on house price growth is used as a proxy, named RE Beta ₂₅ . The housing price index for each state is obtained from the Federal Housing Finance Agency (FHFA).	Compustat Bank Fundamentals, Federal Housing Finance Agency.
RE Beta ₁₇	RE Beta ₁₇ is computed for each bank by running separate OLS regressions of ROA changes on house price growth in each state, using house price increases in the 17 states that experienced the most severe house price growth during the	Compustat Bank Fundamentals,

⁴⁵ The growth rate of total loans is computed over different periods. Loan growth₀₁₀₅ Loan growth₀₂₀₅, Loan growth₀₁₀₄ , Loan growth₀₂₀₄ are the annualized growth rates of total loans from 2001 to 2005, from 2002 to 2005, from 2001 to 2004 and from 2002 to 2004, respectively.

	boom period (2002-2005). The average of the coefficients on house price growth is used as a proxy, named RE Beta ₁₇ . The housing price index for each state is obtained from the Federal Housing Finance Agency (FHFA).	Federal Housing Finance Agency.
Real Estate Exposure	<p>The ratio of loans backed by real estate to total assets.</p> $\frac{\text{Loans backed by real estate (BHCK1410)}}{\text{Total assets (BHCK2170)}} \times 100$	U.S. Federal Reserve FRY-9C Report (obtained from the Wharton Research Data Services (WRDS) Bank Regulatory Database)
Return	Return in calendar year 2004.	CRSP Monthly Stock file
Return _{2006:M04:2006:M12}	The buy-and-hold return from April to December 2006.	CRSP Monthly Stock file
ROA growth ⁴⁶	Annualized growth rate of ROA (Return on assets). Return on assets is defined as the ratio of net income (ni) to total assets (at).	Compustat Bank Fundamentals
SBC	SBC, stock-based compensation, is the sum of the value of the restricted stock grant during that year (ExecuComp item: rstkgmnt) and the aggregate value of stock options granted to the executive during the year, valued using S&P's Black Scholes methodology (ExecuComp item: option_awards_blk_value). This variable is available at the executive-bank-year level in ExecuComp database. For a given bank, we take the average of the variables over years 2000-2004.	ExecuComp
TCE ratio	<p>Tangible common equity ratio is defined as</p> $\frac{\text{Tangible common equity (ceqt)}}{\text{Tangible assets}} \times 100$ <p>where tangible assets is defined as total assets(at) - intangible assets(intan).</p>	Compustat
TDC1	TDC1 (Total direct compensation) is taken directly from ExecuComp database, and is defined as: Salary, Bonus, Other Annual, Total Value of Restricted Stock Granted, Total Value of Stock Options Granted (using Black-Scholes), Long-	ExecuComp

⁴⁶ The growth rate of ROA is computed over different periods. ROA growth₀₁₀₅, ROA growth₀₂₀₅, ROA growth₀₁₀₄, ROA growth₀₂₀₄ are the annualized growth rates of return on assets (ROA) from 2001 to 2005, from 2002 to 2005, from 2001 to 2004 and from 2002 to 2004, respectively.

	Term Incentive Payouts, and All Other Total. This variable is available at the executive-bank-year level in ExecuComp database. For a given bank, we take the average of the variable over the years 2000-2004.	
Tier 1 capital ratio	Tier 1 capital ratio as reported in Compustat Bank. Data item <i>capr1</i> .	Compustat Bank Fundamentals
Total assets	Total book assets (in million \$). Data item <i>at</i> .	Compustat
Total liabilities	Total book liabilities (in million \$). Data item <i>lt</i> .	Compustat

TABLE A2
SUMMARY STATISTICS OF VARIABLES ONLY USED IN APPENDIX

	Obs.	25% quantile	Median	75% quantile	Mean	Std. Dev.
Crisis return (Jan07-Dec08)	170	-0.47	-0.24	-0.04	-0.27	0.28
Crisis return (July07-Sept08)	170	-0.52	-0.18	0.09	-0.22	0.39
Δ #Sell	170	-1.00	1.00	3.00	1.56	8.45
#Sell	170	1.00	3.00	6.00	5.42	10.98
Δ Net Sell	170	-0.04	0.03	0.15	0.03	0.44
Net Sell	170	0.03	0.11	0.32	0.26	0.47
Δ Sell _{non-option}	170	0.00	0.00	0.08	0.02	0.33
Δ Sell _{option}	170	0.00	0.00	0.06	0.03	0.30
Sell _{immediatelybefore}	170	0.00	0.04	0.15	0.12	0.21
Leverage _{Acharya et al., 2010}	170	4.94	5.86	7.01	6.38	2.59
Liquidity	170	2.25	3.11	5.45	5.07	5.42
NPL	157	0.30	0.54	0.80	0.64	0.53
TCE ratio	166	6.10	7.30	8.76	8.00	5.10
Tier 1 capital ratio	131	9.67	10.94	12.34	11.42	3.05
Leverage ₂₀₀₆	170	0.49	0.60	0.70	0.59	0.18
Leverage ₂₀₀₇	157	0.53	0.63	0.72	0.62	0.16
Dividend ₂₀₀₆	170	0.25	0.39	0.54	0.42	0.27
Dividend ₂₀₀₇	157	0.26	0.40	0.54	0.43	0.28
Real Estate Exposure ₂₀₀₆	122	40.73	50.94	60.26	50.51	15.83
Real Estate exposure ₂₀₀₇	119	41.34	51.04	62.39	51.66	16.60
ROA growth ₀₁₀₅	153	-2.87	1.19	4.89	1.80	10.80
ROA growth ₀₂₀₅	156	-6.14	-0.98	2.99	-1.44	12.63
ROA growth ₀₁₀₄	155	-3.37	1.49	6.68	2.25	14.86
ROA growth ₀₂₀₄	156	-8.15	-1.95	2.39	-3.42	13.15
Loan growth ₀₁₀₅	158	6.44	11.35	15.60	12.06	8.93
Loan growth ₀₂₀₅	158	5.97	9.28	13.01	10.21	7.36
Loan growth ₀₁₀₄	158	3.97	7.56	12.13	8.37	7.24
Loan growth ₀₂₀₄	158	3.44	6.16	9.25	6.59	5.69
RE Beta ₂₅	170	-1.15	0.16	1.71	0.03	17.85
RE Beta ₁₇	170	-1.06	0.27	3.08	10.32	52.76

Descriptive statistics of variables only used in Appendix. All variables are defined in Table A1 in the Appendix. Leverage_{Acharya et al., 2010}, Liquidity, NPL, TCE ratio and Tier 1 capital ratio are measured at the end of the 2004 fiscal year. Leverage₂₀₀₆, Dividend₂₀₀₆ and Real Estate Exposure₂₀₀₆ are measured at the end of the 2006 fiscal year and Leverage₂₀₀₇, Dividend₂₀₀₇ and Real Estate Exposure₂₀₀₇ measured at the end of the 2007 fiscal year.

TABLE A3

ROBUSTNESS: ALTERNATIVE PERIODS FOR FINANCIAL CRISIS

VARIABLES	(1) Crisis return (Jan07-Dec08)	(2) Crisis return (Jan07-Dec08)	(3) Crisis return (July07-Sept08)	(4) Crisis return (July07-Sept08)	(5) Crisis return (Jan07-Dec08)	(6) Crisis return (Jan07-Dec08)	(7) Crisis return (July07-Sept08)	(8) Crisis return (July07-Sept08)
ΔSell	-0.133*** (0.045)	-0.112*** (0.042)	-0.176*** (0.060)	-0.129** (0.056)				
Sell					-0.036** (0.015)	-0.039*** (0.014)	-0.056*** (0.020)	-0.057*** (0.019)
Return		-0.417*** (0.125)		-0.492*** (0.182)		-0.372*** (0.126)		-0.418** (0.180)
Book-to-market		-0.475*** (0.170)		-0.646*** (0.234)		-0.488*** (0.167)		-0.662*** (0.227)
Log(market value)		-0.029** (0.013)		-0.041** (0.019)		-0.041*** (0.014)		-0.059*** (0.020)
Beta		0.025 (0.045)		0.143* (0.073)		0.034 (0.043)		0.150** (0.070)
Leverage		-0.206* (0.117)		-0.285* (0.151)		-0.169 (0.112)		-0.223 (0.145)
Observations	170	170	170	170	170	170	170	170
R-squared	0.044	0.163	0.041	0.177	0.042	0.174	0.056	0.204

This table shows results from cross-sectional regressions of bank crisis period performance computed over alternative periods on insider trading measures. All variables are defined in Table A1 in the Appendix. In columns 1-2 and 5-6 bank's crisis period performance is defined as the annualized buy-and-hold return from January 2007 to December 2008, and in columns 3-4 and 7-8 the bank's crisis period performance is defined as the annualized buy-and-hold return from July 2007 to September 2008. In columns 1-4 the main variable of interest is $\Delta Sell$, which is the value of top-five executives' sell transactions that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. In columns 5-8 the main variable of interest is $Sell$, which is the sum of top-five executives' dollar value of sell transactions in the period of 2005Q1-2006Q1 (in logs). Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE A4

ROBUSTNESS: ALTERNATIVE MEASURES OF INSIDER TRADING

VARIABLES	(1) Crisis return	(2) Crisis return	(3) Crisis return	(4) Crisis return	(5) Crisis return	(6) Crisis return	(7) Crisis return	(8) Crisis return
$\Delta\#Sell$	-0.016*** (0.004)	-0.012*** (0.004)						
$\#Sell$			-0.011*** (0.004)	-0.008* (0.004)				
$\Delta NetSell$					-0.161** (0.071)	-0.123* (0.066)		
$NetSell$							-0.154** (0.060)	-0.121** (0.059)
Return		-0.369** (0.163)		-0.389** (0.166)		-0.445*** (0.157)		-0.390** (0.160)
Book-to-market		-0.565*** (0.185)		-0.582*** (0.190)		-0.587*** (0.193)		-0.586*** (0.191)
Log(market value)		-0.040*** (0.015)		-0.041*** (0.015)		-0.043*** (0.015)		-0.047*** (0.015)
Beta		0.105* (0.059)		0.116* (0.060)		0.100 (0.062)		0.106* (0.060)
Leverage		-0.168 (0.144)		-0.174 (0.144)		-0.195 (0.143)		-0.168 (0.141)
Observations	170	170	170	170	170	170	170	170
R-squared	0.066	0.174	0.034	0.154	0.032	0.158	0.035	0.159

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measures. All variables are defined in Table A1 in the Appendix. In columns 1-2 the main variable of interest is $\Delta\#Sell$, which is the number of sell transactions that were held before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the number of sell transactions in 2004. In columns 3-4 the main variable of interest is $\#Sell$, which is the number of sell transactions that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1). In columns 5-6 the main variable of interest is $\Delta NetSell$, which is the net value of sell transactions (sell minus buy) that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the net value of sell transactions (sell minus buy) in 2004. In columns 7-8 the main variable of interest is $NetSell$, which is the net value of sell transactions (sell minus buy) that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1). Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. All insider trading measures are winsorized at 2% and 98%. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE A5

ROBUSTNESS: CONTROL FOR LEVERAGE (Acharya et al., 2010), TCE RATIO, TIER 1, NPL and LIQUIDITY

VARIABLES	(1) Crisis return	(2) Crisis return	(3) Crisis return	(4) Crisis return	(5) Crisis return	(6) Crisis return	(7) Crisis return	(8) Crisis return	(9) Crisis return	(10) Crisis return
ΔSell	-0.136** (0.054)	-0.137*** (0.048)	-0.154** (0.065)	-0.155*** (0.051)	-0.134** (0.052)	-0.215*** (0.070)	-0.232*** (0.071)	-0.169** (0.065)	-0.211*** (0.066)	-0.210*** (0.069)
Return	-0.399*** (0.151)	-0.396** (0.157)	-0.253 (0.207)	-0.314* (0.162)	-0.411*** (0.156)	-0.175 (0.205)	-0.178 (0.198)	-0.217 (0.216)	-0.137 (0.212)	-0.125 (0.192)
Book-to-market	-0.373* (0.200)	-0.594*** (0.194)	-0.232 (0.219)	-0.423** (0.201)	-0.621*** (0.185)	-0.307 (0.342)	-0.419 (0.276)	-0.361 (0.268)	-0.304 (0.289)	-0.396 (0.275)
Log(market value)	-0.046*** (0.013)	-0.051*** (0.015)	-0.000 (0.019)	-0.027 (0.017)	-0.046*** (0.015)	-0.030* (0.018)	-0.032* (0.018)	-0.003 (0.020)	-0.015 (0.019)	-0.021 (0.017)
Beta	0.080 (0.060)	0.106* (0.062)	0.075 (0.064)	0.092 (0.061)	0.090 (0.062)	0.097 (0.062)	0.112* (0.064)	0.082 (0.065)	0.098 (0.063)	0.099 (0.063)
Leverage	-0.031*** (0.010)					-0.017 (0.025)				
TCE ratio		-0.001 (0.007)					-0.005 (0.016)			
Tier 1 capital ratio			0.026*** (0.010)					0.022** (0.009)		
NPL				-0.006 (0.045)					-0.045 (0.054)	
Liquidity					-0.004 (0.004)					-0.008 (0.005)
Observations	170	166	131	157	170	125	122	120	122	125
R-squared	0.197	0.155	0.156	0.111	0.163	0.132	0.141	0.142	0.118	0.142

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measures, with different bank controls and for different samples of banks. All variables are defined in Table A1 in the Appendix. The main variable of interest is Δ*Sell*, which is the value of top-five executives' sell transactions that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. Columns 1-5 present results using the full sample and columns 6-10 present results with the subsample of bank holding companies that filed Y-9 reports with the Federal Reserve in 2004. Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE A6

ROBUSTNESS: EXCLUDING DELISTED BANKS

VARIABLES	(1) Crisis Return	(2) Crisis Return	(3) Crisis Return	(4) Crisis Return
ΔSell	-0.195*** (0.058)	-0.166*** (0.056)	-0.148** (0.060)	-0.146** (0.060)
Return		-0.317* (0.170)	-0.331** (0.165)	-0.334** (0.163)
Book-to-market		-0.598*** (0.195)	-0.523*** (0.197)	-0.512** (0.203)
Log(market value)		-0.025* (0.013)	-0.031** (0.014)	-0.029* (0.015)
Beta			0.091 (0.060)	0.092 (0.060)
Leverage				-0.038 (0.148)
Observations	145	145	145	145
R-squared	0.066	0.132	0.146	0.147

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measures after excluding banks that are delisted between July 2007 and December 2008. All variables are defined in Table A1 in the Appendix. The main variable of interest is ΔSell , which is the value of top-five executives' sell transactions that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE A7

ROBUSTNESS: “THE DOG THAT DID NOT BARK” REGRESSION

VARIABLES	(1) Crisis return	(2) Crisis return	(3) Crisis return
Sell	-0.046*** (0.017)		-0.053*** (0.019)
Sell _{immediatelybefore}		0.005 (0.145)	0.148 (0.152)
Return	-0.375** (0.156)	-0.461*** (0.159)	-0.369** (0.156)
Book-to-market	-0.600*** (0.189)	-0.595*** (0.193)	-0.591*** (0.185)
Log(market value)	-0.057*** (0.016)	-0.042*** (0.015)	-0.058*** (0.016)
Beta	0.102* (0.058)	0.114* (0.061)	0.103* (0.058)
Leverage	-0.152 (0.136)	-0.222 (0.145)	-0.174 (0.138)
Observations	170	170	170
R-squared	0.179	0.140	0.186

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measures. All variables are defined in Table A1 in the Appendix. The main variable of interest is *Sell_{immediatelybefore}*, which is the sum of top-five executives' dollar value of sell transactions immediately preceding the financial crisis (2006Q2-2007Q2) in logs. Accounting control variables are measured at the end of the 2005 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE A8

ROBUSTNESS: EXCLUDING SALES RELATED TO OPTIONS EXERCISE

VARIABLES	(1) Crisis return	(2) Crisis return	(3) Crisis return	(4) Crisis return	(5) Crisis return	(6) Crisis return	(7) Crisis return	(8) Crisis return
$\Delta Sell_{non-option}$	-0.192*** (0.056)	-0.177*** (0.055)	-0.170*** (0.051)	-0.166*** (0.050)				
$\Delta Sell_{option}$					-0.127 (0.095)	-0.112 (0.085)	-0.089 (0.093)	-0.081 (0.094)
Return		-0.432*** (0.160)	-0.439*** (0.153)	-0.442*** (0.154)		-0.437** (0.169)	-0.446*** (0.161)	-0.449*** (0.160)
Book-to-market		-0.725*** (0.179)	-0.632*** (0.185)	-0.578*** (0.190)		-0.742*** (0.181)	-0.653*** (0.189)	-0.598*** (0.194)
Log(market value)		-0.042*** (0.013)	-0.051*** (0.014)	-0.043*** (0.015)		-0.042*** (0.014)	-0.050*** (0.014)	-0.043*** (0.015)
Beta			0.106* (0.059)	0.106* (0.060)			0.103 (0.063)	0.104 (0.063)
Leverage				-0.208 (0.142)				-0.211 (0.143)
Observations	170	170	170	170	170	170	170	170
R-squared	0.035	0.139	0.155	0.165	0.012	0.120	0.134	0.145

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measures. All variables are defined in Table A1 in the Appendix. In columns 1–4 the main variable of interest is $\Delta Sell_{non-option}$, which is the value of top-five executives' sales not related to options exercise before the peak of the real estate prices in April 2006 (2005Q1–2006Q1), minus the sales not related to options exercise in 2004. In columns 5–8 the main variable of interest is $\Delta Sell_{option}$, which is the value of top-five executives' sales related to options exercise before the peak of the real estate prices in April 2006 (2005Q1–2006Q1), minus the sales related to options exercise in 2004. Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE A9

ROBUSTNESS: CONTROL FOR EXECUTIVE COMPENSATION DURING BOOM PERIOD

Panel A: Summary Statistics of Subsample

	Obs.	25% quantile	Median	75% quantile	Mean	Std. Dev.
Crisis return	44	-0.68	-0.313	-0.09	-0.37	0.34
Δ Sell	44	-0.00	0.023	0.10	0.02	0.29
Total assets	44	7016.29	21156.239	97518.82	121206.47	256108.79
Total liabilities	44	6190.18	19772.212	87583.08	112070.83	237853.06
Market value	44	1626.47	3170.790	22247.93	19726.50	42077.77
Book-to-market	44	0.37	0.463	0.54	0.46	0.12
Return _{2006:M04-2006:M12}	44	0.00	0.065	0.13	0.06	0.09
Return	44	0.09	0.126	0.19	0.13	0.11
Beta	44	0.76	0.939	1.15	0.99	0.30
Leverage	44	0.61	0.697	0.79	0.67	0.18
Dividend	44	0.33	0.473	0.68	0.50	0.28
Real Estate Exposure	31	27.49	38.603	48.41	37.21	14.07
TDC1	44	1367.63	2794.238	7240.23	5784.78	6948.29
SBC	44	442.90	1261.694	4668.09	3216.34	4334.98

This table reports summary statistics for the subsample that we are able to match with Executive Compensation Database (ExecuComp) during years of 2000-2004. All variables are defined in Table A1 in the Appendix.

Panel B: Result

VARIABLES	(1) Crisis return	(2) Crisis return	(3) Crisis return	(4) Crisis return
$\Delta Sell$	-0.131** (0.052)	-0.316*** (0.098)	-0.385*** (0.105)	-0.335*** (0.096)
Return	-0.428*** (0.156)	-0.101 (0.420)	0.088 (0.449)	-0.065 (0.443)
Book-to-market	-0.585*** (0.191)	-1.152*** (0.358)	-1.043*** (0.360)	-1.122*** (0.358)
Log(market value)	-0.043*** (0.015)	-0.041 (0.032)	0.019 (0.041)	0.005 (0.041)
Beta	0.091 (0.062)	-0.087 (0.156)	0.034 (0.163)	-0.004 (0.157)
Leverage	-0.196 (0.142)	-0.597** (0.264)	-0.413 (0.265)	-0.430 (0.280)
TDC1			-0.000** (0.000)	
SBC				-0.000* (0.000)
Observations	170	44	44	44
R-squared	0.168	0.511	0.548	0.535

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measures. All variables are defined in Table A1 in the Appendix. The main variable of interest is $\Delta Sell$, which is the value of top-five executives' sell transactions that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. Column 1 is the same as Column 4 of Table 2 in the paper. Column 2 replicates Column 4 of Table 2 with the restricted sample. Column 3 and 4 include new control variables related to executive compensation (*TDC1* and *SBC*, respectively). Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE A10: RISK EXPOSURE AND DIVIDEND REDUCTION

ROBUSTNESS: YEAR OF MEASUREMENT

VARIABLES	(1) Leverage ₂₀₀₇	(2) Dividend ₂₀₀₇	(3) Real Estate Exposure ₂₀₀₇	(4) Leverage ₂₀₀₇	(5) Dividend ₂₀₀₇	(6) Real Estate Exposure ₂₀₀₇
ΔSell	0.004 (0.019)	0.001 (0.024)	-0.008 (1.509)			
Sell				0.007 (0.005)	0.000 (0.008)	-0.061 (0.346)
Return	0.063 (0.085)	0.104 (0.135)	6.495 (4.702)	0.052 (0.084)	0.104 (0.133)	6.563 (4.719)
Book-to-market	0.060 (0.080)	0.103 (0.211)	4.249 (6.135)	0.059 (0.079)	0.103 (0.211)	4.159 (6.079)
Log(market value)	0.018*** (0.006)	0.016** (0.008)	-0.638 (0.412)	0.020*** (0.007)	0.016* (0.009)	-0.660 (0.434)
Beta	-0.017 (0.026)	0.018 (0.047)	-0.012 (1.196)	-0.017 (0.025)	0.018 (0.045)	-0.037 (1.207)
Leverage	0.615*** (0.064)			0.606*** (0.064)		
Dividend		0.808*** (0.108)			0.808*** (0.109)	
Real Estate Exposure			0.921*** (0.034)			0.922*** (0.034)
Observations	157	157	117	157	157	117
R-squared	0.572	0.670	0.887	0.576	0.670	0.887

This table shows results from cross-sectional regressions of Leverage (column 1 and 4), Dividend (column 2 and 5) and Real Estate Exposure (column 3 and 6) as of 2007 fiscal year end on insider trading measures. All variables are defined in Table A1 in the Appendix. In columns 1-3 the main variable of interest is *ΔSel*, which is the value of top-five executives' sell transactions that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. In columns 4-6 the main variable of interest is *Sell*, which is the sum of top-five executives' dollar value of sell transactions in the period of 2005Q1-2006Q1 (in logs). Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE A11: RISK EXPOSURE AND DIVIDEND REDUCTION

ROBUSTNESS: TYPE OF INSIDER – INDEPENDENT DIRECTORS AND MIDDLE OFFICERS

VARIABLES	(1) Leverage ₂₀₀₆	(2) Dividend ₂₀₀₆	(3) Real Estate Exposure ₂₀₀₆	(4) Leverage ₂₀₀₆	(5) Dividend ₂₀₀₆	(6) Real Estate Exposure ₂₀₀₆
ΔSell_Independent Directors	-0.000 (0.013)	-0.016 (0.012)	0.346 (1.017)			
ΔSell_Middle Officers				0.015 (0.047)	0.051 (0.058)	-1.787 (3.405)
Return	0.025 (0.074)	-0.065 (0.107)	1.295 (4.148)	0.027 (0.074)	-0.051 (0.106)	1.182 (4.118)
Book-to-market	0.085 (0.076)	0.006 (0.201)	3.748 (5.000)	0.085 (0.076)	0.011 (0.199)	3.698 (4.943)
log(market value)	0.014** (0.006)	0.014* (0.008)	-0.180 (0.399)	0.014** (0.005)	0.014* (0.008)	-0.199 (0.400)
Beta	-0.017 (0.021)	0.035 (0.042)	0.596 (0.948)	-0.017 (0.021)	0.033 (0.042)	0.556 (0.975)
Leverage	0.771*** (0.057)			0.772*** (0.056)		
Dividend		0.715*** (0.106)			0.724*** (0.103)	
RE Exposure			0.939*** (0.029)			0.937*** (0.029)
Observations	170	170	121	170	170	121
R-squared	0.701	0.676	0.913	0.702	0.676	0.913

This table shows results from cross-sectional regressions of Leverage (column 1 and 4), Dividend (column 2 and 5) and Real Estate Exposure (column 3 and 6) as of 2006 fiscal year end on insider trading measures. All variables are defined in Table A1 in the Appendix. In columns 1-3 the main variable of interest is *ΔSell_Independent Directors*, which is the value of independent directors' sell transactions that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. In columns 4-6 the main variable of interest is *ΔSell_Middle Officers*, which is the value of middle officers' sell transactions that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus their sales in 2004. Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE A12: ROBUSTNESS: CONTROL FOR LOAN GROWTH AND PROFIT CHANGES DURING BOOM PERIOD

VARIABLES	(1) Crisis return	(2) Crisis return	(3) Crisis return	(4) Crisis return	(5) Crisis return	(6) Crisis return	(7) Crisis return	(8) Crisis return
ΔSell	-0.123** (0.048)	-0.114** (0.046)	-0.147*** (0.050)	-0.141*** (0.048)	-0.178*** (0.055)	-0.160*** (0.057)	-0.201*** (0.059)	-0.194*** (0.058)
Return	-0.045 (0.181)	-0.097 (0.157)	-0.056 (0.172)	-0.071 (0.185)	0.085 (0.185)	0.123 (0.183)	-0.005 (0.207)	-0.006 (0.200)
Book-to-market	-0.638*** (0.232)	-0.624*** (0.220)	-0.471** (0.207)	-0.432** (0.210)	-0.529** (0.235)	-0.531** (0.230)	-0.417* (0.249)	-0.436* (0.242)
Log(market value)	-0.025 (0.018)	-0.024 (0.016)	-0.022 (0.017)	-0.019 (0.018)	-0.044** (0.022)	-0.043** (0.021)	-0.050** (0.023)	-0.047** (0.022)
Beta	0.080 (0.062)	0.092 (0.060)	0.084 (0.063)	0.093 (0.060)	0.071 (0.065)	0.074 (0.062)	0.070 (0.066)	0.068 (0.064)
Leverage	-0.195 (0.141)	-0.210 (0.139)	-0.133 (0.142)	-0.132 (0.138)	0.005 (0.154)	-0.026 (0.152)	0.064 (0.156)	0.061 (0.158)
ROA growth ₀₁₀₅	-0.002 (0.003)				-0.002 (0.003)			
Loan growth ₀₁₀₅	-0.014*** (0.003)				-0.009*** (0.003)			
ROA growth ₀₂₀₅		-0.003* (0.002)				-0.005* (0.003)		
Loan growth ₀₂₀₅		-0.016*** (0.003)				-0.013*** (0.004)		
ROA growth ₀₁₀₄			-0.001 (0.002)				0.001 (0.002)	
Loan growth ₀₁₀₄			-0.014*** (0.004)				-0.004 (0.005)	
ROA growth ₀₂₀₄				-0.002 (0.002)				-0.001 (0.002)
Loan growth ₀₂₀₄				-0.017*** (0.004)				-0.006 (0.006)
Re Exposure					-0.006*** (0.002)	-0.006*** (0.002)	-0.007*** (0.002)	-0.007*** (0.002)
Observations	153	156	155	156	121	122	122	123
R-squared	0.214	0.225	0.176	0.179	0.288	0.309	0.243	0.245

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measures, controlling for loan growth and past profit changes during boom period. The main variable of interest is Δ*Sell*, which is the value of top-five executives' sell transactions that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. Columns 1-4 we replicate Column 4 of Table 2, including the growth of Return on assets (ROA) and growth of Loans computed over different periods. In columns 5-8 we replicate Column 1-4 by adding our real estate loan measure. Accounting control variables are measured at the end of the 2004 fiscal year. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE A13

ROBUSTNESS: RESULTS WITH ALTERNATIVE REAL ESTATE EXPOSURE MEASURE

Panel A: Results with RE Beta₂₅ and RE Beta₁₇

VARIABLES	HighExposure (1) Crisis return	HighExposure (2) Crisis return	HighExposure (3) Crisis return	LowExposure (4) Crisis return	LowExposure (5) Crisis return	LowExposure (6) Crisis return
ΔSell	-0.224*** (0.083)	-0.231*** (0.080)	-0.235*** (0.080)	-0.090 (0.095)	-0.053 (0.077)	-0.052 (0.075)
Log (market value)	-0.054** (0.025)	-0.059** (0.023)	-0.051** (0.023)	-0.048* (0.026)	-0.031 (0.022)	-0.039* (0.022)
Book-to-market	-0.870*** (0.301)	-0.554* (0.296)	-0.367 (0.277)	-0.089 (0.375)	-0.649** (0.303)	-0.692** (0.302)
Return	-0.223 (0.214)	-0.394 (0.243)	-0.247 (0.230)	0.055 (0.293)	-0.546** (0.235)	-0.616*** (0.221)
Beta	-0.074 (0.086)	0.108 (0.089)	0.145 (0.090)	0.199** (0.092)	0.110 (0.096)	0.115 (0.095)
Leverage	0.079 (0.255)	-0.050 (0.186)	-0.067 (0.176)	-0.119 (0.193)	-0.334 (0.209)	-0.329 (0.215)
RE Exposure	-0.015*** (0.004)			-0.001 (0.005)		
RE Beta ₂₅		-0.000 (0.003)			0.002 (0.002)	
RE Beta ₁₇			-0.001 (0.000)			0.007 (0.005)
Observations	63	85	85	62	85	85
R-squared	0.338	0.208	0.202	0.177	0.185	0.209

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measures, using new real estate exposure measures (replicates Table 3 in the paper). The main variable of interest is $\Delta Sell$, which is the value of top-five executives' sell transactions that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. All variables are defined in Table A1 in the Appendix. Columns 1-3 presents results for banks with real estate exposure measure above the median and Columns 4-6 show results for banks with real estate exposure measure below the median. Column 1 and Column 4 are the same as Column 2 and Column 4 of Table 3. In Column 2 and Column 5 we use the new real estate exposure RE Beta₂₅, computed using the 25 states that experienced the most severe house price growth during the boom period (2002-2005). Column 3 and Column 6 presents results with the new real estate exposure measure RE Beta₁₇, computed using the 17 states that experienced the most severe house price growth during the boom period (2002-2005). The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Panel B: Results with RE Beta₂₅ × RE Exposure and RE Beta₁₇ × RE Exposure

	HighExposure	HighExposure	HighExposure	LowExposure	LowExposure	LowExposure
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Crisis return	Crisis return	Crisis return	Crisis return	Crisis return	Crisis return
ΔSell	-0.224*** (0.083)	-0.330*** (0.109)	-0.365*** (0.110)	-0.090 (0.095)	-0.150* (0.082)	-0.139* (0.077)
Log (market value)	-0.054** (0.025)	-0.062** (0.026)	-0.048* (0.025)	-0.048* (0.026)	-0.002 (0.030)	-0.014 (0.029)
Book-to-market	-0.870*** (0.301)	-0.606 (0.428)	-0.275 (0.421)	-0.089 (0.375)	-0.310 (0.390)	-0.516 (0.381)
Return	-0.223 (0.214)	-0.293 (0.292)	-0.143 (0.273)	0.055 (0.293)	-0.080 (0.325)	-0.132 (0.302)
Beta	-0.074 (0.086)	0.130 (0.092)	0.110 (0.098)	0.199** (0.092)	0.112 (0.105)	0.149 (0.102)
Leverage	0.079 (0.255)	0.103 (0.222)	0.180 (0.221)	-0.119 (0.193)	-0.128 (0.256)	-0.195 (0.249)
RE Exposure	-0.015*** (0.004)			-0.001 (0.005)		
RE Beta ₂₅ × RE Exposure		-0.000** (0.000)			0.000 (0.000)	
RE Beta ₁₇ × RE Exposure			-0.000* (0.000)			0.000 (0.000)
Observations	63	63	63	62	62	62
R-squared	0.338	0.264	0.221	0.177	0.088	0.147

This table shows results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measures, using new real estate exposure measures (replicates Table 3 in the paper). The main variable of interest is $\Delta Sell$, which is the value of top-five executives' sell transactions that took place before the peak of the real estate prices in April 2006 (2005Q1-2006Q1), minus the sales in 2004. All variables are defined in Table A1 in the Appendix. Columns 1-3 show results for banks with real estate exposure measure above the median and Columns 4-6 show results for banks with real estate exposure measure below the median. Column 1 and Column 4 present results with our real estate exposure measure that is used in the paper. RE Exposure is defined as the ratio of loans backed by real estate divided by total assets. These columns are the same as Column 2 and Column 4 of Table 3. In Column 2 and Column 5 we use our second new real estate exposure, defined as RE Beta₂₅ × RE Exposure. Column 3 and Column 6 presents results with the new exposure measure, RE Beta₁₇ × RE Exposure. The regressions include a constant term, which is not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

**FIGURE A1:
CASE-SHILLER HOME PRICE AND MARKET INDEX**

The figure plots the Case-Shiller seasonally adjusted 20-city composite index of home prices and the CRSP value-weighted market index from January 2005 through January 2009. The CRSP value-weighted index, reported by CRSP, is the index constructed using the value-weighted return for stocks listed on the NYSE, AMEX, and NASDAQ.