Universitat Pompeu Fabra Barcelona
Department of Economics and Business

Economic Working Paper Series
Working Paper No. 1524

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Updated version: February 2019

(May 2016)

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Abstract

Banking crises are recurrent phenomena, often induced by excessive bank risk-taking, which may be due to behavioral reasons (over-optimistic banks neglecting risks) and to agency problems between bank shareholders with debt-holders and taxpayers (banks understand high risk-taking). We test whether US banks' stock returns in the 2007-08 crisis are related to bank insiders' sales of their own bank shares in the period prior to 2006:Q2 (the peak and reversal in real estate prices). We find that top-five executives' sales of shares predict the cross-section of banks returns during the crisis; interestingly, effects are insignificant for independent directors' and other officers' sales. Moreover, the top-five executives' significant impact is stronger for banks with higher exposure to the real estate bubble, where an increase of one standard deviation of insider sales is associated with a 13.33 percentage point drop in stock returns during the crisis period. The informational content of bank insider trading before the crisis suggests that insiders understood the excessive risk-taking in their banks, which has important implications for theory, public policy and the understanding of crises.

JEL Codes: G01, G02, G21, G28.
Keywords: Financial crises, insider trading, banking, risk-taking, agency problems in firms.

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1 Introduction

In 2007-2008 the United States was overwhelmed by a financial (notably banking) crisis, which was followed by a severe economic recession. Banking crises are recurrent phenomena and often trigger deep and long-lasting recessions (Reinhart and Rogoff, 2009). Importantly, banking crises are not exogenous events, but regularly come after periods of strong bank credit growth and risk-taking, especially associated to real-estate bubbles (Jordà, Schularick, and Taylor, 2015; Kindleberger, 1978; Schularick and Taylor, 2012). The recent crisis was not different, and hence banks also took high risk in the run-up of the bubble (Acharya, Cooley, Richardson, and Walter, 2010; Brunnermeier, 2009; Calomiris, 2009; Rajan, 2010).

A key question for policy and for the academic literature is why banks take on so much risk. There are two (not mutually-exclusive) views. First, the moral hazard view (see, e.g., Admati and Hellwig, 2013; Allen and Gale, 2007; Freixas and Rochet, 2008) implies that agency problems mainly between bank shareholders with bank debt-holders and taxpayers due to excessive bank leverage and the explicit and implicit bank guarantees (such as deposit insurance, central bank liquidity and bail-outs) make rational for banks to take on excessive risk. Consistent with this view, bankers understand risks and it is optimal for them to take on high risks. Moreover, bankers' incentives are affected by bonuses, which typically are tied to short-term profits rather than to the long-term profitability of their bets (Acharya, Cooley, Richardson, and Walter, 2010). Therefore, bank insiders such as CEO, CFO or Chairman of the board contribute to the standard agency problem when acting on behalf of shareholders, but also when acting on their own interest and, in this case, against the interests of shareholders, bondholders and taxpayers.[1] Note that 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 due to the large bank leverage and the strong explicit and implicit bank guarantees. Second, the behavioral view states that banks take on high risk because for example they neglect unlikely tail risks and have over-optimistic beliefs (Akerlof and Shiller, 2010; Gennaioli, Shleifer, and Vishny, 2012; Kahneman, 2011).[2] In the limit case of this view, banks were not aware of

[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 shareholder and bank debt-holders and taxpayers. Given the ability to trade on their own account (sell), bank executives may choose banks risk exposure which 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,

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 bank heterogeneity in performance (some banks even failed) as high risk-taking was not uniform across banks (Beltratti and Stulz, 2012). If bank insiders understood the risks they were taking, and risk exposure at the bank level was not reduced, we should find that bank insiders in the riskiest banks (the ones with worse returns during the crisis) as compared to bank insiders in less risky banks 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 that became publicly observed in 2006:Q2).[3] Moreover, this effect should be stronger both with higher bank exposure to the real estate sector prior to the crisis (banks more exposed to the real estate bubble) and with more and better information insiders have (top-five executives such as 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, namely, insiders sales being larger for insiders in highly (versus low) exposed to real estate banks – and hence, for insiders in banks with the worse returns during the crisis – and for better (versus worse) informed insiders, are shared by all models of asset trading with asymmetric information and (noisy) rational expectations, where the selling by insiders is increasing in the size of the perceived overpricing of the stock and the precision of the information. It is also true in models such as Marin and Olivier (2008) where insider trading is subject to trading constraints and can be unlawful. Also notice that larger sales by insiders in the riskiest banks does not presume any special prediction talent of insiders in these banks compared to the rest of insiders, 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 compatible with the anticipation hypothesis and are just the consequence of these banks being more or less exposed to real estate and, consequently, more or

bank executives did not believe that they were taking on excessive risk. Foote, Gerardi, and Willen (2012) and Gerardi, Lehnert, Willen, and Sherland (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; it was just very bad luck.

[3] Once the real estate market starts falling, given the quantitative effects on 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.

less overpriced.

We analyze bank stock returns in the crisis (July 2007-December 2008) based on bank insiders' sales during 2005:Q1-2006:Q1 controlling for other important bank characteristics.[4] Following Fahlenbrach and Stulz (2011) and Fahlenbrach, Prilmeier, and Stulz (2012), we set the start of the financial crisis in July 2007 (also due to the problems in the wholesale market in August 2007) and analyze 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 nationalization 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 also analyze other time periods for the financial crisis. On the other hand, the choice of 2005:Q1-2006:Q1 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 unlawful when done in possession of 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 immediate period prior to the crash. So, insiders sell but not in the period immediately preceding the crisis, because either their constraints are binding and/or because material information is being generated in the bank and insiders cease selling to avoid prosecution. Crashes indeed are preceded by a period of low insiders selling activity. In our case, given that the real estate market peaked in 2006:Q2 and that Mian and Sufi (2011) documents that real estate related defaults started in 2006, it seems reasonable to assume that this points sets the starting point of the period of 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 2006:Q2 and no unusual sales between this point and the start of the financial

[4] Pre-crisis bank leverage, size, stock performance and other bank variables for robustness. We define the peak in 2006:Q2, and posterior reversal in the Case-Shiller 20-city composite home price index (see Figure A1 in the Appendix), as the major public event on the real estate market.

[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.

crisis.[6] This hypothesis is explicitly tested in the Appendix. But given that our identification strategy relies on the unusual activity by insiders, in the main text we focus on the selling activity by insiders during 2005:Q1-2006:Q1 and ignore sales during 2006:Q2-2007:Q2.

Implicit in the previous 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 agency problems, we should expect insiders with executive powers in high risky banks (who anticipated that their excessive bank risk would materialize) to decrease risk exposure in general, and to the real estate sector in particular, consistent with their increase in their (insiders) sales, and also reduce payouts to shareholders for precautionary reasons. However, in a world in which conflicts of interest (agency problems) prevail, and in the banking sector agency problems are of key importance,[7] or there is a strong bank risk culture (the risk culture hypothesis in Fahlenbrach, Prilmeier, and Stulz (2012)), or top executives are not powerful enough to change the stated course (Adams, Almeida, and Ferreira, 2005), or the prevalence of relative performance evaluation in compensation packages that leads to bank investments correlated with their piers (Albuquerque, Cabral, and Guedes, 2017), such reaction at the bank level may not take place. Hence, either because managers do not have an incentive to deviate and reduce risk and dividends, or because managers are unable to influence other executives and directors, top executives may not react at the corporate level but trade on their account pursuing their own personal interests.

Our key variable in this paper is bank insiders' trading, i.e., the selling and buying of shares of their own bank. We obtain the insiders' trades from Thomson Financial Insider Filings database, which provides the 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 (such as CEO, CFO and other top-executives), middle-officers and independent directors.[8]

[6] Notice that this equilibrium is consistent with insiders leaving a substantial amount of shares unsold (so insiders leave a lot of money on the table), because the constraints and the avoid prosecution hypothesis may result in a large amounts of vested stock unsold.

[7] Say, agency issues arising from banks bail-outs guarantees (Acharya, Mehran, and Thakor, 2016; Farhi and Tirole, 2012; Ratnovski, 2009).

[8] It is important to notice that our variable does not include the trading by insiders in instruments

We follow the approach suggested in the insider trading literature to set up our empirical strategy. The primary focus of the literature is to investigate insiders' use of non-public information in their trades. Since we do not have their private information set or any variable that is perfectly related to it, we follow the literature, which uses forward-looking variables. To the extent that insiders' trades are also based on private information about their company (not just e.g. simply liquidity needs of the insiders when they sell), these trades will have a predictive power of the future performance of the firm such as the return in the next periods, which suggests that insider trading has informational content on future performance of the firm (as insiders have inside knowledge of the firm that is not perfectly known by the market).[9] Our empirical methodology relies on the same idea. In a cross-sectional analysis, we predict crisis period bank returns (2007:Q3-2008:Q4) based on the insider selling measures before the public bad news about the real estate sector in 2006:Q2.

We find that top-five executives' sales of shares in the period prior to the peak and reversal in house prices predict bank performance during the financial crisis. One standard deviation increase in top-five executives' sales predicts a 7.33 percentage point drop in bank crisis period returns. All the results that we present are robust to the inclusion of controls such as the bank characteristics that have been associated to bank crisis performance (Fahlenbrach, Prilmeier, and Stulz, 2012; Fahlenbrach and Stulz, 2011). Bank 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 (become even stronger) when we exclude insiders sales related to options exercise or control for compensation, which clears suspicions on our identification mechanism being contaminated by the increase in compensation during the run-up of the real state bubble, and that was specially intense in banks highly exposed to real estate. In addition, we perform other several robustness checks. For example, we measure bank stock performance over alternative periods (such as January 2007-December 2008 or July

related to the underlying risk of the bank, but not issued by the bank (for instance, CDS on subprime indexes) and, consequently, our analysis may underestimate the economic effects of our results.

[9]The insider trading literature provides evidence on insiders' ability to predict future stock price changes in their own firm stock (see, e.g., Cohen, Malloy, and Pomorski, 2012; Huddart, Ke, and Shi, 2007; Lakonishok and Lee, 2001; Seyhun, 1986, 1992b).

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

2007-September 2008); our results are not sensitive to the definition of the crisis period.[11] In addition, we compute several alternative insider trading measures (in changes or in levels, gross or net sales, and in volumes or in number of transactions) and our results are not sensitive to the choice of insider trading measure. All in all, we find robust evidence that top-five executives' sales of shares predict bank performance during the crisis.

If bank insiders understood the risks they were taking, not only should we find that bank insiders in the riskier banks should sell more shares, but effects should be stronger both with higher bank exposure to the real estate sector prior to the crisis and with better information insiders have. We indeed find that the effects are insignificant for independent directors' and middle-officers' sale of shares – opposite to top–five executives in which the estimated coefficient is strong both statistically and economically. Moreover, we also find that the impact of ex-ante top-five executives' sales on worse crisis performance is stronger for banks with higher ex-ante exposure to the real estate sector. In particular, for banks with real estate exposure higher than the average, 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 is approximately 32% of the approximately 40% drop in the return of these banks.

Finally, we further investigate the link between bank insiders' sales before April 2006 and 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, neither unconditionally in the aggregate, nor conditional on insider sales in the cross-section of 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 signaling implicit in dividend reductions, 2) the prevalence of an equilibrium in which no bank manager has an incentive to unilaterally deviate (for instance, prevalence of high investment correlations due to the prevalence of relative performance evaluation in compensation packages as in Albuquerque, Cabral, and Guedes (2017)) and reduce risk and div-

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

idends or, 3) persistency in banks risk culture (Fahlenbrach, Prilmeier, and Stulz, 2012) or lack of managerial power (Adams, Almeida, and Ferreira, 2005).

In summary, this paper provides robust evidence that insider sales by those bank insiders with access to more precise information on their own bank 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 some very few banks that performed badly in the crisis sold a significant part of their shares before the crisis hit; however, there is lack of evidence across the board. Our paper provides sector–wide cross–sectional analysis of the bank insiders' trading just before the peak and reversal in house prices and bank returns during the crisis. Bebchuk, Cohen, and Spamann (2010) provide a case study of compensation in Bear Stearns and Lehman Brothers during 2000-2008 and document that both CEO and also top-five executives in these banks significantly sold during this period.[12] A paper close to ours is Cziraki (2015) that analyzes insider trading in US banks around the crisis. This paper 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 different results are explained by the use of a different sample of banks, choice of insiders and empirical methodology.[13]

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 there is no contradiction at all between this statement and the results in this paper. While Fahlenbrach and Stulz (2011) look at insiders selling activity immediately prior or during the bank crisis (January 2007 to December 2008), we look at insiders selling activity

[12]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. Especially the huge jump in Lehman CEO's sell from 2004 to 2005 is striking. The amount he obtained from selling Lehman's shares was $20 million in 2004 whereas it jumps 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).

[13]We have double number of banks. Also, Cziraki (2015) divides insiders into three sub-categories such as officers, independent directors and finally looks at only CEOs. But we focus on top-five executives trading including CEO and other top-executives as well. Finally, Cziraki (2015) classifies banks in 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.

prior to the real estate crisis (2005:Q1 to 2006:Q1) and relatively far away from the bank crisis. But, as previously argued, according to Marin and Olivier (2008), we should expect unusual trading activity only in the earlier period (the period analyzed in this paper). That is the findings in Fahlenbrach and Stulz (2011) and in this paper are exactly what Marin and Olivier (2008) predicts, and Fahlenbrach and Stulz (2011) finds no unusual selling activity prior to the crisis just because their analysis focuses in the period where it is not expected to take place such unusual selling, even under the hypothesis of insiders anticipation. To clarify the absolute consistency of the results in this paper and those in Fahlenbrach and Stulz (2011) with the predictions in Marin and Olivier (2008), in robustness checks we document that while sales during the period July 2006 to June 2007 do not predict bank crisis returns (consistent with Fahlenbrach and Stulz (2011) results), sales during the period January 2005 to March 2006 do predict crisis returns (result in this paper), which is exactly what Marin and Olivier (2008) predicts.

Our results (top executives in riskier banks sell more their shares before the crisis) are consistent with the agency view of banking crises and have important implications for theory and public policy. First, they contribute to the general theory of corporate finance (see, e.g., Tirole, 2006) and banking (see, e.g., Freixas and Rochet, 2008) that are to a great extent based on agency problems, and also to the theory of financial crises (see, e.g., Allen and Gale, 2007) suggesting that agency problems are an important factor behind excessive risk-taking by banks. Second, our results provide an additional rationale for current policy initiatives on higher bank capital (including Basel III) or macroprudential policies around the world (for a summary, see, Freixas, Laeven, and Peydró, 2015) towards limiting excessive risk-taking by financial institutions. If excessive risk-taking were exclusively due to behavioral reasons, then some of the new prudential policies providing better incentives in banks would not matter at all.

The remainder of the paper is organized as follows. Section 2 provides the details of data sources, sample construction, and empirical strategy. In section 3, we present and discuss the results and robustness checks. Finally, in section 4 we conclude.

2 Data and Empirical Strategy

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

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.[14] Accounting data is obtained from Compustat and Tier 1, non-performing loans data are from Compustat Bank. We obtain real estate loans data from FR_Y–9 statements from 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, Prilmeier, and Stulz (2012). Their sample includes 347 publicly listed US firms from the banking industry. To reduce the noise, we choose the firms in which there was at least one open market sell transaction by any top-five executives in the period of 2005Q1–2006Q1.[15] 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. The transactions on which we focus come from 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 (officers, directors or other positions held by insider in the firm),

[14] 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.

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

whether it is an acquisition or disposition, the transaction code which describes the nature of the transaction, the transaction date, amount and price. The transaction reported on Form 4 could be any transaction that causes a change in ownership position. Among these transactions, we keep only insiders' open market purchases and sales.[16] All other types of transactions, such as grants and awards or exercise of derivatives, are excluded.[17]

Following Lakonishok and Lee (2001), before merging insider transaction data with other databases, we first identify and eliminate non-meaningful records in insider trading database. We exclude amended records (Amendment Indicator is "A"), filings marked as inaccurate or incomplete by the Thomson database (Cleanse code is "S" or "A"), small transactions where less than 100 shares were traded and also trades for which we do not have the insider's transaction price nor the closing price of the stock.[18] Additionally, some 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 to avoid problematic records.

Depending on their positions in the firm, insiders may have different access to firm-specific information (Lin and Howe, 1990; Piotroski and Roulstone, 2005; Ravina and Sapienza, 2010; Seyhun, 1986). One of the main trader characteristics that Thomson Financial Insider Filings database provides is the role rank (data item is "rolecode") of insiders in their firm. This data item enables us to identify the position of the insider in the bank i.e. officer, director, chairman of the board, large shareholder, etc. 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, which includes the firm's Chairman of the Board, CEO, CFO, COO and President.[19] This group

[16]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.

[17]Note, however, that the sales of stocks acquired through the exercise of a derivative are counted as an open market sale ("S") and is therefore included in our sample. In robustness checks, we verify that our results are not driven by insiders' sales related to options exercise.

[18]Thomson Financial Insider Filings database provides the eight digit CUSIP number as an identifier for each security. We merge the insider trade information of each security on each date with CRSP daily stock file using CUSIP to obtain the closing price of the stock and the number of shares outstanding on each transaction date.

[19]The corresponding relationship codes in Thomson Financial Insider Filings database are "CB",

of insiders has access to better information than insiders in the other categories (Beneish and Vargus, 2002; Core, Guay, Richardson, and Verdi, 2006). Moreover, we also provide results with middle-officers and independent directors of those firms.[20]

2.2 Empirical strategy

In the empirical strategy, we follow the approach suggested in the insider trading literature. The primary focus of the literature is to investigate insiders' use of non-public information in their trades. Since we do not have their private information set or any variable that is perfectly related to it, we follow the literature, which uses forward-looking variables. To the extent that insiders' trades are also based on private information about their company (not just simply liquidity needs of the insiders when they sell), these trades will have predictive power of the firm future performance, such as the return in the next period.[21] Following Marin and Olivier (2008) we test the relationship between insider selling during the period just before the real estate price peak in 2006:Q2 and firm returns in 2007:Q3–2008:Q4 financial crisis, using cross–sectional OLS estimation.

Our main regression equation is:

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

where subscript *i* denotes the bank, and bank controls are at the end of fiscal year

"CEO", "CFO", "CO", and "P", respectively.

[20]Executives may hold more than one title in the bank. Thomson Financial Insider Filings database provides information 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) than being a large shareholder.

[21]The motives for insiders to trade are multiple, not only information driven, but also non-information driven such as hedging, diversification or liquidity needs. Therefore, investors never know if sales are due to bad news learned by insiders or, say liquidity needs, which implies that the true information from insiders is not perfectly revealed. Hence, the result in our paper does not require more than already known about financial markets, namely that financial markets are not efficient in the strong form of market efficiency (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, e.g., Bettis, Vickrey, and Vickrey, 1997). This is evidence of lack of market efficiency in the semi–strong form (prices do not reveal all public information in the market).

2004. For simplicity, in the tables we use the variable $Sell$ (change or level) without indicating the exact period in the pre-crisis period.

We now discuss the variables included in the regression equation (1) and interpret summary statistics presented in Table 1.[22] The dependent variable, $Crisis\,return_i$, is the annualized buy-and-hold return on bank i stock during the crisis period, which is defined as the period July 2007 to December 2008 (Fahlenbrach, Prilmeier, and Stulz, 2012; Fahlenbrach and Stulz, 2011).[23] If a bank is delisted during the crisis period, we put proceeds into a cash account.[24] Not surprisingly, in our final sample of 170 banks, the average bank return during the crisis period is highly negative, with 28% average loss and 27% median loss (standard deviation is 35%). We compute the banks' crisis period performance for two alternative periods as well. In the first one we take the beginning of the crisis as January 2007 and compute buy-and-hold return from January 2007 to December 2008; in the second, we compute buy–and–hold return for the period July 2007–September 2008.[25] The summary statistics of these two stock performance measures that are computed over alternative periods of crisis indicate negative bank performance, similar to our main performance measure, with the median bank returns of -24% in the January 2007-December 2008 and -18% in the July 2007–September 2008.[26]

The other main variable of interest in equation (1) is the insider trading measure, $\Delta Sell_i$.[27] The literature defines several measures for insider trading. 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 (purchase), the number of transactions

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

[23] For each bank, buy–and–hold return is computed as the product of one plus each month return, minus one. Monthly returns are directly obtained from CRSP Monthly Stock File.

[24] If banks delist or merge prior to December 2008, we put proceeds in a cash account until December 2008 (Fahlenbrach, Prilmeier, and Stulz, 2012; Fahlenbrach and Stulz, 2011). In order to deal with 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 merger we keep the return reported in CRSP in the delisting month. In case the return in the delisting month is missing we incorporate delisting return if it is available in CRSP.

[25] We follow Erkens, Hung, and Matos (2012) to decide on the alternative crisis periods. The first measure 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 the 2008:Q4 in order to eliminate the effect of government intervention.

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

[27] 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). But, for robustness, we also use the level of sales ($Sell_i$).

(or separately the number of sell/buy transactions) are the most common ones. We follow Marin and Olivier (2008) and use the dollar value of sell transactions normalized by market capitalization as our leading measure of insider trading. In each bank, first we go through all open market sell transactions held in each day during the period 2005:Q1–2006:Q1 and compute the value of each transaction (number of shares sold $\times$ transaction price) and divide it by the market capitalization on the transaction day.[28] Then we sum the value of sell transactions at the bank-insider sub-group level. Market capitalization is calculated by multiplying the bank share price by the number of shares outstanding that is obtained from CRSP 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 2005:Q1-2006:Q1 (before the peak of real estate prices in 2006:Q2) minus the sales in the preceding 12 months, which for simplicity we refer to as 2004, and (2) $Sell_i$, the total value of sell transactions during the period 2005:Q1–2006:Q1.[29] These two variables are our main variables of interest and our aim is to analyse the relationship between these two main insider trading measures and bank return in the financial crisis.

The first variable of interest is $\Delta Sell_i$. The mean of this variable, 0.04, indicates that on average top-five executives sold 0.04 (as a percentage of market capitalization) more in the anticipating period (2005:Q1-2006:Q1) as compared to 2004. Moreover, out of the 170 banks in our sample, 120 banks have a positive value for $\Delta Sell_i$, thus implying that we observe an increase in selling in 71% of our sample of banks. The second insider trading variable of interest is the $Sell_i$ which is just the sum of the value of each sell transaction (after adjusting it by market capitalization on the transaction day) that was held during 2005:Q1–2006:Q1. Median bank top-five executives sold in total 0.12% of the company during the sample period. The average is 0.29% and the standard deviation is 0.43%.[30]

[Table 1 about here.]

In robustness analysis, we include more insider trading measures.[31] For instance,

[28] The period 2005:Q1-2006:Q1 refers to the period of January 3rd 2005 to March 31st 2006.

[29] For computational details of the variables see Table A1 in the Appendix.

[30] We also compute our main insider trading measures ($\Delta Sell_i$ and $Sell_i$) using the middle-officers' and independent directors' transactions. If we compare median sell value across the three groups, we observe that top-five executives selling transactions are substantially higher than those of the other two groups. The median sell for independent directors is 0.03% and for middle-officers is 0.04%, whereas top-five executives sold 0.12% as we mentioned above.

[31] See Table A1 for computational details and Table A2 in the Appendix for the summary statistics

we compute the change in the number of sell transactions, $\Delta \#Sell_i$, as well as the number of sell transactions, $\#Sell_i$ in the anticipating period. Summary statistics show that median $\#Sell_i$ is 3 in 2005:Q1–2006:Q1 and the difference in the number of sell transactions (as compared to 2004) is 1. Additionally, we compute net sell value, $NetSell_i$, instead of raw sell by subtracting the total value of insider purchases from sales and also change in net sell value, $\Delta NetSell_i$. The summary statistics of net sell value are close to raw sell value, thus indicating that the volume of buy transactions is very low. After subtracting the total value of buy transactions, median sell represents 0.11% of the company and the average sell is 0.26%.

In our analysis, we include several control variables following both the insider trading literature and the recent literature on financial crises. All the control variables are at the end of fiscal year 2004.[32] Our sample of banks has an average of $33 billion in assets, its large standard deviation indicates large variation in terms of size, and the median bank has $2.2 billion in asset. For the total liabilities, the median value is $1.98 billion and the average is $30 billion. The market capitalization 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 obtain its beta from weekly market model of daily returns from January 2002 to December 2004, where the market is represented by value-weighted CRSP index obtained from CRSP daily data. The average beta is 0.79, 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% and the standard deviation is 0.29%. Real estate exposure of each bank is measured by the loans backed by real estate as of 2004 (adjusted by total assets). The median (also the mean) bank has 48% of its total assets in real estate loans.

We also perform heterogeneous analysis on equation (1). If bank insiders understood the risks they were taking, not only should we find that bank insiders in the riskiest banks (the ones with worse 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 this effect should be stronger the higher the bank

of these alternative insider trading measures.

[32] We choose end of 2004 as the last available data point prior to the beginning of our insiders selling period. However, in untabulated result we verify that results hold even when measuring the control variables at the end of 2005 or 2006.

exposure to the real estate sector prior to the crisis (i.e., in banks more exposed to the real estate bubble) and also the more information insiders have (top-five executives such as CEO and CFO versus independent directors and middle-officers). Therefore, we also analyze equation (1) only for the banks with exposure to real estate sector in 2004 higher (and lower) than the median. Moreover, we analyze sales ($\Delta Sell_i$ and $Sell_i$) not only for top–five executives, but also in other regressions, for middle–officers and for independent directors. Finally, we analyze in a cross-section analysis whether the insiders' sale of shares in 2005:Q1–2006:Q1 lead to different bank risk measures in the following period.

3 Results

This section presents and discusses the main results of the paper. We start by analyzing the impact of the top-five executives' sale 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 $\Delta Sell_i$, which measures the change in insider sales before the peak and reversal in house prices (2005:Q1-2006:Q1) with respect to the previous year in 2004. That is, we analyze the change in stock prices of banks during the crisis period with ex-ante change in insider trading. The coefficient is negative (-0.163***) and statistically significant at the 1% level.[33] The estimated coefficient implies that an increase in one standard deviation of the insider trading measure reduces bank returns in the crisis by 7.33 percentage point.

[Table 2 about here.]

In column 2 to 4, we find similar coefficients of ex-ante insider trading on bank crisis returns when we add different bank controls (as of end of 2004). Fahlenbrach and Stulz (2011) document a negative relationship between bank crisis period performance and bank characteristics such as return, book-to-market and size as of 2006. We find the same results with a larger sample. Return in 2004 has a negative coefficient, thus suggesting that banks with relatively higher returns in 2004 performed relatively worse in the financial crisis. Book-to-market has statistically significant negative coefficient as well. Market capitalization has also a significant

[33] ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

negative coefficient, thus suggesting that larger banks experienced lower returns in the 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, $Sell_i$, which measures the level of insider trading before the peak and reversal in house prices (2005:Q1-2006:Q1). 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 estate price peak (both in raw value and compared to 2004) performed significantly worse during the 2007-08 crisis period.

Table 3 shows the results from cross-sectional regressions of annualized buy-and-hold returns from July 2007 to December 2008 on insider trading measure (as in Table 2), but across two group of banks depending on their real estate exposure. We divide the banks into two groups by the median value of the real estate exposure at the end of fiscal year 2004. For our main insider trading variable, columns 1 and 2 of Table 3 show results for banks with high real estate exposure measure (real estate exposure measure higher than the median value) and columns 3-4 show results for banks with low real estate exposure (the measure below the median). Columns 5 to 8 do the same for our second insider trading measure.

[Table 3 about 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 the average bank in Table 2. An increase of one standard deviation of the insider sales measure leads to 13.33 percentage point drop in stock returns during the crisis period, which is approximately 32% of the 40% negative bank returns over the crisis for the banks with exposure to real estate above average (see also Table 1). Finally, results in columns 2, 5 and 6 are similar – i.e., for banks with high real estate exposure, there are statistical and economic significance – but there are insignificant effects for bank 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 ex-ante exposure

to the real estate bubble.

In Table 4 we explore the relationship between insider sales before real estate price peak and 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 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 (column 5 and 6 of Table 4). To facilitate comparisons, Column 1 and 2 of Table 4 are identical to column 1 and 4 in Table 2 as we use in here top-five executives' sales.

[Table 4 about here.]

Results are only statistically and economically significant for top–five executives. For example, columns 1, 3 and 5 have the following estimated coefficients for insider sales: -0.163***, 0.026, and 0.007, respectively. For the sake of space, we use in Table 4 our main measure of insider trading, but we find identical results (unreported) if we use our second measure of insider trading on the level of insider sales (i.e., results are only significant for top–five executives).

That is, 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 should sell more shares, but effects should be stronger the higher the information insiders have. And we indeed find that the effects are insignificant for independent directors' and middle–officers' sale of shares – opposite to top–five executives, in which the estimated coefficient is strong statistically and economically speaking.

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 (2006:Q2–2006:Q4). Results on top–five executives' trading are insignificant.

[Table 5 about here.]

In the Appendix we report many other robustness checks.[34] In Table A3, we test for the sensitivity of our results to alternative crisis period definitions. The crisis period

[34] Summary statistics of the additional control variables that are only used in robustness tests are

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 replicate our main result in Table 2. The results remain very similar. In Table A4, we use four alternative measures of insider trading for robustness. Columns 1 and 2 use the difference in the number of sell transactions between 2005:Q1-2006:Q1 and 2004; similarly, columns 3 and 4 present results with the raw number of transactions instead of volume. As in the benchmark regressions with the volume of insider trading sales, we find similar results with the number of transactions by insiders. Moreover, in robustness we also use 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 2005:Q1–2006:Q1 and 2004, and columns 7 and 8 use the net value of sales in 2005:Q1–2006:Q1. We find as well similar results as in the benchmark regressions with volume of sales (Table 2).

In Table A5, and also for robustness, 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 returns during the crisis is robust to all the new control variables and different samples of banks. Columns 1-5 present results using the full sample of 170 banks. First, following Fahlenbrach, Prilmeier, and Stulz (2012) in column 1 we replace our leverage measure with market-based leverage measure of Acharya, Pedersen, Philippon, and Richardson (2010), and in columns 2 and 3 we replace leverage with tangible common equity (TCE) ratio and Tier 1 capital ratio, respectively.[35] Similar to Fahlenbrach, Prilmeier, and Stulz (2012), the coefficient on leverage is negative and statistically significant at 1% level, thus indicating that highly levered banks as of 2004 performed worse in the crisis. We find positive and statistically significant coefficient on Tier 1 capital ratio, but the coefficient on tangible common equity ratio is not statistically significant. These results are also consistent with Fahlenbrach, Prilmeier, and Stulz (2012).[36] Finally in columns 4 and 5, we control for non-performing loans and liquidity, respectively. The coefficients on these two additional control variables

reported in Table A2 in the Appendix. Table XX uses a restricted merged sample and includes its own summary statistics.

[35]Note that column 1 of Table A5 replicates column 4 of our main analysis in Table 2 by replacing the leverage measure with Acharya, Pedersen, Philippon, and Richardson (2010) measure.

[36]Both Fahlenbrach and Stulz (2011) and Fahlenbrach, Prilmeier, and Stulz (2012) document a positive relationship between Tier 1 capital ratio as of 2006 and bank crisis period performance. Additionally, Fahlenbrach, Prilmeier, and Stulz (2012) includes tangible common equity ratio in the equation, but similar to us, there is not a significant relationship between tangible common equity ratio and bank crisis period performance.

are statistically indistinguishable from zero. Furthermore, in columns 6–10 we replicate the analysis we do in columns 1-5 with the sub-sample of 125 bank holding companies that file 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 leverage in column 6. The leverage measure of Acharya, Pedersen, Philippon, and Richardson (2010) has a negative coefficient but it is not statistically significant in this sub-sample. Importantly, in all columns, we observe that our main finding is robust to all these new control variables. Finally, as a final robustness check, we replicate our main analysis with only the banks that survived until December 2008. In Table A6, we rerun our analysis after excluding the banks that are delisted during July 2007-December 2008. Results are very similar.

In Table A7, we explicitly test for the predictions of Marin and Olivier (2008). Consistently with this paper, we find that crisis returns are positively related (negative sign coefficient in our sell variable) to insiders sales in the first period (2005Q1-2006Q1) and not related (the coefficient switches sign and becomes positive, but no statistically significant) to insiders 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 (sales for the period July 2006 to June 2007) do not predict the cross-section of bank crisis returns is consistent with Fahlenbrach and Stulz (2011).

In Table A8 and A9 we clear suspicions on our identification mechanism being contaminated by the increase in compensation during the run-up of the real state bubble. First, using the full sample used in all the previous robustness checks, in Table A8 we analyze whether the result is driven or not 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 going from -0.163***(all sales) to -0.192*** (only sales not related to options exercise). On the other hand, columns 5 to 8 show that sales related to options exercise are not predictive of the cross-section of bank crisis returns.[37] Second, we explicitly control for compensation. Compensation data is obtained from the ExecuComp database, what force us to match this data with all the other data set used (Thomson, Compustat, CRSP). We end up with 44 banks in which we have data in all databases (including ExecuComp). This merged subsample has a bias toward larger banks. In Table A9

[37]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 with the data field optionsell "A" or "P", which stand for all, and partial, respectively.

we report the results. For comparisons, in column 1 we report our main result (same as column 4 of Table 2 in the paper). In column 2 we replicate our main regression with the restricted sample i.e. the sample that we are able to match with ExecuComp database. In column 3, we add our measure of compensation as an additional control variable which is total direct compensation (TDC1). 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. As we can observe, our results hold when controlling for compensation, even in this subsample of relatively larger banks, whose insiders are more closely monitored, and consequently, more reluctant to trade on private information.

Finally, in Table 6 we analyze whether differential insider trading before the peak and reversal in real estate prices implies different bank 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 as of end of 2006 in Table 6.

As stated in the introduction, in a frictionless world without agency problems, we should expect insiders (who anticipated the real estate crash) with executive powers in high risk banks to decrease risk exposure to the real estate sector in particular, and perhaps also to reduce bank risk exposure in general, consistent with the increase in their (insiders) 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, and in the banking sector these agency problems are of key importance, such reaction at the bank level may not take place.

[Table 6 about here.]

We find no reaction in any of the bank variables (leverage, real estate exposure and dividends) in 2006, neither unconditionally in the aggregate, nor conditional on insider sales in the cross-section of banks, which means that the insiders of riskier banks as compared to the insiders of the other banks reacted similarly in terms of bank risk taking and payout policy. We find very similar results in Table 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 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– and the pervasive signaling implicit in dividend reductions, or to 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 due to excessive bank leverage and the explicit and implicit bank guarantees such as deposit insurance, central bank liquidity and bail-outs (see Admati and Hellwig, 2013; Allen and Gale, 2007; Freixas and Rochet, 2008). Therefore, bankers may take rationally excessive risk due to incentives rather than just pure behavioral reasons such as over-optimism and neglecting tail risks.

One empirical way to analyze 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' sale of their own bank shares in the period prior to the peak and reversal in house prices in 2006:Q2. We find robust evidence that top-five executives' ex-ante sale of their own bank shares predicts worse bank returns during the crisis. Moreover, we find that the top-five executives' significant impact is stronger for banks with higher ex-ante exposure to the real estate market (i.e., banks more exposed to the real estate bubble). An increase of one standard deviation of top–five executive sales leads to a 13.33 percentage point drop in stock returns during the crisis period, which is approximately 32% percent of the 40% negative returns of banks with above average exposure to real estate. All in all, given the informational content of bank insider trading before overall real estate problems, our results suggest that insiders understood the large risk–taking in their banks, they were not simply overoptimistic, and hence the insiders in the riskier banks sold more before the crisis.

These results have not only implications for corporate finance or banking theory based on agency problems, as we also discuss in the Introduction, but also for the understanding of financial crises and public policy – especially on the recent prudential policy measures across both sides of the Atlantic. Our evidence is con-

sistent with agency problems in the banking industry being important in driving risk–taking and, therefore, the recent policy initiatives on higher bank capital (including Basel III) or macroprudential policies around the world (Freixas, Laeven, and Peydró, 2015; Jiménez, Ongena, Peydró, and Saurina Salas, 2016) may be useful for limiting excessive bank risk-taking. If high risk-taking in banks were exclusively due to behavioral reasons, then some of the new prudential policies providing better incentives for bankers would not matter at all. Moreover, our results may also yield policy implications for the insider trading regulation in banking institutions. The ability to trade by insiders (selling shares of their own bank when they anticipate that their excessive risk-taking may materialize) may exacerbate conflicts of interest. Banning trading by bank insiders may endogenously result in lower excessive 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 costs and benefits involved that should be accounted for. We leave these questions for future research.

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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
$\Delta Sell$	170	-0.01	0.03	0.17	0.04	0.45
$Sell$	170	0.04	0.12	0.34	0.29	0.43
$\Delta Sell_{Independent\ Directors}$	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
$\Delta Sell_{Middle\ Officers}$	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

Descriptive statistics for the sample of 170 banks. All variables are defined in Table A1 in the Appendix. Accounting variables are as of 2004 fiscal year end. Real Estate Exposure is available only for bank holding companies that file Y-9 reports with the Federal Reserve in 2004.

Table 2

BANK RETURN IN THE FINANCIAL CRISIS AND TOP-FIVE EXECUTIVE EX-ANTE 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
$\Delta Sell$	-0.163***	-0.149***	-0.136***	-0.131**				
	(0.053)	(0.050)	(0.051)	(0.052)				
$Sell$					-0.041**	-0.051***	-0.049***	-0.046***
					(0.018)	(0.017)	(0.017)	(0.017)
Return		-0.416**	-0.424***	-0.428***		-0.358**	-0.368**	-0.375**
		(0.161)	(0.155)	(0.156)		(0.163)	(0.156)	(0.156)
Book-to-market		-0.713***	-0.636***	-0.585***		-0.728***	-0.639***	-0.600***
		(0.180)	(0.187)	(0.191)		(0.177)	(0.183)	(0.189)
Log(market value)		-0.043***	-0.050***	-0.043***		-0.056***	-0.064***	-0.057***
		(0.013)	(0.014)	(0.015)		(0.014)	(0.015)	(0.016)
Beta			0.091	0.091			0.102*	0.102*
			(0.062)	(0.062)			(0.058)	(0.058)
Leverage				-0.196				-0.152
				(0.142)				(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 measure. 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 before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1), minus the sales in the previous year of 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 2005:Q1–2006:Q1(in logs). Accounting control variables are as of 2004 fiscal year end. Constant term is included but 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

	High Exposure	High Exposure	Low Exposure	Low Exposure	High Exposure	High Exposure	Low Exposure	Low Exposure
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Crisis return	Crisis return	Crisis return	Crisis return	Crisis return	Crisis return	Crisis return	Crisis return
$\Delta Sell$	-0.303***	-0.224***	-0.087	-0.090				
	(0.077)	(0.083)	(0.103)	(0.095)				
$Sell$					-0.067**	-0.062***	0.020	0.007
					(0.026)	(0.023)	(0.027)	(0.026)
Log(market value)		-0.054**		-0.048*		-0.078***		-0.045
		(0.025)		(0.026)		(0.024)		(0.028)
Book-to-market		-0.870***		-0.089		-0.970***		-0.072
		(0.301)		(0.375)		(0.310)		(0.407)
Return		-0.223		0.055		-0.154		0.015
		(0.214)		(0.293)		(0.220)		(0.291)
Beta		-0.074		0.199**		-0.084		0.211**
		(0.086)		(0.092)		(0.083)		(0.095)
Real Estate Exposure		-0.015***		-0.001		-0.016***		-0.001
		(0.004)		(0.005)		(0.004)		(0.005)
Leverage		0.079		-0.119		0.094		-0.134
		(0.255)		(0.193)		(0.242)		(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 measure across real estate exposure groups. 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 before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1), minus the sales in the previous year of 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 2005:Q1–2006:Q1(in logs). Real Estate Exposure of each bank is measured with the ratio of loans backed by real estate (obtained through FR-Y9C filings (item BHCK1410)) to total assets. Columns 1-2 and 5-6 present results for banks with real estate exposure measure higher than the median and columns 3-4 and 7-8 show results for banks with real estate exposure measure below the median. Accounting control variables are as of 2004 fiscal year end. Constant term is included but 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***	-0.131**				
	(0.053)	(0.052)				
$\Delta Sell_{Independent\ Directors}$			0.026	0.006		
			(0.035)	(0.040)		
$\Delta Sell_{Middle\ Officers}$					0.007	-0.019
					(0.157)	(0.152)
Observations	170	170	170	170	170	170
R-squared	0.045	0.168	0.001	0.140	0.000	0.140
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 before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1), minus the sales in the previous year of 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 of middle-officers ($\Delta Sell_{Middle\ Officers}$). Accounting control variables are as of 2004 fiscal year end. Constant term is included but 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) $\text{Return}_{2006:M04-2006:M12}$	(2) $\text{Return}_{2006:M04-2006:M12}$	(3) $\text{Return}_{2006:M04-2006:M12}$	(4) $\text{Return}_{2006:M04-2006:M12}$
$\Delta Sell$	-0.064	-0.067		
	(0.048)	(0.050)		
$Sell$			0.002	0.004
			(0.007)	(0.007)
Return		0.160*		0.135
		(0.095)		(0.085)
Book-to-market		0.114		0.109
		(0.077)		(0.078)
Log(market value)		0.011		0.013*
		(0.007)		(0.007)
Beta		-0.002		0.010
		(0.037)		(0.040)
Leverage		0.006		-0.013
		(0.074)		(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 before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1), minus the sales in the previous year of 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 2005:Q1–2006:Q1(in logs). Accounting control variables are as of 2004 fiscal year end. Constant term is included but not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

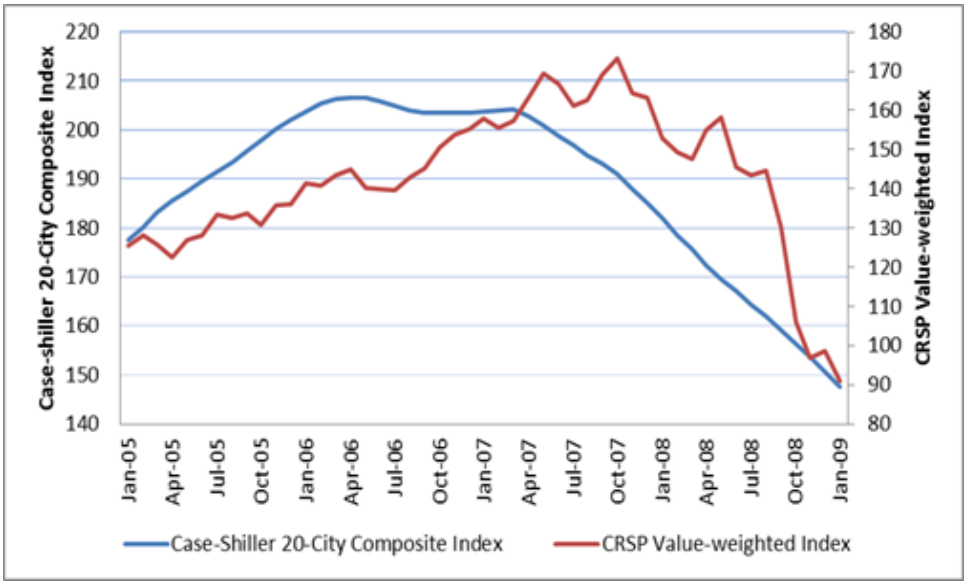
Table 6

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

VARIABLES	(1) Leverage	(2) Dividend	(3) Real Estate Exposure	(4) Leverage	(5) Dividend	(6) Real Estate Exposure
$\Delta Sell$	0.017	-0.008	-0.382			
	(0.015)	(0.020)	(1.088)			
$Sell$				0.007	-0.009	-0.317
				(0.005)	(0.008)	(0.289)
Return	0.020	-0.060	1.321	0.012	-0.047	1.726
	(0.075)	(0.107)	(4.139)	(0.073)	(0.104)	(4.110)
Book-to-market	0.083	0.010	3.807	0.086	0.011	3.276
	(0.076)	(0.199)	(4.916)	(0.075)	(0.199)	(4.979)
Log(market value)	0.014**	0.015*	-0.183	0.016***	0.012	-0.277
	(0.005)	(0.008)	(0.395)	(0.006)	(0.008)	(0.391)
Beta	-0.014	0.031	0.624	-0.015	0.030	0.515
	(0.021)	(0.043)	(0.966)	(0.021)	(0.043)	(0.998)
Leverage	0.768***			0.761***		
	(0.056)			(0.057)		
Dividend		0.718***			0.712***	
		(0.105)			(0.105)	
Real Estate Exposure			0.939***			0.941***
			(0.028)			(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) as of 2006 fiscal year end on insider trading measure. All variables are defined in Table A1 in the Appendix. In columns 1-3 the main variable of interest is $\Delta Sell$ which is the value of top–five executives' sell transactions before the peak of the real estate prices in April 2006 (2005:Q1-2006:Q1), minus the sales in the previous year of 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 2005:Q1-2006:Q1(in logs). Accounting control variables are as of 2004 fiscal year end. Constant term is included but not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Figure A.1: CASE-SHILLER HOME PRICE INDEX AND MARKET INDEX



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

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 return from January 2007 to December 2008.	CRSP Monthly stock file
Crisis return (July07-Sept08)	The annualized buy-and-hold return from July 2007 to September 2008.	CRSP Monthly stock file
$Sell_i$ [38]	The total value of top-five executives' sell transactions (as % of market capitalization) before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1). $\sum_{t\epsilon[2005:Q1,2006:Q1]} \frac{\$Sell_{i,t,k}}{Market\,Capitalization_{i,t}} \times 100$ where $Sell_{i,t,k}$ is the value of each sell transaction (transaction price × number of shares sold) 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 × shares outstanding). The period 2005:Q1–2006:Q1 refers to the period of January 3rd 2005 to March 31st 2006.	Thomson Financial Insider Filings and CRSP Daily Stock file
$\Delta Sell_i$ [39]	The total value of top–five executives' sell transactions (as % of market capitalization) before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1), minus the sales in the previous year of 2004. $\sum_{t\epsilon[2005:Q1,2006:Q1]} \frac{Sell_{i,t,k}}{Market\,Capitalization_{i,t}} \times 100 - \sum_{t\epsilon[2004:Q1,2004:Q4]} \frac{Sell_{i,t,k}}{Market\,Capitalization_{i,t}} \times 100$ where $Sell_{i,t,k}$ is the value of each sell transaction (transaction price × number of shares sold) 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 × shares outstanding). The period 2005:Q1–2006:Q1 refers to the period of January 3rd 2005 to March 31st 2006 and 2004:Q1–2004:Q4 refers to calendar year 2004.	Thomson Financial Insider Filings and CRSP Daily Stock file

(Continued)

[38] $Sell_{Independent\ Directors}$ and $Sell_{Middle\ Officers}$ are computed in the same way using transactions of independent directors and middle–officers, respectively.

[39] $\Delta Sell_{Independent\ Directors}$ and $\Delta Sell_{Middle\ Officers}$ are computed in the same way using transactions of independent directors and middle–officers, respectively.

Table A1–Continued:

Variable	Calculation	Sources
$\#Sell_i$	The total number of top–five executives' sell transactions before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1). $\sum_{t\epsilon[2005:Q1,2006:Q1]} \#Sell_{i,t,k}$ where $\#Sell_{i,t,k}$ is the number of sell transactions on transaction day *t* by any top-five executives *k* of bank *i*. The period 2005:Q1-2006:Q1 refers to the period of January 3rd 2005 to March 31st 2006.	Thomson Financial Insider Filings
$\Delta\#Sell_i$	The total number of top-five executives' sell transactions before the peak of the real estate prices in April 2006 (2005:Q1-2006:Q1), minus the number of sell transactions in the previous year of 2004. $\sum_{t\epsilon[2005:Q1,2006:Q1]} \#Sell_{i,t,k} - \sum_{t\epsilon[2004:Q1,2004:Q4]} \#Sell_{i,t,k}$ where $\#Sell_{i,t,k}$ is the number of sell transactions on transaction day *t* by any top-five executives *k* of bank *i*. The period 2005:Q1–2006:Q1 refers to the period of January 3rd 2005 to March 31st 2006 and 2004:Q1–2004:Q4 refers to calendar year 2004.	Thomson Financial Insider Filings
$Net\ Sell_i$	The net value of top–five executives' sell transactions before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1). $\sum_{t\epsilon[2005:Q1,2006:Q1]} \frac{Sell_{i,t,k}-Buy_{i,t,k}}{Market\,Capitalization_{i,t}} \times 100$ where $Sell_{i,t,k}$ is the value of each sell transaction (transaction price $\times$ number of shares sold) on transaction day *t* by any top–five executives *k* of bank *i*, $Buy_{i,t,k}$ is the value of each buy transaction (transaction price $\times$ number of shares purchased) on transactio 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 2005:Q1–2006:Q1 refers to the period of January 3rd 2005 to March 31st 2006.	Thomson Financial Insider Filings and CRSP Daily Stock file

(Continued)

Table A1–Continued:

Variable	Calculation	Sources
$\Delta NetSell_i$	The net value of top–five executives' sell transactions before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1), minus the net sales in the previous year of 2004. $\sum_{t\epsilon[2005:Q1,2006:Q1]} \frac{Sell_{i,t,k}-Buy_{i,t,k}}{Market\,Capitalization_{i,t}} \times 100 - \sum_{t\epsilon[2004:Q1,2004:Q4]} \frac{Sell_{i,t,k}-Buy_{i,t,k}}{Market\,Capitalization_{i,t}} \times 100$ where $Sell_{i,t,k}$ is the value of each sell transaction (transaction price $\times$ number of shares sold) on transaction day *t* by any top–five executives *k* of bank *i*, $Buy_{i,t,k}$ is the value of each buy transaction (transaction price $\times$ number of shares purchased) 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 2005:Q1–2006:Q1 refers to the period of January 3rd 2005 to March 31st 2006 and 2004:Q1–2004:Q4 refers to calendar year 2004.	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 value-weighted CRSP index.	CRSP Daily Stock file
Book–to–market	The ratio of equity book value to equity market value. $\frac{Equity\,book\,value(ceq)}{Equity\,market\,value} \times 100$ Market value of common equity is defined as 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.	Compustat
Dividend	The ratio of total dividends (common and preferred) to total assets. $\frac{Common\,dividends(dvc)+Preferred\,dividends(dvp)}{Total\,assets(at)} \times 100$	Compustat
Leverage	The ratio of long term debt and debt in current liabilities to stockholders' equity, long term debt and debt in current liabilities. $\frac{Long\,term\,debt(dltt)+Debt\,in\,currentliabilities(dlc)}{Long\,term\,debt(dltt)+Debt\,in\,currentliabilities(dlc)+Shareholders'equity(seq)} \times 100$	Compustat
Leverage Acharya etal. 2010	Quasi-market value of assets divided by the market value of equity. $\frac{Asset\,book\,value(at)-Equity\,book\,value(ceq)+Equity\,market\,value}{Equity\,market\,value} \times 100$ Equity market value is defined as 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.	Compustat
Liquidity	The ratio of cash to total assets. $\frac{Cash\,and\,short\,term\,investments(che)}{Total\,assets(at)} \times 100$	Compustat

(Continued)

Table A1–Continued:

Variable	Calculation	Sources
Market value	Equity market value 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$).	Compustat
NPL	Non performing loans is defined as the ratio of non performing loans to total loans (total loans net of total allowance for loan losses). $\frac{Non\,performing\,loans\,(npat)}{Loans\,net\,of\,total\,allowance\,for\,loan\,losses(lntal)} \times 100$	Compustat Bank Fundamentals
Real Estate Exposure	The ratio of Loans backed by real estate to total assets. $\frac{Loans\,backed\,by\,real\,estate(BHCK1410)}{Total\,assets(BHCK2170)} \times 100$	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 returns from April to December 2006.	CRSP Monthly Stock file
TCE ratio	Tangible common equity ratio is defined as $\frac{Tangible\,common\,equity(ceqt)}{Tangible\,assets} \times 100$ where tangible assets is defined as total assets(at) – intangible assets(intan)	Compustat
Tier 1 capital ratio	Tier 1 capital ratio as reported in Compustat Bank. Data item is *capr1*	Compustat Bank Fundamentals
Total assets	Total book assets (in million$). Data item is *at*	Compustat
Total liabilities	Total book liabilities (in million$). Data item is *lt*	Compustat

Table A2

SUMMARY STATISTICS OF VARIABLES ONLY USED IN APPENDIX (all tables except Table A9)

	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(July 07-Sept08)	170	-0.52	-0.18	0.09	-0.22	0.39
$\Delta \# Sell$	170	-1.00	1.00	3.00	1.56	8.45
$\# Sell$	170	1.00	3.00	6.00	5.42	10.98
$\Delta Net\ Sell$	170	-0.04	0.03	0.15	0.03	0.44
$Net\ Sell$	170	0.03	0.11	0.32	0.26	0.47
$\Delta Sell_{non-option}$	170	0.00	0.00	0.08	0.02	0.33
$\Delta Sell_{option}$	170	0.00	0.00	0.06	0.03	0.30
$Sell_{immediately\ before}$	170	0.00	0.02	0.11	0.11	0.26
Leverage $_{\text{Acharya etal. 2010}}$	170	4.94	5.86	7.01	6.38	2.59
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
NPL	157	0.30	0.54	0.80	0.64	0.53
Liquidity	170	2.25	3.11	5.45	5.07	5.42

Descriptive statistics of variables only used in Appendix. All variables are defined in Table A1 in the Appendix. Accounting variables are as of 2004 fiscal year end.

Table A3
ROBUSTNESS: ALTERNATIVE PERIODS FOR FINANCIAL CRISIS

VARIABLES	(1) Jan07-Dec08	(2) Jan07-Dec08	(3) July07-Sept08	(4) July07-Sept08	(5) Jan07-Dec08	(6) Jan07-Dec08	(7) July07-Sept08	(8) July07-Sept08
$\Delta Sell$	-0.133***	-0.112***	-0.176***	-0.129**				
	(0.045)	(0.042)	(0.060)	(0.056)				
$Sell$					-0.036**	-0.039***	-0.056***	-0.057***
					(0.015)	(0.014)	(0.020)	(0.019)
Return		-0.417***		-0.492***		-0.372***		-0.418**
		(0.125)		(0.182)		(0.126)		(0.180)
Book-to-market		-0.475***		-0.646***		-0.488***		-0.662***
		(0.170)		(0.234)		(0.167)		(0.227)
Log(market value)		-0.029**		-0.041**		-0.041***		-0.059***
		(0.013)		(0.019)		(0.014)		(0.020)
Beta		0.025		0.143*		0.034		0.150**
		(0.045)		(0.073)		(0.043)		(0.070)
Leverage		-0.206*		-0.285*		-0.169		-0.223
		(0.117)		(0.151)		(0.112)		(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 measure. 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 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 before the peak of the real estate prices in April 2006 (2005:Q1-2006:Q1), minus the sales in the previous year of 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 2005:Q1-2006:Q1(in logs). Accounting control variables are as of 2004 fiscal year end. Constant term is included but 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***	-0.012***						
	(0.004)	(0.004)						
$\#Sell$			-0.011***	-0.008*				
			(0.004)	(0.004)				
$\Delta Net\ Sell$					-0.161**	-0.123*		
					(0.071)	(0.066)		
$Net\ Sell$							-0.154**	-0.121**
							(0.060)	(0.059)
Return		-0.369**		-0.389**		-0.445***		-0.390**
		(0.163)		(0.166)		(0.157)		(0.160)
Book-to-market		-0.565***		-0.582***		-0.587***		-0.586***
		(0.185)		(0.190)		(0.193)		(0.191)
Log(market value)		-0.040***		-0.041***		-0.043***		-0.047***
		(0.015)		(0.015)		(0.015)		(0.015)
Beta		0.105*		0.116*		0.100		0.106*
		(0.059)		(0.060)		(0.062)		(0.060)
Leverage		-0.168		-0.174		-0.195		-0.168
		(0.144)		(0.144)		(0.143)		(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 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 number of sell transactions before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1), minus the number of sell transactions in the previous year of 2004. In columns 3-4 the main variable of interest is $\#Sell$ which is the number of sell transactions before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1). In columns 5-6 the main variable of interest is $\Delta NetSell$ which is the net value of sell transactions(sell minus buy) before the peak of the real estate prices in April 2006 (2005:Q1-2006:Q1), minus the net value of sell transactions(sell minus buy) in the previous year of 2004. In columns 7-8 the main variable of interest is $NetSell$ which is the net value of sell transactions (sell minus buy) before the peak of the real estate prices in April 2006 (2005:Q1-2006:Q1). Accounting control variables are as of 2004 fiscal year end. All insider trading measures are winsorized at 2% and 98%. Constant term is included but not reported to avoid cluttering. 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
$\Delta Sell$	-0.136**	-0.137***	-0.154**	-0.155***	-0.134**	-0.215***	-0.232***	-0.169**	-0.211***	-0.210***
	(0.054)	(0.048)	(0.065)	(0.051)	(0.052)	(0.070)	(0.071)	(0.065)	(0.066)	(0.069)
Return	-0.399***	-0.396**	-0.253	-0.314*	-0.411***	-0.175	-0.178	-0.217	-0.137	-0.125
	(0.151)	(0.157)	(0.207)	(0.162)	(0.156)	(0.205)	(0.198)	(0.216)	(0.212)	(0.192)
Book-to-market	-0.373*	-0.594***	-0.232	-0.423**	-0.621***	-0.307	-0.419	-0.361	-0.304	-0.396
	(0.200)	(0.194)	(0.219)	(0.201)	(0.185)	(0.342)	(0.276)	(0.268)	(0.289)	(0.275)
Log(market value)	-0.046***	-0.051***	-0.000	-0.027	-0.046***	-0.030*	-0.032*	-0.003	-0.015	-0.021
	(0.013)	(0.015)	(0.019)	(0.017)	(0.015)	(0.018)	(0.018)	(0.020)	(0.019)	(0.017)
Beta	0.080	0.106*	0.075	0.092	0.090	0.097	0.112*	0.082	0.098	0.099
	(0.060)	(0.062)	(0.064)	(0.061)	(0.062)	(0.062)	(0.064)	(0.065)	(0.063)	(0.063)
Leverage $_{\text{Acharya etal. 2010}}$	-0.031***					-0.017				
	(0.010)					(0.025)				
TCE ratio		-0.001					-0.005			
		(0.007)					(0.016)			
Tier 1 capital ratio			0.026***					0.022**		
			(0.010)					(0.009)		
NPL				-0.006					-0.045	
				(0.045)					(0.054)	
Liquidity					-0.004					-0.008
					(0.004)					(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 measure with different bank controls and for different sample of banks. 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 before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1), minus the sales in the previous year of 2004. Columns 1-5 present results using the full sample of 170 banks and columns 6-10 present results with the subsample of 125 bank holding companies that file Y-9 reports with the Federal Reserve in 2004. Accounting control variables are as of 2004 fiscal year end. Constant term is included but 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
$\Delta Sell$	-0.195***	-0.166***	-0.148**	-0.146**
	(0.058)	(0.056)	(0.060)	(0.060)
Return		-0.317*	-0.331**	-0.334**
		(0.170)	(0.165)	(0.163)
Book-to-market		-0.598***	-0.523***	-0.512**
		(0.195)	(0.197)	(0.203)
Log(market value)		-0.025*	-0.031**	-0.029*
		(0.013)	(0.014)	(0.015)
Beta			0.091	0.092
			(0.060)	(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 measure 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 $\Delta Sell$ which is the value of top–five executives' sell transactions before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1), minus the sales in the previous year of 2004. Accounting control variables are as of 2004 fiscal year end. Constant term is included but 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***		-0.053***
	(0.017)		(0.019)
Sell_2006Q2_2007Q2		0.005	0.148
		(0.145)	(0.152)
Return	-0.375**	-0.461***	-0.369**
	(0.156)	(0.159)	(0.156)
Book-to-market	-0.600***	-0.595***	-0.591***
	(0.189)	(0.193)	(0.185)
Log(market value)	-0.057***	-0.042***	-0.058***
	(0.016)	(0.015)	(0.016)
Beta	0.102*	0.114*	0.103*
	(0.058)	(0.061)	(0.058)
Leverage	-0.152	-0.222	-0.174
	(0.136)	(0.145)	(0.138)
Constant	0.353**	0.408**	0.327**
	(0.162)	(0.162)	(0.159)
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 measure. All variables are defined in Table A1 in the Appendix. The main variable of interest is Sell_2006Q2_2007Q2, which is the sum of top-five executives' dollar value of sell transactions immediately preceding the financial crisis in logs. Accounting control variables are as of 2005 fiscal year end. Constant term is included but 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***	-0.177***	-0.170***	-0.166***				
	(0.056)	(0.055)	(0.051)	(0.050)				
$\Delta Sell_{option}$					-0.127	-0.112	-0.089	-0.081
					(0.095)	(0.085)	(0.093)	(0.094)
Return		-0.432***	-0.439***	-0.442***		-0.437**	-0.446***	-0.449***
		(0.160)	(0.153)	(0.154)		(0.169)	(0.161)	(0.160)
Book-to-market		-0.725***	-0.632***	-0.578***		-0.742***	-0.653***	-0.598***
		(0.179)	(0.185)	(0.190)		(0.181)	(0.189)	(0.194)
Log(market value)		-0.042***	-0.051***	-0.043***		-0.042***	-0.050***	-0.043***
		(0.013)	(0.014)	(0.015)		(0.014)	(0.014)	(0.015)
Beta			0.106*	0.106*			0.103	0.104
			(0.059)	(0.060)			(0.063)	(0.063)
Leverage				-0.208				-0.211
				(0.142)				(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 measure. 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 (2005:Q1–2006:Q1), minus the sales not related to options exercise in the previous year of 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 (2005:Q1–2006:Q1), minus the sales related to options exercise in the previous year of 2004. Accounting control variables are as of 2004 fiscal year end. Constant term is included but 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
Controlling for Compensation

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
$\Delta Sell$	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
ret_bah_2006M4_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 ExecuComp during years of 2000-2004. 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-Term Incentive Payouts, and All Other Total. SBC, stock-based compensation, is the sum of the value of the restricted stock grant during that year (ExecuComp item: rstkgrnt) and the aggregate value of stock options granted to the executive during the year as valued using S&P's Black Scholes methodology (ExecuComp item: option_awards_blk_value). Each compensation variable defined above is available at executive-bank-year level in ExecuComp database. For a given bank, we take the average of the variables over the 5 years, 2000-2004.

Panel B: Results

	(1)	(2)	(3)	(4)
VARIABLES	Crisis return	Crisis return	Crisis return	Crisis return
$\Delta Sell$	-0.131**	-0.316***	-0.385***	-0.335***
	(0.052)	(0.098)	(0.105)	(0.096)
Return	-0.428***	-0.101	0.088	-0.065
	(0.156)	(0.420)	(0.449)	(0.443)
Book-to-market	-0.585***	-1.152***	-1.043***	-1.122***
	(0.191)	(0.358)	(0.360)	(0.358)
Log(market value)	-0.043***	-0.041	0.019	0.005
	(0.015)	(0.032)	(0.041)	(0.041)
Beta	0.091	-0.087	0.034	-0.004
	(0.062)	(0.156)	(0.163)	(0.157)
Leverage	-0.196	-0.597**	-0.413	-0.430
	(0.142)	(0.264)	(0.265)	(0.280)
TDC1			-0.000**	
			(0.000)	
SBC				-0.000*
				(0.000)
Constant	0.411**	1.022***	0.285	0.481
	(0.162)	(0.364)	(0.515)	(0.487)
Observations	170	44	44	44
R-squared	0.168	0.511	0.548	0.535

All variables are defined in Panel A.

Table A10
RISK EXPOSURE AND DIVIDEND REDUCTION
ROBUSTNESS: YEAR OF MEASUREMENT

VARIABLES	(1) Leverage	(2) Dividend	(3) Real Estate Exposure	(4) Leverage	(5) Dividend	(6) Real Estate Exposure
$\Delta Sell$	0.004	0.001	-0.008			
	(0.019)	(0.024)	(1.509)			
$Sell$				0.007	0.000	-0.061
				(0.005)	(0.008)	(0.346)
Return	0.063	0.104	6.495	0.052	0.104	6.563
	(0.085)	(0.135)	(4.702)	(0.084)	(0.133)	(4.719)
Book-to-market	0.060	0.103	4.249	0.059	0.103	4.159
	(0.080)	(0.211)	(6.135)	(0.079)	(0.211)	(6.079)
Log(market value)	0.018***	0.016**	-0.638	0.020***	0.016*	-0.660
	(0.006)	(0.008)	(0.412)	(0.007)	(0.009)	(0.434)
Beta	-0.017	0.018	-0.012	-0.017	0.018	-0.037
	(0.026)	(0.047)	(1.196)	(0.025)	(0.045)	(1.207)
Leverage	0.615***			0.606***		
	(0.064)			(0.064)		
Dividend		0.808***			0.808***	
		(0.108)			(0.109)	
Real Estate Exposure			0.921***			0.922***
			(0.034)			(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 measure. All variables are defined in Table A1 in the Appendix. In columns 1-3 the main variable of interest is $\Delta Sell$ which is the value of top–five executives' sell transactions before the peak of the real estate prices in April 2006 (2005:Q1–2006:Q1), minus the sales in the previous year of 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 2005:Q1-2006:Q1(in logs). Constant term is included but not reported to avoid cluttering. Accounting control variables are as of 2004 fiscal year end. 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	(2) Dividend	(3) Real Estate Exposure	(4) Leverage	(5) Dividend	(6) Real Estate Exposure
$\Delta Sell_{Independent\ Directors}$	-0.000	-0.016	0.346			
	(0.013)	(0.012)	(1.017)			
$\Delta Sell_{Middle\ Officers}$				0.015	0.051	-1.787
				(0.047)	(0.058)	(3.405)
Return	0.025	-0.065	1.295	0.027	-0.051	1.182
	(0.074)	(0.107)	(4.148)	(0.074)	(0.106)	(4.118)
Book-to-market	0.085	0.006	3.748	0.085	0.011	3.698
	(0.076)	(0.201)	(5.000)	(0.076)	(0.199)	(4.943)
Log(market value)	0.014**	0.014*	-0.180	0.014**	0.014*	-0.199
	(0.006)	(0.008)	(0.399)	(0.005)	(0.008)	(0.400)
Beta	-0.017	0.035	0.596	-0.017	0.033	0.556
	(0.021)	(0.042)	(0.948)	(0.021)	(0.042)	(0.975)
Leverage	0.771***			0.772***		
	(0.057)			(0.056)		
Dividend		0.715***			0.724***	
		(0.106)			(0.103)	
Real Estate Exposure			0.939***			0.937***
			(0.029)			(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 measure. All variables are defined in Table A1 in the Appendix. In columns 1-3 the main variable of interest is $\Delta Sell_{Independent\ Directors}$ which is the value of independent directors' sell transactions before the peak of the real estate prices in April 2006 (2005:Q1-2006:Q1), minus the sales in the previous year of 2004. In columns 4-6 the main variable of interest is $\Delta Sell_{Middle\ Officers}$ which is the value of middle–officers' sell transactions before the peak of the real estate prices in April 2006 (2005:Q1-2006:Q1), minus their sales in the previous year of 2004. Accounting control variables are as of 2004 fiscal year end. Constant term is included but not reported to avoid cluttering. Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Reply to the referee report of the paper: "Anticipating the financial crisis: Evidence from insider trading in banks"

LEGEND:

Italics Bold Times New Roman – (referee)

Times New Roman – our comments on the referee report (to be sent to the referee)

Times New Roman – references to changes in the manuscript

We would like to thank the referee for the many and insightful comments. We have addressed all the issues raised by the referee and made substantive amendments in the manuscript. We carefully address each comment in turn. All references to sections, pages, footnotes, etc. below apply to the current revised version of the manuscript.

The paper under review shows that insider trades in banks by the top five executives during the period 2005Q1 to 2006Q1 are positively correlated with stock returns during the recent financial crisis. Insider sales by independent directors or non-top 5 named executive officers do not predict crisis returns. The effect is more pronounced in banks with more exposure to real estate; in those banks, an increase in insider selling during 2005 predicts a large fraction of crisis returns. Banks with a higher fraction of insider sales do not change their corporate policies. The authors argue that their results show that top-level bankers were fully aware of the highly risky exposure to the real estate sector. Based on their evidence, the authors reject a behavioral explanation (overconfidence, neglected risks) of the recent crisis in favor of an explanation in which bankers exploited misaligned incentives between them and policy makers / shareholders.

As a small comment, we must remark here that our take is not that "***top-level bankers were fully aware of the highly risky exposure of the real estate sector***" and that we "***reject a behavioral explanation of the recent crisis***". Regarding the first issue, our claim is not that top-bankers knew for sure, but that they had information or beliefs, which could be wrong with some probability, about such risks. They expected corrections in real estate values in some uncertain date in the future. These expectations could even not realize in the future, but they were precise enough to induce top-managers to reduce their own risk exposure (what is consistent with the increase in sales we document in the paper).

Regarding the second issue, our claim is that the evidence is consistent with the incentives view, but we do not claim at all that behavioral issues did not play a role. Indeed, behavioral considerations could have played an important role here too. So, we do not view the two explanations as mutually exclusive.

To avoid confusion on these two issues, we have amended the text of the manuscript in several places toning down our claims.

General assessment

The paper contributes to a recent literature on the causes and consequences of the recent financial crisis and is very topical. The regressions are carefully executed and the paper is well written.

I have three main objections, which are related to the definition of the period over which insider sales are measured, the omission of a discussion of the level of insider ownership prior to the crisis, and the strong policy recommendations despite the lack of identification.

Measurement period

I think the authors ought to do a better job to defend the period over which they measure insider trading and stock returns, for at least two reasons. First, other papers (and they do, too, in robustness checks) have shown that insider trading directly prior to the crisis and insider trading before the period 2005Q1 and 2006Q1 are actually not related to financial crisis returns. In addition, the authors also show that during the year immediately following 2005Q1 to 2006Q1, these insider sales actually do not predict bank returns. This is what the classic insider trading papers would have done.

Bank stocks significantly appreciated in value until 2007, so in some ways the authors show that insider trading was quite poorly timed, and that insiders left a considerable amount of money on the table. They would have been much better off selling in June 2007.

The bottom line: Why do insider sales, only during 2005Q1 to 2006Q1, only predict financial crisis returns? The authors briefly mention a 2008 JF paper that could give justification for the chosen period, but it seems that much more work is needed to reduce concerns about data snooping. That could be either done via a much better explanation and application of the JF model to the current setup, or by arguing why this period is so especially suited for predicting the crisis. While the Case-Shiller index stopped growing after 2006Q1, it really stayed flat at a very high level until 2007Q2.

The referee has a general concern with data snooping in the choice of the periods for insider trading. In the discussion, the referee also raises two specific questions: 1) why insider trading right after 2006Q1 does not predict returns? and, 2) why did insiders leave so much money on the table? Point 1) is specially puzzling for the referee as he claims that this is the evidence that classical insider trading papers would use to conclude lack of insiders anticipation (the opposite to our claim).

But there is no data snooping at all in our analysis. All the results we obtain are consistent with sound economic reasoning and the literature on insider trading (or informed trading in general) and stock price crashes. Moreover, this economic reasoning and literature give the answer to the two specific questions raised by the referee. Let's see this.

The trading by corporate insiders based in private information is a particular form of informed trading with some peculiarities.

1. As a form of informed trading, it shares some of the properties of informed trading documented in the theoretical literature. Both in the case of a competitive (say, as in Grossman and Stiglitz (1980) and a strategic informed trader (as in Kyle (1985)), the insider will take:

    a. Limited positions in the stock. That is, in general, an insider with good news will not buy an infinite amount of shares (or the total supply of the security); nor sell an infinite amount (or the total supply of the security) when he has bad news. The size of the trade and resulting post-trade holdings will be a function of the precision of the information and risk sharing/bearing considerations. This observation already provides a first (partial) explanation for the "leaving money on the table issue".

    b. Positions in the stock which are increasing in the size of the expected mispricing. That is, the bank insider will sell more, the more his bank is exposed to an overpriced real estate market (the larger the exposure to the Real Estate market) as this will be associated to a larger expected bank stock price drop. This is the main basis of our identification mechanism.

2. But, insider trading is special in some dimensions:

    a. First, it is unlawful when it is based in so called non-public material information. So, insiders will trade using their private information, but trying to avoid prosecution. For instance, they will refrain from selling when these sales can be easily linked to information they have because of their position in their firm, but that is not available to the general public. For instance, a banker who believes that real state risk is high will stop selling if he already verifies a substantive increase in defaults in his bank's Real Estate lending operations, as these sales could be linked to private internal bank information the insider has. Importantly enough, Mian and Sufi (2011) documents that real estate related defaults started in 2006. Consequently, due to the avoid prosecution effect, we should expect that the increase in sales slows down or even ceases in 2006. This already provides a partial explanation as to why "***insider trading directly prior to the crisis are actually not related to financial crisis returns".***

    b. Second, the selling by insiders is subject to constraints. These constraints are both explicit (no short selling, no trading around corporate events, etc.) and implicit given the position of the insider in the corporation – for instance, top insiders would tend to hold even a relative large amount of shares (including more than the non-vested ones) to convince shareholders that incentives are fully aligned. This is an additional rationale for the leaving money on the table issue.

Marin and Olivier (1998) provides a model that incorporates all these ingredients. In this model insiders trade with private information, but face trading constraints. The immediate consequence of these constraints is that price crashes (large price drops or crisis in the terminology of our paper) occur in equilibrium precisely because of the trading constraints faced by insiders. When these selling constraints are binding, bad news do not get impounded into prices in the short run, but later on in a discontinuous manner. The main prediction of this model, which is corroborated in the empirical part of the paper, is that price crashes are preceded by high selling activity and stop selling right before the crash. That is crashes are positively correlated to "far in the past" insider sales and negatively or no correlated with "immediately preceding" insider sales.

So, we have the following:

1. The referee is right in that in the context of a classic insider trading paper (where insiders are just informed traders), we would expect selling by insiders to be unusually high after 2006Q1 and perhaps even insiders ending with no much money left on the table if the perceived mispricing is very precise. But in this classic paper we would not observe crashes. This is just not the right model to analyze the anticipation of the "crisis" (price crashes) by bank insiders. Indeed, ignoring this fact is a key weakness of papers such as Fahlenbrach, Prilmeier and Stultz (2012) that use the low selling activity of insiders in the period immediately prior to the crisis as evidence of lack of anticipation. On the contrary, this evidence indeed is the most clear data in favor of the anticipation hypothesis, as it clearly points at selling constraints being binding or that insiders are trying to avoid prosecution.

2. To analyze insiders' activity around crashes we need a model where insider trading is associated to crashes. This is exactly what happens in Marin and Olivier (1998). In this model:

    a. As in the classical insider trading model, insiders sell when they have bad news and they sell more the more the estimated misspricing. This is the basis of our identification mechanism. We show that indeed, prior to the 2007 bank crisis, bank insiders sold heavily and those in banks with high exposure to real estate (where the expected mispricing is larger) sold more.

    b. Insiders will stop this unusual selling activity some time before the crash when their selling constraints are binding and/or understand that the trading could be associated with corporate material information (and result in prosecution).

3. In our context this implies:

        i. That the increase in sales by insiders should have taken place much before the start of the crisis (mid 2007), and that there should exist a period immediately before the start of the crisis in which the unusual insiders sales

stop. In the first (far away) period insider sales are positively correlated to the crisis returns and in the second, either not correlated or negatively correlated.

ii. Given the evidence on real estate related defaults starting to pick up in 2006 (Mian and Sufi (2011) we expect the avoiding prosecution hypothesis to start applying from this point on. Also, we ex ante expect that by 2006 many anticipating insiders already sold shares that put them close to their limit constraints. So, 2006 is the clear date to separate the two periods of insider trading activity related to crisis returns in Marin and Olivier (1998):

1. Period immediately before 2006. Under the hypothesis of anticipating insiders, in this period we should expect unusual selling activity by insiders (insider sales positively related to crisis returns). Based on this reasoning we take a 12-month period, what explains our 2005Q1-2006Q1 choice for insider trading.
2. Period 2006 until crisis starts. Under the hypothesis of anticipating insiders we should expect unusual selling by insiders to cease (insiders sales either not related or negatively related to crisis returns).

In the paper we focus on the first period as it is the one that explicitly links insider activity and crisis returns. But as the table below shows, the data indeed corroborates the expected outcome in both periods. As we can see, crisis returns are positively related (negative sign coefficient in our sell variable) to insiders sales in the first period (2005Q1-2006Q1) and not related (the coefficient switches sign and becomes positive, but no statistically significant) to insiders sales in the second period (2006Q2-2007Q2).

Table 1: The Dog that Did not Bark (Marin and Olivier (1998))

VARIABLES	(1) Crisis return	(2) Crisis return	(3) Crisis return
Sell	-0.046***		-0.053***
	(0.017)		(0.019)
Sell_2006Q2_2007Q2		0.005	0.148
		(0.145)	(0.152)
Return	-0.375**	-0.461***	-0.369**
	(0.156)	(0.159)	(0.156)
Book-to-market	-0.600***	-0.595***	-0.591***
	(0.189)	(0.193)	(0.185)
Log(market value)	-0.057***	-0.042***	-0.058***
	(0.016)	(0.015)	(0.016)
Beta	0.102*	0.114*	0.103*
	(0.058)	(0.061)	(0.058)
Leverage	-0.152	-0.222	-0.174
	(0.136)	(0.145)	(0.138)
Observations	170	170	170
R-squared	0.179	0.140	0.186

In summary, there is no data mining in our approach: the identification mechanism and the chosen periods are 100% motivated by economic reasoning and in particular by the model in Marin and Olivier (2008), which represents the right setting as what we want is to test for bank insiders activity preceding a crisis, and not unconditional insiders selling. In the context of this model, leaving money on the table and no unusual selling after 2006:Q1 are equilibrium phenomena. This point has critically been ignored in some papers in the literature. In particular, Fahlenbrach, Prilmeier and Stultz (2012) find no unusual activity before the crisis and use this is evidence to claim lack of insider anticipation. As argued above, this evidence is consistent precisely with the opposite: the existence of crisis anticipation.

We have clarified this issue in several parts of the paper. In particular, we have:

- Added a paragraph starting with "The three …" (page 3)
- Added arguments in old paragraph starting with "We analyze …" (pages 4 and 5)
- Add a new footnote (number 6) in the previous paragraph to address the issue of "money left on the table" (page 5).
- Made changes in paragraph starting with "Fahlenbrach et al …" (pages 8 and 9).
- Made changes in paragraph staring with "In Table A7 …" (page 20).
- Include table reported above as table A7 that substitutes the old table A8.

Insider ownership vs. insider sales

The authors mention in Table 1 that median insider sales amounted to approximately 0.12% of market capitalization in the period 2005Q1 to 2006Q1 for banks, and this is their main measure to conclude that these insiders fully understood the excessive risk-taking of their banks. I think to reach this strong conclusion the authors would also have to show that the level of inside ownership after these sales was very small. Suppose the median level of inside ownership in 2006Q2 was 5%. By selling 0.12% in 2005, can we really argue that they knew about excessive risk-taking if they hold on to so much equity?

To give another example, the authors cite Bebchuck and Spamann who show that the CEO of Bear Stearns and Lehman sold hundreds of million dollars' worth of bank shares prior to the crisis, and that this evidence that they knew that their banks were taking excessive risks. However, both of these CEOs held close to $1billion worth of equity in their stock at the onset of the financial crisis, with virtually all of it fully vested. What model would predict such large, voluntary equity ownership if executives knew about excessive risks on their balance sheet?

Most of the issues raised by the referee here have already been answered in this reply. First, our proposition is not that bank insiders "***fully understood***", but that they had information that made them believe that their bank's real estate risk exposure was too high. Second, as we argued before, leaving money on the table is the expected result in equilibrium. The presence of explicit (no short sales) or implicit (minimum holding consistent with incentives being aligned with shareholders) selling constraints and the early materialization of defaults that could constitute material information (which activates the stop selling to avoid prosecution) cause abnormal selling activity to cease. So, it is perfectly normal that some insiders stopped selling before they got rid of all their (vested) holding.

In further inspection of the last issue, we have looked at the intensity of selling relative to insiders' holdings as the referee suggests. Although the analysis is by force noisy because we must merge data with other datasets, what results in a smaller and biased sample of banks/insiders, the results point at sales by insiders in the group of "Bad Performing" banks (banks with crisis returns below median) that represent almost 40% (median) of their of total holdings (vested and not vested, in 2004)) and which are more than ten times the sales of the insiders in the group of "Good Performing" banks (median of 3,4%). The data hence corroborates very large sales relative to initial holdings in anticipation of the crisis. Here are the details.

Given that Thomson Insider dataset does not include insiders' ownership, we obtain this variable from other sources. In particular, we compute ownership in two alternative ways:

- In the first one we use the data in Kim and Lu (2011). The authors compute ownership using data from ExecuComp and taking into account both the value of common stocks and stock options.[1] Unfortunately, although they perform some analysis for top 5 managers, they only compute this variable for CEOs, so we are restricted to this smaller set. We've been able to match CEO ownership data for **44 of our 170 banks.** The table below shows the ownership of CEO in median bank of each group over years of 2004-2005. Banks are grouped based on their performance during the crisis: "Bad performers" ("Good Performers") are banks with crisis return below (above) median. There are 22 banks in each group. So, the data (median) show that during 2005 CEOs of bad performing banks got rid of 28% of their holding, what is almost three times more than the reduction of the CEOs of the good performing banks (10%).

Table 2: CEO's Ownership (including stock options) - restricted merged set

	CEO (Median)			
Year	Bad performers (22 banks)	% change	Good performers (22 banks)	% change
2004	0.0043		0.0041	
2005	0.0031	-28%	0.0037	-10%

- In the second, we directly use stock ownership variable from ExecuComp database. The database provides the data on the percentage of stocks held by each executive as a percentage of shares outstanding. This variable excludes stock options. We match ownership data for 51 of our 170 banks. We take the average of the fractions of shares held by executives to find the ownership at bank level. The table below reports the average ownership (as a percentage of shares outstanding) at median bank in each group. As the table below shows, (median) show that during 2005 executives of bad performing banks

[1] The authors' estimate of CEO ownership with firm ID and by year are available from the *Journal of Financial Economics* Web page. They follow Core and Guay (2002) methodology to calculate the delta of exercisable and unexercisable stock options. The ownership variable they provide is the percentage of the total delta of all outstanding stocks and options belonging to a CEO.

got rid of 28% (median) of their holding, what is more than 10 times more than the reduction of the executives of the good performing banks (3,7%).

Table 3: Executives Ownership (not including stock options) - restricted merged set

	EXECUTIVES (Median)			
Year	Bad performers (26 banks)	% change	Good performers (25 banks)	% change
2004	0.13%		0.27%	
2005	0.08%	38%	0.26%	3.7%

To avoid suspicions that the asymmetric selling activity is due to a larger amount of vested stock in the group of executives of the "Bad performing" banks, in Table 4 below we report the percentage that the vested stocks represents on the total of shares held. The table shows that executives in both groups have most of their stocks vested. But, if any, it is the executives in the group of "Good Performing" banks the one with the largest fraction, so lack of enough vested stock holdings cannot be the reason behind the asymmetric selling activity documented.

Table 4: Vested Stock of Executives (as a fraction of Ownership)

	Bad performers (26 banks)		**Good performers (25 banks)**	
	Mean	Median	Mean	Median
2004	79%	88%	91%	100%
2005	72%	73%	90%	100%

We must emphasize that both measures of Ownership feed from the ExecuComp database, what biases the analysis towards large banks (as EXECOMP focuses on S&P stocks). This indeed biases the results against our hypothesis (for instance, insiders of large companies are more closely monitored by analysts and other market participants and, consequently, more reluctant to trade on private information).

The previous results are already revealing of a large and asymmetric drop in Ownership during 2005: irrespectively of the definition of ownership, we find a large drop in ownership during 2005 (prior to the drop in Real Estate prices) and, as expected, the drop was much larger for insiders in the bad performing group of banks. However, the selling activity inferred from Ownership over this period infra-estimates the one we compute in the paper, as our sell variable extends all the way

until the end of Q1 2006 and also because during the period, insiders could have sold some granted stock during 2005. To get a closer picture of the intensity of selling by insiders during our measurement period relative to (pre-period) ownership, we have performed the following exercise.

We merged insider data from Thomson with ExecuComp ownership data at individual level. So we go through the names of top-5 insiders included in our analysis and we match them with executives in ExecuComp. Then we compute total sell value of each insider during anticipation period and divide it by his ownership as of 2004.[2] Bank level variables are obtained as the average of individual variables.

Table 5 below reports the mean and median values of variables of interest for bad performers and good performers. As we can see, selling activity in this metric is much larger than in the previous one and, again, much larger for insiders in the group bad performing banks than for insiders in the group of the good performing banks.[3]

Table 5: Selling Intensity of Executives

	Bad performers (25 banks)		Good performers (25 banks)	
	Mean	Median	Mean	Median
Sell / Ownership	59.68%	28.26%	29.73%	14.82%
Net Sell / Ownership	59.34%	27.84%	25.99%	12.79%
Sell / Vested Stocks	71.81%	31.25%	39.42%	14.82%
Net Sell / Vested Stocks	71.46%	31.25%	35.69%	13.54%

Sell is the value of total sell during anticipation period (2005Q1:2006Q3). *Ownership* is the value of ownership as of 2004 fiscal year end. The value of ownership is computed as the number of shares owned (excluding options) times stock price end of fiscal year (shrown_excl_opts × prcc_f). *Net Sell* is the difference between total value of sell and buy during the anticipation period. Value of *Vested Stocks* is obtained by multiplying the number of vested shares by the stock price as of fiscal year end 2004. The number of vested shares is the difference between shares owned (shrown_excl_opts) and the number of restricted stock holdings (stock_unvest_num). All variables are winsorized at the highest value to eliminate the effect of extreme values.

Given that retaining large stake of shares is an equilibrium phenomenon (something explicitly said in the new foonote 6), and the limitations of all these analyses, we have opted not to include them in the manuscript, but we will gladly do it if the referees feel we should.

[2] Initially, we matched 125 insiders in ExecuComp database. But due to data availability for the relevant variables (shrown_excl_opts and stock_unvest_num), we end up with 85 matched insiders in 50 banks.

[3] The difference between ratios gets even larger if compare the banks below 25% (worst performers) and above 75%(best performers). But the number of observations in each group gets smaller. So, we divide the banks by median value and compare banks above and below median. Results are available upon request.

Identification

One specific concern that I have is that the authors show that the predictive power of insider sales for crisis returns is restricted to banks that have relatively large exposure to real estate. Banks with real estate exposure probably did very well in the years of the housing bubble, and executives whose bonuses were tight to bank performance may have gotten large bonuses during the period 2000- 2005. If part of those bonuses is being paid in equity, it would make sense for bank executives to liquidate some of these positions after big years as soon as they can just for rebalancing reasons, which may just coincide with the measurement period 2005Q1 to 2006Q1. The authors partially address this by looking at option exercises, but it would be nice if they could do more (for example, just tabulating from the insider tapes the new grants of stock and stock options given during the years 2000 – 2005 for banks with high and low real estate exposure) to alleviate these concerns. The concerns about omitted variables may be substantiated by the somewhat unreasonably large effect of insider sales. It seems implausible that a one standard deviation increase in insider sales in 2005 can predict up to 50% of financial crisis returns.

If the authors cannot provide better identification, I would suggest that they back off a bit of their strong claim "suggesting that agency problems are at the heart of excessive risk taking by banks".

The referee raises a very important issue related to our identification strategy and makes some additional observations that deserve comment. We start with the identification issue.

As the referee rightly points out, our identification mechanism may be severely contaminated by pure portfolio rebalancing (risk sharing) considerations. Insiders of high (low) exposure banks most likely received relatively high (low) remuneration in the form of shares and consequently have reasons for large (small) sales just to rebalance their risk exposure in the bank, and not necessarily to exploit private information. We were concerned with this issue and accordingly provided results excluding sales from options exercise, which could be done using our full sample. But we agree with the referee that this is not enough to clear all suspicions associated to compensation. We did not pursue this issue further in the paper, because compensation issues force us to use a new data set (ExecuComp) that severely reduces the universe of banks in the analysis (as we saw in the previous discussion). But in any case, we agree the issue deserves a more thoughtful analysis.

To avoid all suspicions on our results being driven by compensation, we add alternative variables to control for compensation in our main regression. Since compensation data is from ExecuComp,

the analysis is performed in a subset of our set of banks. Although the new sample is biased against our results (as we saw before), our results hold true when controlling for compensation. Here are the details of the construction.

Compensation data is obtained from ExecuComp database. When we do the matching, we end up with 44 banks in which we have data in all databases (including ExecuComp). We first report the summary statistics of the variables for this subsample.

Table 6: Summary Statistics of subsample (merged with ExecuComp)

	Obs.	25\%	Median	75\%	Mean	Std. Dev.
Crisis return	44	-0.68	-0.313	-0.09	-0.37	0.34
ΔSell	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
ret_bah_2006M4_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	921.51	1749.720	4838.52	4322.03	6228.31
SBC	44	288.64	798.854	2638.38	2324.72	3865.59

This table reports summary statistics for the subsample that we are able to match with ExecuComp during years of 2000-2004. *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-Term Incentive Payouts, and All Other Total. *SBC*, stock-based compensation, is the sum of the value of the restricted stock grant during that year (ExecuComp item: rstkgrnt) and the aggregate value of stock options granted to the executive during the year as valued using S&P's Black Scholes methodology (ExecuComp item: option_awards_blk_value). Each compensation variable defined above is available at executive-bank-year level in ExecuComp database. For a given bank, we take the average of the variables over the 5 years, 2000-2004.

As previously argued, this subsample is clearly biased toward larger banks. As expected, given that these banks are more closely and widely monitored, all the insider sale related variables exhibit smaller figures than in our full sample.

In the Table 7, we replicate our main result in the paper (Table 2) controlling for several compensation variables. All these measures of compensation are computed at bank level over the 2000-2004 period. Compensation data is reported in ExecuComp at executive-bank-year level. For a given bank, we take the average of the variables over the 5 years.

In column 1, we report our main result (same as column 4 of Table 2 in the paper). In column 2 we replicate our main regression with the restricted sample i.e. the sample that we are able to match with ExecuComp database. In column 3, we add our first measure of compensation as an additional control variable which is total direct compensation (TDC1). 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.

Table 7: Control for insider compensation

VARIABLES	(1) Crisis return	(2) Crisis return	(3) Crisis return	(4) Crisis return
ΔSell	-0.131**	-0.316***	-0.385***	-0.335***
	(0.052)	(0.098)	(0.105)	(0.096)
Return	-0.428***	-0.101	0.088	-0.065
	(0.156)	(0.420)	(0.449)	(0.443)
Book-to-market	-0.585***	-1.152***	-1.043***	-1.122***
	(0.191)	(0.358)	(0.360)	(0.358)
Log(market value)	-0.043***	-0.041	0.019	0.005
	(0.015)	(0.032)	(0.041)	(0.041)
Beta	0.091	-0.087	0.034	-0.004
	(0.062)	(0.156)	(0.163)	(0.157)
Leverage	-0.196	-0.597**	-0.413	-0.430
	(0.142)	(0.264)	(0.265)	(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

All variables are defined in Table 6.

As we can observe, our results hold when controlling for compensation.

We have amended the paper to include this new evidence. Given that compensation can only be computed in a small, restricted and biased subsample of banks we opted to include the result as a robustness check and maintain our leading analysis (that does not control for compensation). In particular, we have added table A9 in page 46 and a discussion of the issue in:

- Paragraph starting "We find that top five …" (pages 6 and 7)
- Paragraph starting "In Table A8 and A9 …" (pages 20 and 21)

Now we turn to clarify some other minor points raised by the referee.

First, our claim is not that the "***predictive power of insider sales for crisis returns is restricted to banks that have relatively large exposure to real estate***". We have no reason to believe that insiders of highly exposed banks have some especial predictive talent that the insiders of the other banks do not have. So we do not make that assumption anywhere in the paper. Our hypothesis is that top bank executives, in general, had information of mispricing in the real estate market (overvaluation or RE assets, underestimation of RE risk, etc.). This results in the overpricing of all banks, but in different degrees depending on their specific real estate exposures. Under this hypothesis, theory predicts that we should observe a larger selling activity by insiders of highly exposed banks (large overpricing) versus lowly exposed banks (small overpricing) when both types have the same predictive powers. Our empirical analysis corroborates this conjecture.

We have clarified this issue in the new paragraph starting "The three predictions …" (pages 3 and 4)

Second, the referee feels that our quantitative results are too large and finds implausible that "***one standard deviation increase in insider sales in 2005 can predict up to 50% of financial crisis returns***". Regarding this, we clarify that the statement of the 50% refers to the overall banking sector, which felt by 28%. But the drop in the segment of banks with exposure above to the average was 40%. So, the 13% corresponding to the 1 standard deviation represents around 32% of the crisis returns of these banks. Once we take into account that the crisis had a single main factor (real estate sector), we believe this 32% is not too large.

We have changed the old metric (overall banking sector) to this new one in:

- paragraphs starting "If bank insiders … " (pag. 7)
- Paragraph starting with "Our findings are …" (pags. 17 and 18)
- Paragraph starting with "One empirical way …" (pag. 22)

Finally, the referee suggests that if we cannot provide a better identification, we should "***back off a bit of their strong claim "suggesting that agency problems are at the heart of excessive risk taking by banks***"". Although we believe we have successfully addressed the identification issue, as argued above, we agree that toning down some of our expressions in the manuscript is in order, as it was never our intention to claim that only agency issue play a role in excessive risk taking by banks. As argued before, behavioral considerations could have played an important role here too. So, we do not view the two explanations as mutually exclusive.

Smaller issues

The group of insiders that are non-top five executives on the Thomson tapes are still so-called named executive officers, i.e. they are very high in the corporate hierarchy. It is therefore not really appropriate to compare them with the mid-level executives of the Cheng, Raina, and Xiong (2014) paper.

We agree with the referee. In view of this we have completely eliminated all references to this paper.

If the authors use a filter of no insider sales during 2005Q1 to 2006Q1 to construct their sample (page 9), does this bias their results towards a sample of banks with active trading, or is this just a way to ensure that banks are alive during this period?

We construct our initial sample by following Stulz et al (2012) who focus on banks that were alive in 1998 crisis and were still alive in 2007 crisis. This sample consists of 347 banks. Out of 347 banks we conduct our analysis with the 170 banks in which we observe at one non-zero trading at least once during our anticipation period to focus on banks whose insiders are active either buying or selling. This filter however, does not bias our results. In particular, it is easy to see that our results hold without the filter.

Out of the 347 initial banks we are able to identify 328 banks with information in all databases merged in the study. In Table 8 below we report the results of our main regressions in the paper (Table 2) in this larger unfiltered set of banks.

Table 8: Results including banks with no insider trading during the measurement 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	-0.143***	-0.133***	-0.120***	-0.120***				
	(0.044)	(0.041)	(0.043)	(0.044)				
Sell					-0.174*	-0.164**	-0.156*	-0.145*
					(0.089)	(0.082)	(0.083)	(0.082)
Return		-0.286***	-0.277***	-0.247**		-0.272***	-0.261***	-0.234**
		(0.099)	(0.096)	(0.098)		(0.101)	(0.097)	(0.098)
Book-to-market		-0.585***	-0.517***	-0.457***		-0.594***	-0.518***	-0.459***
		(0.116)	(0.119)	(0.119)		(0.116)	(0.119)	(0.119)
Log(market capitalization)		-0.034***	-0.043***	-0.032***		-0.035***	-0.045***	-0.034***
		(0.010)	(0.011)	(0.011)		(0.010)	(0.011)	(0.011)
Beta			0.095**	0.089**			0.105**	0.100**
			(0.042)	(0.043)			(0.042)	(0.042)
Leverage				-0.311***				-0.304***
				(0.093)				(0.091)
Observations	328	328	328	328	328	328	328	328
R-squared	0.025	0.096	0.110	0.139	0.013	0.086	0.103	0.130

As we can observe, all our insider sale related variable have the right signs and are significant at high levels in this enlarged set of banks.

We have not considered necessary to fully report all these results in the manuscript. We have just added footnote 15 (in page 10 – paragraph starting "Our initial sample …") where we state that in un-tabulated results we verify that all our results hold without the filter. But we will give it a more detail coverage if the referee feels we should.

Equation 1 – why are the controls measured at the end of 2004?

We choose end of 2004 as the last available data point for all these variables prior to the beginning of our insiders selling period. However, it is easy to see that results hold true even when measuring the control variables at the end of 2005 or 2006 as the next two tables show. So the assumed measurement period for controls is not decisive.

Table 9: Main Results (Table 2) with controls dated in 2005

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***	-0.121**	-0.120**	-0.110**				
	(0.053)	(0.052)	(0.052)	(0.052)				
Sell					-0.041**	-0.051***	-0.051***	-0.047***
					(0.018)	(0.017)	(0.017)	(0.017)
Return		-0.980***	-0.951***	-0.983***		-0.993***	-0.965***	-0.989***
		(0.215)	(0.219)	(0.216)		(0.210)	(0.214)	(0.214)
Book-to-market		-0.613***	-0.587***	-0.535***		-0.646***	-0.622***	-0.579***
		(0.170)	(0.178)	(0.180)		(0.165)	(0.172)	(0.176)
Log(market capitalization)		-0.041***	-0.044***	-0.035**		-0.055***	-0.057***	-0.050***
		(0.012)	(0.014)	(0.015)		(0.014)	(0.015)	(0.017)
Beta			0.027	0.022			0.025	0.021
			(0.061)	(0.060)			(0.060)	(0.060)
Leverage				-0.226				-0.177
				(0.142)				(0.139)
Observations	170	170	170	170	170	170	170	170
R-squared	0.045	0.224	0.225	0.236	0.039	0.251	0.252	0.259

All accounting variables are measured as of 2005. Beta is computed using weekly returns during 2003 to 2005.

Table 10: Main Results (Table 2) with controls dated in 2006

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***	-0.178***	-0.174***	-0.168***				
	(0.053)	(0.050)	(0.051)	(0.051)				
Sell					-0.041**	-0.057***	-0.055***	-0.053***
					(0.018)	(0.016)	(0.016)	(0.017)
Return		-0.432***	-0.417***	-0.425***		-0.340**	-0.329*	-0.338**
		(0.159)	(0.158)	(0.157)		(0.167)	(0.169)	(0.170)
Book-to-market		-0.521***	-0.437**	-0.388*		-0.555***	-0.476**	-0.439**
		(0.194)	(0.200)	(0.203)		(0.189)	(0.195)	(0.202)
Log(market capitalization)		-0.044***	-0.055***	-0.047***		-0.060***	-0.069***	-0.063***
		(0.013)	(0.014)	(0.016)		(0.014)	(0.015)	(0.017)

Beta			0.116*	0.112*			0.108*	0.105*
			(0.059)	(0.059)			(0.060)	(0.059)
Leverage				-0.186				-0.133
				(0.154)				(0.153)
Observations	170	170	170	170	170	170	170	170
R-squared	0.045	0.136	0.156	0.163	0.039	0.149	0.166	0.170

All accounting variables are measured as of 2006. Beta is computed using weekly returns during 2004 to 2006.

We have not considered necessary to include all these results in the manuscript. We have just added a footnote (number 32) in the paragraph starting "In our analysis …" (page 15) stating the irrelevance of the date for controls.

The finding on corporate policies is quite surprising and if taken at face value quite damaging for executives. Insiders can time the market and understand when bad risks are going to realize, up to 2 years in the future, but they do absolutely nothing to save their institutions.

We do not find this finding puzzling. We already provide in the paper some possible explanations as to why top executives did not do much in their banks to reduce real estate exposure before the crisis. There we mention: 1) agency issues arising from banks bail-outs guarantees (Ratnovski (2009), Farhi and Tirole (2012), and Acharya, Mehran, and Thakor (2016)); 2) persistence in banks risk culture (Fahlenbrach et al. (2012); and, 3) lack of enough power of top executives (Adams et al (2005)). To these possible explanations perhaps we can add even more. For instance, the prevalence of relative performance evaluation in compensation packages leads to bank investments correlated with their piers (Alburquerque, Cabral and Guedes (2017)). So when all banks are highly exposed to real estate, the bank manager may choose to continue highly exposed for pure compensations considerations.

We have added this new reference in:

- Paragraph starting "Implicit in the …" (pag. 5)
- Paragraph starting "Finally, we further investigate …" (pag. 7)

One more iteration for spell checking, grammar, and repetitions would have been nice.

We have done it and hope the referee is now happy with the new grammar.

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