The level and quality of Value-at-Risk disclosure by commercial banks

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\begin{abstract}
In this paper we study both the level of Value-at-Risk (VaR) disclosure and the accuracy of the disclosed VaR figures for a sample of US and international commercial banks. To measure the level of VaR disclosures, we develop a VaR Disclosure Index that captures many different facets of market risk disclosure. Using panel data over the period 1996–2005, we find an overall upward trend in the quantity of information released to the public. We also find that Historical Simulation is by far the most popular VaR method. We assess the accuracy of VaR figures by studying the number of VaR exceedances and whether actual daily VaRs contain information about the volatility of subsequent trading revenues. Unlike the level of VaR disclosure, the quality of VaR disclosure shows no sign of improvement over time. We find that VaR computed using Historical Simulation contains very little information about future volatility.
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\section{Introduction}
Following a string of high profile trading losses, greater attention has recently been focused on the trading risk faced by commercial banks. In accordance with the 1996 Market Risk Amendment to the Basel Accord (\textit{Basel Committee on Banking Supervision, 1996}), many bank regulatory agencies have set capital requirements to include a market risk charge that reflects the risk of banks’ trading activities. In the US, banks that are large enough are eligible under the Basel Accord to base their required regulatory capital for market risk on an internal Value-at-Risk (hereafter VaR) model.\textsuperscript{1} VaR is defined as the $p$th lower tail percentile of trading revenue over the next $h$ periods $R_{t+h}$, formally $p = \text{Pr}(R_{t+h} < \text{VaR}_{t+h})$, and has become a standard market risk measure (\textit{Jorion, 2006}).

In the US, market risk disclosures are required for all public filers that make material use of derivatives (not just banks) under Financial Reporting Release Number 48 (hereafter FRR 48) published by the US Securities and Exchange Commission (\textit{1997}). VaR disclosure is, along with tabular presentation and sensitivity analysis, one of the three reporting methods described in FRR 48 (\textit{Linsmeier and Pearson, 1997}).\textsuperscript{2} A not so well-known consequence of this multi-format disclosure environment is that VaR public disclosures are not mandatory for all 10-K filings as long as an alternative quantitative disclosure format is used.

The first objective of this paper is to study the level of VaR disclosure since the 1996 Market Risk Amendment to the Basel Accord. The fact that both the Basel Accord and FRR 48 encourage \textit{but do not require} VaR-based risk disclosure presents a strong motivation for looking at the actual level of VaR disclosure. It is the very fact that most banks have the option to use VaR that makes their choice empirically interesting. In this paper, we develop an index, labeled the VaR Disclosure Index (hereafter VaRDI), that summarizes the amount of VaR disclosure by banks and the extent to which banks disclose details about VaR construction and provide

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\footnote{1 The use of internal VaR to set regulatory capital is not a requirement for US banks.}

\footnote{2 Tabular presentation consists of a table of financial instruments (grouped by market risk category and market characteristics) that discloses the fair value of the assets and its future cash-flows. Sensitivity analysis presents the effect on earnings, cash-flows, or fair values of a hypothetical shock on a key risk factor, e.g., a 50 basis-point increase in the short-term interest rate (see \textit{Blankley et al. (2000)} for an illustration).}
information to facilitate interpretation. Specifically, VaRDI comprises six components: (1) VaR characteristics (holding period and confidence level), (2) summary VaR statistics (high, low, average, year-end VaR, VaR by risk category, and diversification effect), (3) summary information about the previous year's VaR, (4) histogram or plot of daily VaRs, (5) definition of trading revenues (hypothetical revenues and non-inclusion of trading fees) and histogram or plot of daily trading revenues, and (6) backtesting (number of exceptions, i.e., days when actual trading loss is greater than VaR, and explanations of these exceptions).

We first compute the annual VaRDI for the largest 10 US banks between 1996 and 2005. We find large differences in the level of disclosure across banks and an overall upward trend in the quantity of information released to the public. We then extend the analysis to Canadian banks and show that disclosures in the US are considerably lower than disclosures in Canada. We next consider a cross-section of 60 US, Canadian, and international banks for the year 2005, which allows us to uncover some drastic differences in disclosure across regions: from an overall satisfactory disclosure in Europe and Canada to absolutely no VaR disclosure in China. Interestingly, we find that Historical Simulation is the most popular VaR method in the world, as 73% of banks that disclose their VaR method report using Historical Simulation.

The second objective of this paper is to assess the accuracy of the disclosed VaR figures. Regardless of how much information banks provide about their VaR, disclosure is only useful if the VaR numbers themselves are accurate, i.e., if VaR is “related to actual performance” (Greenspan, 1996). We first check whether the number of VaR exceptions disclosed by the banks corresponds to its expected value, which is 2.5 per year with a 1-day/99% VaR. We detect a pervasive and persistent overstatement of the VaR which leads to too few (often zero) exceptions. These backtesting results suggest that the quality of VaR disclosure has remained low over our sample period. We then study whether actual daily VaRs contain information about the volatility of subsequent trading revenues. To motivate this test recall that VaR is defined as the lower tail percentile of trading revenues and, as a result, will increase with the conditional volatility. In our empirical tests, we use daily data on VaR and trading revenue extracted from publicly available graphs presented in annual reports using a novel data extraction method. We compare the forecasting ability of two volatility measures: the VaR computed by the bank and a forecast from a simple econometric GARCH model. To formally compare these competing estimates, we employ different econometric approaches: (1) an augmented in-sample GARCH model that includes the VaR measure as an additional variable driving the conditional volatility of trading revenues, and (2) an out-of-sample regression of actual volatility on one or both containing volatility measures. Overall, our empirical tests show that VaR (especially when based on Historical Simulation) helps little in forecasting future volatility.

The paper most closely related to ours is Jorion (2002a) who relies on quarterly data released by eight US commercial banks. In particular, he tests whether the VaR on the last day of a given quarter is able to predict the variability of the following quarterly trading revenue. Given the short history and low frequency of VaR reporting, his analysis relies on a small sample for each bank, i.e., between 14 and 23 observations. Out of the eight US banks studied by Jorion (2002a), four displayed a positive and statistically significant relationship between their VaR and actual trading revenue variability. Our analysis differs from Jorion’s (2002a) study since we use higher frequency data, namely daily VaRs and trading revenues, and we estimate a GARCH model as a benchmark against which to compare the VaR forecasts. Furthermore, in our sample period, most banks use Historical Simulation to compute their VaR.

Studying the accuracy of disclosed VaR figures based on proprietary models is important in regard to the debate on banks’ capital requirements. Under the Market Risk Amendment to the Basel Accord (Basel Committee on Banking Supervision, 1996; Hendricks and Hirtle, 1997), the capital charge for market risk can be based on the output of a bank’s internal VaR model rather than on an externally imposed supervisory measure. Many market commentators have indicated that the high degree of autonomy granted to commercial banks in setting capital charges might have some perverse effects. In particular, banks may be inclined to underestimate their VaR in order to reduce their market risk charge (Lucas, 2001) or to decrease the quality of its risk management system (Danielsson et al., 2002). Conversely, in their theoretical analysis of VaR-based capital requirements, Cuoco and Liu (2006) conclude that VaR-based capital requirements can be very effective in inducing truthful revelation of market risk. While many (conflicting) theoretical models of the accuracy of VaR are available in the literature, little is known on the accuracy of disclosed VaRs. We intend here to contribute to fill this gap.

The rest of the paper is organized as follows. In Section 2, we study the level of VaR disclosure at commercial banks in the US and in the rest of the world. Specifically, we define our Value-at-Risk Disclosure Index and we study its level through time and across banks and countries. Section 3 presents the backtesting results along with the empirical analysis of the relationship between VaR and future volatility. We summarize and conclude our study in Section 4.

2. Level of VaR disclosure

In the US and many other countries, commercial banks are required to provide quantitative information about their trading risks. We undertake an empirical analysis of the actual public disclosure about VaR made by banks to its investors, creditors, and counterparties through financial statements.

2.1. VaR Disclosure Index

To facilitate the empirical analysis we construct a disclosure index, which we label VaRDI. This index aggregates six facets of VaR disclosure into a single number between 0 and 15. The six index components are: VaR characteristics, summary VaR statistics, intertemporal comparison, daily VaR figures, trading revenues, and backtesting. When constructing the index, we give equal weight to all criteria which is of course arbitrary. However, coming up with different weights for each criterion would be even more arbitrary. A maximum of 15 points are allocated if the following pieces of information are publicly released by a given bank:

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3 In an independent study, Hirtle (2007) computes a similar market risk index for a sample of US banks. She finds a positive relationship between public disclosure and subsequent performance of banks.

4 Our sample size is larger than the one used by the Basel Committee on Banking Supervision (2001, 2002, 2003) in its three annual surveys of public disclosures by banks. Moreover, unlike the surveys conducted by the Basel Committee on Banking Supervision, ours is not anonymous.

5 Hirtle (2003) shows that US banks’ quarterly market risk charges contain valuable information about future risk exposures (see also Liu et al., 2004; Bai et al., 2007; Taylor, 2007; Alexander and Sheedy, 2008).

6 Berkowitz and O’Brien (2002) is the most notable exception.

7 To allay concerns about the arbitrary weights used to construct our index we also constructed a disclosure index using the statistically-based Principal Component Analysis weighting scheme. The equally weighted index we consider is remarkably similar to this statistically-based factor. In particular, the correlation between the first principal component and our proposed VaR Disclosure Index for the 60 banks we consider in 2005 is over 95% (Pearson correlation: 95.25; Spearman correlation: 95.34). This gives us confidence that our results are not driven by our choice of weighting scheme.
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