NUS-RMI Credit Research Initiative Technical Report

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This document describes the implementation of the system which the Credit Research Initiative (CRI) at the Risk Management Institute (RMI) of the National University of Singapore (NUS) uses to produce probabilities of default (PD) and actuarial spread (AS). As of this version of the Technical Report, RMI-CRI covers around 65,000 exchange-listed firms (including delisted ones) in 121 economies around the world (see Table A.1). Of them, over 33,000 firms have sufficient data to release daily updated PD and AS. The PD and AS for all firms are freely available to users who can provide evidence of their professional qualifications to ensure that they will not misuse the data. General users who do not request global access are restricted to a list of 5,000 firms. The individual company PD/AS data, along with aggregate PD/AS at the economy and sector level, can be accessed at `http://rmicri.org`.

The primary goal of this initiative is to drive research and development in the critical area of credit rating systems. As such, a transparent methodology is essential to this initiative. Having the details of the methodology available to everybody means that there is a base from which suggestions and improvements can be made. The objective of this Technical Report is to provide a full exposition of the CRI system. Readers of this document who have access to the necessary data and who have a sufficient level of technical expertise will be able to implement a similar system on their own. For a full exposition of the conceptual framework of the CRI, see Duan and Van Laere [2012].

The system used by the CRI will evolve as new innovations and enhancements are applied. The changes to the 2017 technical report and operational implementation of our model are: (1) Revision to parameter estimation on an intercept and Distance–to–default (DTD) for the Chinese sample, and (2) Statistical inference of the parameters with a structural break for the Chinese sample. This version of the technical report provides an update on the operational implementation of the CRI and includes all changes to the system that had been implemented by February 2017. The latest version of the Technical Report and addenda to the latest version are available via the web portal and will include any changes to the system that have been implemented since the publication of this version.

In the remainder of this Technical Report, the PD model and its computational details will be explained in thorough details. As an application of the model, the computation of AS and CVI will be discussed in a much concise manner. Wherever no confusion is caused, "the model" refers to the PD model. The sections are organized as follows. Section 1 describes the quantitative model that is currently used to compute the PDs. The model was first described

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in Duan et al. [2012]. The description includes calibration procedures, which are performed on a monthly basis, and individual firm's PD computations, which are performed on a daily basis.

Section 2 describes the input variables of the model as well as the data used to produce these inputs. This model uses both input variables that are common to all firms in an economy and input variables that are firm-specific. Another critical component in the estimation system is the default data, and this is also described in this section.

While Section 1 provides a broader description of the model, Section 3 describes the implementation details that are necessary for application, given real world issues of, for example, bad or missing data. The specific technical details needed to develop an operational system are also given, including details on the monthly calibration, daily computation of individual firm's PDs and aggregation of the individual firm's PDs. Distance-to-default (DTD) in a Merton-type model is one of the firm-specific variables. The calculation for DTD is not the standard one, and has been modified to allow a meaningful computation of the DTD for financial firms. While most academic studies on default prediction exclude financial firms from consideration, it is important to include them given that the financial sector is a critical component in every economy. The calculation for DTD is detailed in this section.

Section 4 shows an empirical analysis for those economies that are currently covered. While the analysis shows excellent results in several economies, there is room for improvement in a few others. This is because, at the CRI's current stage of development, the economies all use the variables used in the academic study of US firms in Duan et al. [2012]. Future development within the CRI will deal with variable selection specific to different economies, and the performance is then expected to improve. Sections 5 and 6 explain how the CVI and AS are formulated. A detailed theoretical background can be found in Duan [2014]. Section 7 discusses future developments.

1 Model Description

The quantitative model that is currently being used by the CRI is a forward intensity model that was introduced in Duan et al. [2012]. Certain aspects of the model are taken from Duan and Fulop [2013]. This model allows PD forecasts to be made at a range of horizons. In the current CRI implementation of this model, PDs are forecasted from a horizon of one month up to a horizon of five years. At the RMI-CRI website, for every firm, the probability of that firm defaulting within one month, three months, six months, one year, two years, three years, and five years is given. The ability to assess credit quality for different horizons is a useful tool for risk management, credit portfolio management, policy setting, and regulatory purposes, since short- and long-term credit risk profiles can differ greatly depending on a firm's liquidity, debt structures, and other factors.

The forward intensity model is a reduced form model in which the PD is computed as a function of different input variables. These can be firm-specific or common to all firms within an economy. The other category of the default prediction model is the structural model, whereby the corporate structure of a firm is modeled in order to assess the firm's PD.

A similar reduced form model by Duffie et al. [2007] relies on modeling the time series dynamics of the input variables in order to make PD forecasts for different horizons. However, there is little consensus on assumptions for the dynamics of variables such as accounting ratios, and the model output will be highly dependent on these assumptions. In addition, the time series dynamics will be of very high dimension. For example, with the two common variables and two firm-specific variables that Duffie et al. [2007] use, a sample of 10,000 firms gives a dimension of the state variables of 20,002.

Given the complexity in modeling the dynamics of variables such as accounting ratios, this model will be difficult to implement if different forecast horizons are required. The key innovation of the forward intensity model is that PD for different horizons can be consistently and efficiently computed based only on the value of the input variables at the time the prediction is made. Thus, the model specification becomes far more tractable.

Fully specifying a reduced form model includes the specification of the function that computes a PD from the input variables. This function is parameterized, and finding appropriate parameter values is called calibrating the model. The forward intensity model can be calibrated by maximizing a pseudo-likelihood function. The calibration is carried out by groups of economies and all firms within a group of economies will use the same parameter values along with each firm's variables in order to compute the firm's PD.

Subsection 1.1 will describe the modeling framework, including the way PDs are computed based on a set of parameter values for the economy and a set of input variables for a firm. Subsection 1.2 explains how the model can be calibrated. Subsection 1.3 details the way parameters are estimated based on the Sequential Monte Carlo (SMC) technique.

1.1 Modeling Framework

While the model can be formulated in a continuous time framework, as done in Duan et al. [2012], an operational implementation requires discretization in time. Since the model is more easily understood in discrete time, the following exposition of the model will begin in a discrete time framework.

Variables for default prediction can have vastly different update frequencies. Financial statement data is updated only once a quarter or even once a year, while market data like stock prices are available at frequencies of seconds. A way of compromising between these two extremes is to have a fundamental time period Δt of one month in the modeling framework. As will be seen later, this does not preclude updating the PD forecasts on a daily basis. This is important since, for example, large daily changes in a firm's stock price can signal changes in credit quality even when there is no change in FS data.

Thus, for the purposes of calibration and subsequently for computing time series of PD, the input variables at the end of each month will be kept for each firm. The input variables associated with the i^{th} firm at the end of the n^{th} month (at time $t = n\Delta t$) is denoted by $X_i(n)$. This is a vector consisting of two parts: $X_i(n) = (W(n), U_i(n))$. Here, $W(n)$ is a vector of variables at the end of month n that is common to all firms in the economy and $U_i(n)$ is a vector of variables specific to firm i.

In the forward intensity model, a firm's default is signaled by a jump in a Poisson process. The probability of a jump in the Poisson process is determined by the intensity of the Poisson process. The forward intensity model draws an explicit dependence of intensities at time periods in the future (that is, forward intensities) to the values of input variables at the time of prediction. With forward intensities, PDs for any forecast horizon can be computed knowing only the values of the input variables at the time of prediction, without needing to simulate future values of the input variables.

There is a direct analogy in interest rate modeling. In spot rate models where dynamics on a short-term spot rate are specified, bond pricing requires expectations on realizations of the short rate. Alternatively, bond prices can be computed directly if the forward rate curve is known.

One issue in default prediction is that firms can exit public exchanges for reasons other than default, such as merge and acquisition (M&A) and OTC. In order to take these other exits into account, defaults and other exits are modeled as two independent Poisson processes, each with their own intensity. While defaults and exits classified as non-defaults are mutually exclusive by definition, the assumption of independent Poisson processes does not pose a problem since the probability of a simultaneous jump in the two Poisson processes is negligible. In the discrete time framework, the probability of simultaneous jumps in the same time interval is non-zero. As a modeling assumption, a simultaneous jump in the same time interval by both the default Poisson process and the non-default type exit Poisson process is considered as a default. In this way, there are three mutually exclusive possibilities during each time interval: survival, default and non-default exit. As with defaults, the forward intensity of the Poisson process for other exits is a function of the input variables. The parameters of this function can also be calibrated.

To further illustrate the discrete framework, the three possibilities for a firm at each time point are diagrammed. Either the firm survives for the next time period Δt, or it defaults within Δt, or it has a non-default exit within Δt. This setup is pictured in Fig. 1. Information about firm i is known up until time $t = m\Delta t$ and the figure illustrates possibilities in the future between $t = (n-1)\Delta t$ and $(n+1)\Delta t$. Here, m and n are integers with $m < n$.

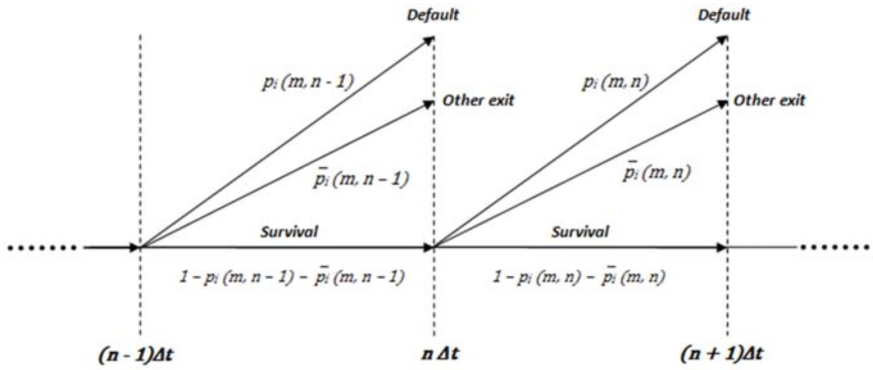

Figure 1: Default-other exit-survival tree for firm i, viewed from time $t = m\Delta t$.

The probabilities of each branch are, for example: $p_i(m,n)$ the conditional probability viewed from $t = m\Delta t$ that firm i will default before $(n+1)\Delta t$, conditioned on firm i surviving up until $n\Delta t$. Likewise, $\bar{p}_i(m,n)$ is the conditional probability viewed from $t = m\Delta t$ that firm i will have a non-default exit before $(n+1)\Delta t$, conditioned on firm i surviving up until $n\Delta t$. It is the modeler's objective to determine $p_i(m,n)$ and $\bar{p}_i(m,n)$, but for now it is assumed that these quantities are known. With the conditional default and other exit probabilities known, the corresponding conditional survival probability of firm i is $1 - p_i(m,n) - \bar{p}_i(m,n)$.

With this diagram in mind, the probability that a particular path will be followed is the product of the conditional probabilities along the path. For example, the probability at time $t = m\Delta t$ of firm i surviving until $(n-1)\Delta t$ and then defaulting between $(n-1)\Delta t$ and $n\Delta t$ is:

$$\text{Prob}_{t=m\Delta t}[\tau_i = n, \tau_i < \bar{\tau}_i] = p_i(m, n-1) \prod_{j=m}^{n-2} [1 - p_i(m,j) - \bar{p}_i(m,j)]\,. \tag{1}$$

Here, τ_i is the default time for firm i measured in units of months, $\bar{\tau}_i$ is the other exit time measured in units of months, and the product is equal to 1 if there is no term in the product. The condition $\tau_i < \bar{\tau}_i$ is the requirement that the firm defaults before it has a non-default type of exit. Note that by measuring exits in units of months, if, for example, a default occurs at any time in the interval $[(n-1)\Delta t, n\Delta t]$, then $\tau_i = n$.

Using Eq. (1), cumulative default probabilities can be computed. At $m\Delta t$ the probability of firm i defaulting at or before $n\Delta t$ and not having an other exit before $t = n\Delta t$ is obtained by taking the sum of all of the paths that lead to default at or before $n\Delta t$:

$$\text{Prob}_{\,t=m\Delta t}[m < \tau_i \leq n, \tau_i < \bar{\tau}_i] = \sum_{k=m}^{n-1} \left\{ p_i(m,k) \prod_{j=m}^{k-1} [1 - p_i(m,j) - \bar{p}_i(m,j)] \right\}. \tag{2}$$

While it is convenient to derive the probabilities given in Eqs. (1) and (2) in terms of the conditional probabilities, expressions for these in terms of the forward intensities need to be found, since the forward intensities will be functions of the input variable $X_i(m)$. The forward intensity for the default of firm i that is observed at time $t = m\Delta t$ for the forward time interval from $t = n\Delta t$ to $(n+1)\Delta t$, is denoted by $h_i(m,n)$, where $m \leq n$. The corresponding forward intensity for a non-default exit is denoted by $\bar{h}_i(m,n)$. Because default is signaled by a jump in a Poisson process, its conditional probability is a simple function of its forward intensity:

$$p_i(m,n) = 1 - \exp[-\Delta t\; h_i(m,n)]. \tag{3}$$

Since joint jumps in the same time interval are assigned as defaults, the conditional other exit probability needs to take this into account:

$$\bar{p}_i(m,n) = \exp[-\Delta t\; h_i(m,n)] \times \{1 - \exp[-\Delta t\; \bar{h}_i(m,n)]\}. \tag{4}$$

The conditional survival probabilities in Eqs. (1) and (2) are computed as the conditional probability that the firm does not default in the period and the firm does not have a non-default exit either:

$$\text{Prob}_{\,t=m\Delta t}[\tau_i, \bar{\tau}_i > n+1 |\; \tau_i, \bar{\tau}_i > n] = \exp\{-\Delta t[h_i(m,n) + \bar{h}_i(m,n)]\}. \tag{5}$$

It remains to be specified the dependence of the forward intensities on the input variable $X_i(m)$. The forward intensities need to be positive so that the conditional probabilities are non-negative. A standard way to impose this constraint is to specify the forward intensities as exponentials of a linear combination of the input variables:

$$\begin{aligned} h_i(m,n) &= \exp[\beta(n-m) \cdot Y_i(m)], \\ \bar{h}_i(m,n) &= \exp[\bar{\beta}(n-m) \cdot Y_i(m)]. \end{aligned} \tag{6}$$

Here, β and $\bar{\beta}$ are coefficient vectors that are functions of the number of months between the observation date and the beginning of the forward period $(n-m)$, and $Y_i(m)$ is simply the vector $X_i(m)$ augmented by a preceding unit element: $Y_i(m) = (1, X_i(m))$. The unit element allows the linear combination in the argument of the exponentials in Eq. (6) to have a non-zero intercept.

In the current implementation of the forward intensity model in the CRI, the maximum forecast horizon is 60 months (5 years) and there are 12 input variables plus the intercept, so there are 60 sets of β and $\bar{\beta}$. While this is a large set of parameters, as will be seen in Subsection 1.2 and 1.3, the calibration is tractable because the default parameters can be calibrated separately from the other exit parameters, and the total number of parameters are greatly reduced after constraining the term-structure of the parameter estimates to be Nelson-Siegel functions.

Before expressing the probabilities in Eqs. (1) and (2) in terms of the forward intensities, a notation H is introduced for the forward intensities so that it becomes clear which parameters the forward intensity depends on:

$$H(\beta(n-m), X_i(m)) = \exp[\beta(n-m) \cdot Y_i(m)]. \tag{7}$$

This is the forward default intensity. The corresponding notation for other exit forward intensities is then just $H(\bar{\beta}(n-m), X_i(m))$. So, the probability in Eq. (1) is expressed in terms of the forward intensities, using Eq. (3) as the conditional default probability and Eq. (5) as the conditional survival probability:

$$
\begin{aligned}
&\text{Prob}_{\,t=m\Delta t}[\tau_i = n, \tau_i < \bar{\tau}_i] \\
&= \{1 - \exp[-\Delta t \; H(\beta(n-1-m), X_i(m))]\} \\
&\quad \times \prod_{j=m}^{n-2} \exp\left\{-\Delta t \; [H(\beta(j-m), X_i(m)) + H(\bar{\beta}(j-m), X_i(m))]\right\} \\
&= \{1 - \exp[-\Delta t \; H(\beta(n-m-1), X_i(m))]\} \\
&\quad \times \exp\left\{ -\Delta t \sum_{j=m}^{n-2} \left[H(\beta(j-m), X_i(m)) + H(\bar{\beta}(j-m), X_i(m))\right] \right\}. \qquad (8)
\end{aligned}
$$

This probability will be relevant in the next part during the calibration. The cumulative default probability given in Eq. (2) in terms of the forward intensities is then:

$$
\begin{aligned}
&\text{Prob}_{\,t=m\Delta t}[m < \tau_i \le n, \tau_i < \bar{\tau}_i] \\
&= \sum_{k=m}^{n-1} \Bigg\{ \{1 - \exp[-\Delta t \; H(\beta(k-m), X_i(m))]\} \\
&\quad \times \exp\left\{ -\Delta t \sum_{j=m}^{k-1} [H(\beta(j-m), X_i(m)) + H(\bar{\beta}(j-m), X_i(m))] \right\} \Bigg\}. \qquad (9)
\end{aligned}
$$

This formula is used to compute the main output of the CRI: an individual firm's PD within various time horizons. The β and $\bar{\beta}$ parameters are obtained when the firm's economy is calibrated, and using those together with the firm's input variables yields the firm's PD.

1.2 Pseudo-Likelihood Function

The empirical data set used for calibration can be described as follows. For the economy as a whole, there are N end of month observations, indexed as $n = 1, \dots, N$. Of course, not all firms will have observations for each of the N months as they may start later than the start of the economy's data set or they may exit before the end of the economy's data set. There are a total of I firms in the economy, and they are indexed as $i = 1, \dots, I$. As before, the input variables for the i^{th} firm in the n^{th} month is $X_i(n)$. The set of all observations for all firms is denoted by X.

In addition, the default times τ_i and non-default exit times $\bar{\tau}_i$ for the i^{th} firm are known if the default or other exit occurs after time $t = \Delta t$ and at or before $t = N\Delta t$. The possible values for τ_i and $\bar{\tau}_i$ are integers between 2 and N, inclusive. If a firm exits before the month end, then the exit time is recorded as the first month end after the exit. If the firm does not exit before $t = N\Delta t$, then the convention can be used that both of these values are infinite. If the firm has a default type of exit within the data set, then $\bar{\tau}_i$ can be considered as infinite. If instead the firm has a non-default type of exit within the data set, then τ_i can be considered as infinite. The set of all default times and non-default exit times for all firms is denoted by τ and $\bar{\tau}$, respectively. The first month in which firm i has an observation is denoted by t_{0i}. Except for cases of missing data, these observations continue until the end of the data set if the firm never exits. If the firm does exit, the last needed input variable $X_i(n)$ is for $n = \min(\tau_i, \bar{\tau}_i) - 1$.

The calibration of the β and $\bar{\beta}$ parameters is done by maximizing a pseudo-likelihood function. The function to be maximized violates the standard assumptions of likelihood functions, but Appendix A in Duan et al. [2012] derives the large sample properties of the pseudo-likelihood function.

In formulating the pseudo-likelihood function, the assumption is made that the firms are conditionally independent of each other. In other words, correlations arise naturally from shared common factors $W(n)$ and any correlations between different firms' firm-specific variables. With this assumption, the pseudo-likelihood function for the horizon of ℓ months, a set of parameters β and $\bar{\beta}$ and the data set $(\tau, \bar{\tau}, X)$ is:

$$\mathcal{L}_\ell(\beta, \bar{\beta}; \tau, \bar{\tau}, X) = \prod_{m=1}^{N-1} \prod_{i=1}^{I} P_{\min(N-m,\ell)}(\beta, \bar{\beta}; \tau_i, \bar{\tau}_i, X_i(m)). \tag{10}$$

Here, $P_{\min(N-m,\ell)}(\beta, \bar{\beta}; \tau_i, \bar{\tau}_i, X_i(m))$ is a probability for the i^{th} firm, with the nature of the probability depending on what happens to the firm during the period from month m to month $m + \min(N - m, \ell)$. This is defined as:

$$\begin{aligned}
&P_\ell(\beta, \bar{\beta}; \tau_i, \bar{\tau}_i, X_i(m)) \\
&= 1_{\{t_{0i} \le m, \min(\tau_i, \bar{\tau}_i) > m+\ell\}} \\
&\quad \times \exp\left\{ -\Delta t \sum_{j=0}^{\ell-1} [H(\beta(j), X_i(m)) + H(\bar{\beta}(j), X_i(m))] \right\} \\
&\quad + 1_{\{t_{0i} \le m, \tau_i \le \bar{\tau}_i, \tau_i \le m+\ell\}} \times \{1 - \exp[-\Delta t\, H(\beta(\tau_i - m - 1), X_i(m))]\} \\
&\quad \times \exp\left\{ -\Delta t \sum_{j=0}^{\tau_i - m - 2} [H(\beta(j), X_i(m)) + H(\bar{\beta}(j), X_i(m))] \right\} \\
&\quad + 1_{\{t_{0i} \le m, \bar{\tau}_i \le \tau_i, \bar{\tau}_i \le m+\ell\}} \times \{1 - \exp[-\Delta t\, H(\bar{\beta}(\bar{\tau}_i - m - 1), X_i(m))]\} \\
&\quad \times \exp[-\Delta t H(\beta(\tau_i - m - 1), X_i(m))] \\
&\quad \times \exp\left\{ -\Delta t \sum_{j=0}^{\bar{\tau}_i - m - 2} [H(\beta(j), X_i(m)) + H(\bar{\beta}(j), X_i(m))] \right\} \\
&\quad + 1_{\{t_{0i} > m\}} + 1_{\{\min(\tau_i, \bar{\tau}_i) \le m\}}.
\end{aligned} \tag{11}$$

In other words, if the i^{th} firm survives from the observation time at month m for the full horizon ℓ until at least $m + \ell$, then the probability is the model-based survival probability for this period. This is the first term in Eq. (11). The second term handles the cases where the firm has a default within the horizon, in which case the probability is the model-based probability of the firm defaulting at the month that it ends up defaulting, as given in Eq. (8). The third term handles the cases where the firm has a non-default exit within the horizon, in which case the probability is the model-based probability of the firm having a non-default type exit at the month that the exit actually does occur. The expression for this probability uses the conditional non-default type exit probability given in Eq. (4). The final two terms handle the cases where the firm is not in the data set at month m - either the first observation for the firm is after m or the firm has already exited. A constant value is assigned in this case so that this firm will not affect the maximization at this time point.

The pseudo-likelihood function given in Eq. (10) can be numerically maximized to give estimates for the coefficients β and $\bar{\beta}$. Notice though that the sample observations for the pseudo-likelihood function are overlapping if the horizon is longer than one month. For example, when $\ell = 2$, default over the next two periods from month m is correlated to default over the next two periods from month $m + 1$ due to the common month in the two sample observations. However, in Appendix A of Duan et al. [2012], the maximum pseudo-likelihood estimator is shown to be consistent, in the sense that the estimators converge to the "true" parameter value in the large sample limit.

Notice though that each of the terms in Eq. (11) can be written as a product of terms containing only β and terms containing only $\bar{\beta}$. This will allow separate maximizations with respect to β and with respect to $\bar{\beta}$, that is, the defaults and other exits.

The β and $\bar{\beta}$ specific versions of Eq. (11) are:

$$
\begin{aligned}
&P_\ell^\beta(\beta;\tau_i,\bar{\tau}_i,X_i(m))\\
&\quad= 1_{\{t_{0i}\le m,\min(\tau_i,\bar{\tau}_i)>m+\ell\}}\exp\left\{-\Delta t\sum_{j=0}^{\ell-1}H(\beta(j),X_i(m))\right\}\\
&\qquad+1_{\{t_{0i}\le m,\tau_i\le\bar{\tau}_i,\tau_i\le m+\ell\}}\exp\left\{-\Delta t\sum_{j=0}^{\tau_i-m-2}H(\beta(j),X_i(m))\right\}\\
&\qquad\quad\times\{1-\exp[-\Delta t\, H(\beta(\tau_i-m-1),X_i(m))]\}\\
&\qquad+1_{\{t_{0i}\le m,\bar{\tau}_i\le\tau_i,\bar{\tau}_i\le m+\ell\}}\exp\left\{-\Delta t\sum_{j=0}^{\bar{\tau}_i-m-2}H(\beta(j),X_i(m))\right\}\\
&\qquad\quad\times\exp[-\Delta t\, H(\beta(\tau_i-m-1),X_i(m))]\\
&\qquad+1_{\{t_{0i}>m\}}+\ 1_{\{\min(\tau_i,\bar{\tau}_i)\le m\}},
\end{aligned}
$$

$$
\begin{aligned}
&P_\ell^{\bar{\beta}}(\bar{\beta};\tau_i,\bar{\tau}_i,X_i(m))\\
&\quad= 1_{\{t_{0i}\le m,\min(\tau_i,\bar{\tau}_i)>m+\ell\}}\exp\left\{-\Delta t\sum_{j=0}^{\ell-1}H(\bar{\beta}(j),X_i(m))\right\}\\
&\qquad+1_{\{t_{0i}\le m,\tau_i\le\bar{\tau}_i,\tau_i\le m+\ell\}}\exp\left\{-\Delta t\sum_{j=0}^{\tau_i-m-2}H(\bar{\beta}(j),X_i(m))\right\}\\
&\qquad+1_{\{t_{0i}\le m,\bar{\tau}_i\le\tau_i,\bar{\tau}_i\le m+\ell\}}\exp\left\{-\Delta t\sum_{j=0}^{\bar{\tau}_i-m-2}H(\bar{\beta}(j),X_i(m))\right\}\\
&\qquad\quad\times\{1-\exp[-\Delta t\, H(\bar{\beta}(\bar{\tau}_i-m-1),X_i(m))]\}\\
&\quad+1_{\{t_{0i}>m\}}+\ 1_{\{\min(\tau_i,\bar{\tau}_i)\le m\}}.
\end{aligned}
\tag{12}
$$

Then, the β and $\bar{\beta}$ specific versions of the pseudo-likelihood function are given by:

$$
\begin{aligned}
\mathcal{L}_\ell^\beta(\beta;\tau,\bar{\tau},X) &= \prod_{m=1}^{N-\ell}\prod_{i=1}^{I}P_\ell^\beta(\beta;\tau_i,\bar{\tau}_i,X_i(m))\\
\mathcal{L}_\ell^{\bar{\beta}}(\bar{\beta};\tau,\bar{\tau},X) &= \prod_{m=1}^{N-\ell}\prod_{i=1}^{I}P_\ell^{\bar{\beta}}(\bar{\beta};\tau_i,\bar{\tau}_i,X_i(m)).
\end{aligned}
\tag{13}
$$

With the definitions given in Eqs. (12) and (13), it can be seen that:

$$
\mathcal{L}_\ell(\beta,\bar{\beta};\tau,\bar{\tau},X) = \mathcal{L}_\ell^\beta(\beta;\tau,\bar{\tau},X)\mathcal{L}_\ell^{\bar{\beta}}(\bar{\beta};\tau,\bar{\tau},X). \tag{14}
$$

Thus, $\mathcal{L}_\ell^\beta$ and $\mathcal{L}_\ell^{\bar{\beta}}$ can be separately maximized to find their respective parameters. Subsection 1.3 will further explain how the optimum parameters can be estimated.

1.3 Parameter Estimation

Previously, the CRI system produced default predictions to a horizon of two years (CRI [2012]). An extension of the forecast horizon has been implemented as of the PD released on 1 April 2013. With this update, horizons of up to five years are now being computed. Technically speaking, horizons of arbitrary length can be calculated.

This extension to a five-year horizon is done by constraining the term-structure of the parameter estimates to be Nelson-Siegel (Nelson and Siegel [1987]; hereafter NS) functions of the forward-starting time. Horizon-specific parameters β and $\bar{\beta}$ can be obtained from the continuous NS function by using the forward prediction horizon as an input. The term-structures are further constrained so that the effect of risk factors on the forward intensity goes to zero as the horizon increases. This allows tractable and parsimonious extrapolations for horizons beyond five years.

The parameter estimation for the NS functions is based on a new numerical method (a pseudo-Bayesian SMC technique) developed in a working paper by Duan and Fulop [2013]. The remainder of this section details the new parameter estimation. Subsection 1.3.1 describes the parameterization of the parameters by NS functions. Subsection 1.3.2 explains how a structural break applies to the parameter estimation for the Chinese sample. Subsection 1.3.3 gives an overview of the SMC method that is used to estimate the NS functions. Subsection 1.3.4 details the calculation of the confidence intervals for the parameter estimation, and Subsection 1.3.5 describes how the parameters can be re-estimated given new data or updates of old data.

1.3.1 Smoothed parameters

Duan et al. [2012] formulate the forward intensity model in which the forward default intensity for a firm is a function of a number of covariates. The forward default intensities for different forward starting periods are computed using different sets of parameters.

In Duan et al. [2012], the sets of parameters are estimated separately for each forward starting time. Parameters at different forward starting times that are associated with each covariate can be approximated by a function of the forward starting time using NS type term structure functions. Duan et al. [2012] show that this approximation by NS functions does not negatively affect prediction performance. The CRI implementation follows Duan and Fulop [2013] to impose the functional restriction during the estimation as opposed to the method used in Duan et al. [2012] of fitting the curve after parameter estimates have been obtained. This is done for two reasons.

First, it will significantly reduce the number of parameters. For example, using 12 covariates for forward default intensities up to 60 months would require a joint estimation of $13 \times 60 = 780$ parameters. Here, 13 comes from adding an intercept to the intensity function with 12 covariates. If the coefficients corresponding to each covariate are represented by the NS function of 4 parameters, there will be at most $13 \times 4 = 52$ parameters. In fact, there will be fewer parameters as some of the NS parameters will be constrained to zero.

Second, the NS function will allow extrapolation. For example, the 13 NS functions estimated with predictions up to 60 months can be used for prediction, say, over 72 months.

The NS function with four free parameters is:

$$r(t; \varrho_0, \varrho_1, \varrho_2, d) = \varrho_0 + \varrho_1 \frac{1 - \exp(-t/d)}{t/d} + \varrho_2 \left[\frac{1 - \exp(-t/d)}{t/d} - \exp(-t/d) \right], \tag{15}$$

where t is the forecast horizon (measured in years). In the CRI implementation, the horizon is 60 months (5 years) so that t ranges from 0 to 59/12. Once the four NS parameters are estimated, individual horizon-specific parameters β, $\bar{\beta}$ are obtained from the the NS function r using the forecast horizon as input to the NS function. In our current implementation with forecast horizons extending to 60 months (5 years), 120 sets of month specific β and $\bar{\beta}$ are obtained. For all covariates, the restriction $d > 0$ is imposed so that the functions converge to a value for large t. This formulation will be used for forward intensities for both defaults and other types of exit.

For the coefficients of all stochastic covariates, the long-run level ϱ_0 is restricted to zero, because the current value of a stochastic covariate should be uninformative of default or other exits when the forward starting time goes to infinity. In other words, the coefficient of such a stochastic covariate should approach zero when t goes to infinity.

The intercept of the forward intensity function is of course non-stochastic. Thus, ϱ_0 can have non-zero values for the intercept. With these restrictions on the NS parameters, take the example of 12 covariates, there will be a total of $12 \times 3 + 1 \times 4 = 40$ parameters.

In the CRI implementation, the NS function is further constrained to be non-positive for certain covariates: DTD level and trend, liquidity level and trend, and profitability level and trend. Refer to Section 2 for descriptions of these covariates.

For the Chinese sample, we further revise the parameter estimation on the intercept and the DTD level. Specifically, the total number of parameters used in the Chinese sample is 51 where 12 parameters are added due to a structural break on 31 December 2004, and 39 parameters are reduced from the original 40 parameters. Refer to Subsection 1.3.2.

1.3.2 Structural break

This technical report delivers a better default prediction performance by using the concept of structural breaks. Especially for the Chinese sample, we can improve the accuracy ratios from 55%, 48%, and 35 % for 1-year, 2-year, and 5-year prediction horizons (Technical Report, Version: 2016, Update 1) to 69%, 66%, and 54%, respectively. We briefly explain how to apply a structural break to the parameter estimation.

The new model specification uses a logistic function. We define a parameter for prediction horizon τ which is subject to a structural break at t_0 as

$$\beta(t,\tau;t_0) = \widetilde{\beta}(\tau) + \widetilde{\gamma}(\tau) \times \frac{1}{1+e^{-\widetilde{\alpha}(\tau)(t-t_0)}}, \tag{16}$$

where $\widetilde{\alpha}(\tau)$ is a positive function of τ and is modelled by a three–parameter NS function. For each prediction horizon τ, $\beta(t,\tau;t_0)$ moves in a smooth manner from $\widetilde{\beta}(\tau)$ to $\widetilde{\beta}(\tau) + \widetilde{\gamma}(\tau)$ through $\widetilde{\alpha}(\tau)$ when the default prediction time advances toward and then beyond t_0.

For the Chinese sample, we revise the parameter specification on the CRI–PD model's intercept and the DTD Level. With respect to the intercept term, ϱ_1 in the NS functions for $\widetilde{\beta}(\tau)$ and $\widetilde{\gamma}(\tau)$ is set to 0, but ϱ_0 is kept free so as to allow for a permanent effect, i.e., the default prediction horizon approaches infinity (see Eq. (15)). With respect to the coefficient on the DTD level, the revised model continues to use a three–parameter NS function where ϱ_0 is set to 0. With these restrictions on the NS parameter, take the example of 12 covariates. There will be (a) the reduced $39(= 11 \times 3 + 2 \times 3)$ parameters with 11 covariates and two $\widetilde{\beta}(\tau)$s for the intercept and the DTD level, and (b) additional $12(= 3 + 3 + 3 + 3)$ parameters with two $\widetilde{\gamma}(\tau)$s and $\widetilde{\alpha}(\tau)$s for the two revised terms.

1.3.3 Parameter estimation by SMC

Reliably estimating a system involving 40 parameters presents a numerical challenge. Moreover, the number of parameters can be greater than 40 if there are more than 12 covariates. The CRI implementation follows Duan and Fulop [2013] who use the SMC pseudo-Bayesian method for estimation and self-normalized statistics for inference.

Due to decomposability, the analysis can be performed separately on the forward default and other exit intensities. The data in the CRI implementation are refreshed with monthly frequency, and the sample likelihood used in estimation relies on default predictions running from 1 month to 60 months with a one month increment. Naturally, default prediction is subject to data availability. Towards the end of the period with available data, the prediction horizon naturally decreases and stops at one-month predictions.

The following exposition closely follows the appendix in Duan and Fulop [2013]. It is important to note that the CRI implementation uses the model described in Duan and Fulop [2013], which does not contain any latent frailty or partial conditioning variable, and hence is technically much simpler in parameter estimation. For example, there is no nonlinear filtering problem.

According to the current modeling framework, where for a particular economy there are N end of the month observations, the input variables of the ith firm in the mth month is given by $X_i(m)$. Let θ denote a set of NS parameters and ℓ denote the forecast horizon ($\ell = 60$). Then the pseudo-likelihood function at step m, denoted by $\mathcal{L}_{m,\min(N-m,\ell)}(\theta)$, takes the form:

$$\mathcal{L}_{m,\min(N-m,\ell)}(\theta) = \prod_{i=1}^{I} P_{\min(N-m,\ell)}(\beta(\theta), \bar{\beta}(\theta); \tau_i, \bar{\tau}_i, X_i(m)), \tag{17}$$

where I is the number of firms, $\beta(\theta)$ and $\bar{\beta}(\theta)$ are the coefficient vectors from Eq. (6) generated from the NS functions with parameter θ. One may notice that $\mathcal{L}_{m,\min(N-m,\ell)}(\theta)$ is one of the terms in the outer-most product in Eq. (10).

Let $\pi(\theta)$ denote the prior. Following the notation from Section 1.1, consider the following pseudo-posterior distribution at time n after one makes the ℓ-period prediction:

$$\gamma_n(\theta) \propto \prod_{m=1}^{n-1} \mathcal{L}_{m,\min(N-m,\ell)}(\theta)\pi(\theta), \text{ for } n = 2, \ldots, N, \tag{18}$$

One can apply the sequential batch-resampling routine of Chopin [2012] together with tempering steps as in Del Moral et al. [2006] to advance the system. For each n, this procedure yields a weighted sample of K particles, $(\theta^{(k,n)}, w^{(k,n)})$ for $k = 1, \ldots, K$, whose empirical distribution function will converge to $\gamma_n(\theta)$ as K increases. In the following paragraphs, the superscript k denotes the particle index. Note that in the CRI implementation, K=1,000.

***Initialization*:** Draw an initial random sample from the prior: $(\theta^{(k,0)} \sim \pi(\theta),\ w^{(k,0)} = 1/K)$. Here, the only role of the prior $\pi(\theta)$, is to provide the initial particle cloud from which the algorithm can start. Of course, the support of $\pi(\theta)$ must contain the true parameter value θ_0. In the CRI implementation, normal/truncated normal priors are used. Truncation applies in order to impose the restriction $d > 0$. To obtain the means of the priors for the SMC method, a least square fit of the MLE parameter estimates to the NS function is conducted. The standard deviations of the priors are set to 5.

***Recursions and defining the tempering sequence*:** Assume there is a particle cloud $(\theta^{(k,n)}, w^{(k,n)})$ whose empirical distribution represents $\gamma_n(\theta)$. Then, a cloud representing $\gamma_{n+1}(\theta)$ will be reached by combining importance sampling and the Markov Chain Monte Carlo (MCMC) steps. Sometimes moving directly from $\gamma_n(\theta)$ to $\gamma_{n+1}(\theta)$ is too ambitious as the two distributions are too far from each other. This will be reflected in highly variable importance weights if one resorts to direct importance sampling. Hence, following Duan and Fulop [2013] which in turn followed Del Moral et al. [2006], a tempered bridge is built between the two densities and the particles are evolved through the resulting sequence of densities. In particular, assume that at time $n+1$, there are P_{n+1} intermediate densities:

$$\overline{\gamma}_{n+1,p}(\theta) \propto \gamma_n(\theta)\mathcal{L}^{\xi_p}_{n,\min(N-n,\ell)}(\theta), \text{ for } p = 1, \ldots, P_{n+1}. \tag{19}$$

This construction defines an appropriate bridge: $\xi_0 = 0$ so that $\overline{\gamma}_{n+1,0}(\theta) = \gamma_n(\theta)$, and $\xi_{P_{n+1}} = 1$ so that $\overline{\gamma}_{n+1,P_{n+1}}(\theta) = \gamma_{n+1}(\theta)$. For p between 0 and P_{n+1}, ξ_p is chosen from a grid of points to evenly distribute the weights, as described below. A particle cloud representing $\overline{\gamma}_{n+1,0}(\theta)$ can be initialized as $(\overline{\theta}^{(k,n+1,0)}, \overline{w}^{(k,n+1,0)}) = (\theta^{(k,n)}, w^{(k,n)})$. Then, for $p = 1, \ldots, P_{n+1}$ the sequence proceeds as follows:

- *Reweighting Step:* In order to arrive at a representation of $\overline{\gamma}_{n+1,p}(\theta)$, the particles representing $\overline{\gamma}_{n+1,p-1}(\theta)$ and the importance sampling principle can be used. This leads to:

$$\overline{\theta}^{(k,n+1,p)} = \overline{\theta}^{(k,n+1,p-1)}, \tag{20}$$

$$\begin{aligned}\overline{w}^{(k,n+1,p)} &= \overline{w}^{(k,n+1,p-1)} \times \frac{\overline{\gamma}_{n+1,p}(\overline{\theta}^{(k,n+1,p)})}{\overline{\gamma}_{n+1,p-1}(\overline{\theta}^{(k,n+1,p)})} \\ &= \overline{w}^{(k,n+1,p-1)} \times \mathcal{L}_{n,\min(N-n,\ell)}^{\xi_p-\xi_{p-1}}(\overline{\theta}^{(k,n+1,p)}).\end{aligned} \tag{21}$$

To avoid particle impoverishment in sequential importance sampling where most of the weight is concentrated in a small number of particles, a resample-move step is run, which is triggered whenever a measure of particle diversity - the efficient sample size (ESS) defined as

$$\mathrm{ESS} = \frac{\left(\sum_{k=1}^{N} \overline{w}^{(k,n+1,p)}\right)^2}{\sum_{k=1}^{N} \left(\overline{w}^{(k,n+1,p)}\right)^2}, \tag{22}$$

falls below some preset value B. Here, resampling directs the particle cloud towards more likely areas of the sampling space, while the move step enriches particle diversity.

In the CRI implementation, B is set to 50% of sample size, which is 500. Thus, if ESS $<$ 500, the following resampling and move steps are performed.

- *Resampling Step:* The particles are resampled proportional to their weights. If $I^{(k,n+1,p)} \in (1,\ldots,K)$ are particle indices sampled proportional to $\overline{w}^{(k,n+1,p)}$, the equally weighted particles are obtained as

$$\overline{\theta}^{(k,n+1,p)} = \overline{\theta}^{(I^{(k,n+1,p)},n+1,p)}, \tag{23}$$

$$\overline{w}^{(k,n+1,p)} = \frac{1}{K}. \tag{24}$$

- *Move Step:* Each particle is passed through a Markov kernel $\mathcal{K}_{n+1,p}(\overline{\theta}^{(k,n+1,p)},\cdot)$ that leaves $\overline{\gamma}_{n+1,p}(\theta)$ invariant, typically a Metropolis-Hastings kernel:

  1. Propose $\theta^{*(k)} \sim \mathcal{Q}_{n+1,p}\left(\cdot \;\middle|\overline{\theta}^{(k,n+1,p)}\right)$.
  2. Compute the acceptance weight α, where:

$$\alpha = \min\left(1, \frac{\overline{\gamma}_{n+1,p}(\theta^{*(k)})\mathcal{Q}_{n+1,p}(\overline{\theta}^{(k,n+1,p)} \mid \theta^{*(k)})}{\overline{\gamma}_{n+1,p}(\overline{\theta}^{(k,n+1,p)})\mathcal{Q}_{n+1,p}(\theta^{*(k)} \mid \overline{\theta}^{(k,n+1,p)})}\right). \tag{25}$$

  3. With probability α, set $\overline{\theta}^{(k,n+1,p)} = \theta^{*(k)}$, otherwise keep the old particle.

This step will enrich the support of the particle cloud while conserving its distribution. If the particle set is a poor representation of the target distribution, the move step can also help adjust the location of the support. Crucially, given the importance of the sampling setup, the proposal distribution $Q_{n+1,p}(\cdot \mid \overline{\theta}^{(k,n+1,p)})$ can be adapted using the existing particle cloud.

In the CRI implementation, block independent normal distribution proposals using the means and the standard deviations implied by the particle set are fitted to the particle cloud before the move. Three (or four) NS parameters corresponding to each covariate form one block. To ensure that the NS parameter d remains positive, any block with a non-positive value for d is discarded. To ensure the smoothness of the term structure of the forward intensity parameters, any block that does not produce an increasing or decreasing structure of the NS function for the first five months is also discarded. Once some block is discarded, the particle is regenerated until it meets the requirements. Note that the likelihood ratio in the Metropolis-Hastings algorithm is not affected by this because the truncated normal creates a common adjustment term in both numerator and denominator.

As mentioned previously, the coefficients for some covariates are also required to be non-positive over all forward starting times. This is achieved by checking whether the NS curve at a particular set of three (or four) parameters meets the condition. If not, the parameter set will be discarded.

To improve the support of the particle cloud, one can execute multiple such Metropolis-Hastings steps each time. In the CRI implementation, such Metropolis-Hastings steps are consecutively performed in each resampling-move step until the number of unique particles exceeds $K/2$.

When $p = P_{n+1}$ is reached, a representation of $\gamma_{n+1}(\theta)$ is:

$$(\theta^{(k,n+1)}, w^{(k,n+1)}) = (\overline{\theta}^{(k,n+1,P_{n+1})}, \overline{w}^{(k,n+1,P_{n+1})}). \tag{26}$$

Following Duan and Fulop [2013], the tempering sequence ξ_p is automatically set to ensure that the efficient sample size stays close to 500. This is done by a grid search, where the ESS is evaluated at a grid of candidate ξ_p and the one that produces the closest ESS to 500 is chosen.

After the recursion procedure (i.e., ξ_p reaches 1), additional moves using the means implied by the particle set but all standard deviations increased by a factor of 30% are further performed to enrich the support and adjust the location of the particle set. The number of such moves is set to 20 for the first time point and exponentially declines to 3 mid-way to the sample period and stays at 3 for the remainder. After that, if the number of unique particles is still below $K/2$, more moves using the means and the standard deviations implied by the particle set (without expansions) are consecutively performed until the particle set meets the requirement. (This case could only happen when ESS ≥ 500 for $\xi_p = 1$.)

1.3.4 Statistical inference

The full sample size has N time series data points, but one can only make default prediction at $N-1$ time points; for example, at time point 2, the data is only available for making one-period default prediction at time point 1. Denote the pseudo-posterior mean of the parameter of the whole sample by $\hat{\theta}_N$. And for $n = 2, \cdots, N$,

$$\hat{\theta}_n = \frac{1}{\sum_{k=1}^{K} w^{(k,n)}} \sum_{k=1}^{K} w^{(k,n)} \theta^{(k,n)}. \tag{27}$$

Note that $(\overline{\theta}^{(k,n+1,0)}, \overline{\omega}^{(k,n+1,0)}) = (\theta^{(k,n)}, \omega^{(k,n)})$ is not a true posterior because the likelihood function in Eq. (18) is not a true likelihood function. Thus, it cannot directly provide valid Bayesian inference. But following Duan and Fulop [2013] - which is in turn based on Shao's self-normalized statistic (Shao [2010]) - inference can be performed using the t-like statistic. To test, for example, the hypothesis of the kth element of $\overline{\theta}^{(k,n+1,p)} = \overline{\theta}^{(I^{(k,n+1,p)},n+1,p)}$, denoted by $\overline{\omega}^{(k,n+1,p)} = \frac{1}{K}$, equal to a, one has:

$$t^* = \frac{\sqrt{N-1}\left(\hat{\theta}_N^{(k)} - a\right)}{\sqrt{\hat{\delta}_{k,N}}} \xrightarrow{d} \frac{W(1)}{\left[\int_0^1 (W(r) - rW(1))^2 dr\right]^{1/2}}, \tag{28}$$

where $W(r)$ is a Wiener process, $\hat{\delta}_{k,N}$ is the kth diagonal element of $\hat{C}_N$, and

$$\hat{C}_N = \frac{1}{(N-1)^2} \sum_{n=2}^{N} n^2 (\hat{\theta}_n - \hat{\theta}_N)(\hat{\theta}_n - \hat{\theta}_N)'. \tag{29}$$

The right-hand-side random variable for t^* does not have a known distribution, but can be easily simulated. Kiefer et al. [2000] reported that the 95% quantile is 5.374 and the 97.5% quantile is 6.811. These values can also be used to set up confidence intervals.

The statistical inference on the structural–break parameters are again based on Shaos self-normalized statistic (see Subsection 1.3.2). Since the parameters in connection with the structural break cannot be identified using the data before the break point, the sequence of parameter estimates used in Shaos self-normalized statistic can only start from the break point onward. In our implementation, all parameter estimates, break or non-break related, start from the break point. Denote by T the endpoint of the data set and t_0 again the structural break point. The number of points in the sequence, N, used to compute the norming matrix and the confidence intervals (see Eq. (29)) therefore equals $T - t_0 + 1$.

1.3.5 Periodic updating

In reality, portfolio credit risk models need to be updated periodically as new data arrive and/or old data are revised. With one new month of data, this means that the final date index N is increased to $N+1$. A particular strength of Duan and Fulop [2013]'s methodology is that the estimation routine does not need to be re-initialized from the prior as the pseudo-posterior using data up to $N\Delta t$ will provide a much better proposal distribution.

Let the pseudo-posterior at time N (based on the old data set available at time N) be denoted by

$$\gamma_N^{(N)}(\theta) \propto \prod_{m=1}^{N-1} \mathcal{L}_{m,\min(N-m,\ell)}^{(N)}(\theta)\pi(\theta), \tag{30}$$

and the pseudo-posterior at time $N+1$ (based on the new data set available at time $N+1$) by

$$\gamma_{N+1}^{(N+1)}(\theta) \propto \prod_{m=1}^{N} \mathcal{L}_{m,\min((N+1)-m,\ell)}^{(N+1)}(\theta)\pi(\theta). \tag{31}$$

The superscript is introduced to differentiate the data set available at time N and $N+1$, respectively. It is important to note that $\mathcal{L}_{m,k}^{(N+1)}(\theta) \neq \mathcal{L}_{m,k}^{(N)}(\theta)$ can be caused by revisions to the old data set. More importantly, there is a generic difference between the pseudo-posterior distribution up to time N under the new data set and the corresponding quantity under the old data set specifically due to multiperiod prediction; that is, $\gamma_{N+1}^{(N)}(\theta) \neq \gamma_N^{(N)}(\theta)$ even without any data revisions to the period covered by the old data set. To put it concretely, using the new data set and at, say, one period before the last (i.e., time $N-1$), one can make default predictions up to two periods, whereas at the same time point, it was only possible to make one-period predictions under the old data set because there were no data beyond time N. Adjustments to the weights are thus necessary to reflect the change in data set before making any sequential updates.

There are several possible ways of advancing the system. The CRI implementation decomposes the move into two steps. First, we take care of data revision up to time N and then act as if we were making predictions with data only up to time N. Doing it this way is meant to maintain the same default prediction setting; that is, for example, only makes one-period default prediction at time $N-1$ even though the new data set permits predictions up to two periods. Thus, we introduce

$$\gamma_N^{(N+1,N)}(\theta) \propto \prod_{m=1}^{N-1} \mathcal{L}_{m,\min(N-m,\ell)}^{(N+1)}(\theta)\pi(\theta) \tag{32}$$

to denote this pseudo-posterior when the superscript $(N+1, N)$ stands for the updated data set available at time $N+1$ but making default predictions as if the data were only available up to time N.

From the previous run up to time N, one already has a weighted set of particles $(\theta^{(k,N)}, w^{(k,N)})$ representing the pseudo-posterior distribution $\gamma_N^{(N)}(\theta)$. Next, perform a reweighting by

$$\theta^{*(k,N)} = \theta^{(k,N)}, \tag{33}$$

$$w^{*(k,N)} = w^{(k,N)} \times \frac{\gamma_N^{(N+1,N)}(\theta^{(k,N)})}{\gamma_N^{(N)}(\theta^{(k,N)})}. \tag{34}$$

Since the denominator is available from the previous run, one only needs to compute the numerator using the new data set up to time N. Then, the weighted set $(\theta^{*(k,N)}, w^{*(k,N)})$ represents the revised pseudo-posterior distribution at time N, i,e, $\gamma_N^{(N+1,N)}(\theta)$, specifically to account for data revisions. From this point onward, one can apply the same recursive procedure described in Subsection 1.3.3, starting from Eq. (19), to complete the updating task.

Reweighting may substantially alter the ESS of the particle set due to a large volume of data changes. If the reweighting leads to a satisfactory ESS, i.e., ESS $\geq B$, advancing to $N+1$ continues as usual. Otherwise, the weighted sample will be discarded to prevent the support from degeneration. One can return to the particle set before reweighting and perform resampling to create an equally-weighted particle set. Then, make the Metropolis-Hastings moves by targeting $\gamma_N^{(N+1,N)}(\theta)$ using the Gaussian-type sampler described earlier and starting with the mean and variance implied by the resampled particle set. One should make these Metropolis-Hastings moves until the particle set reaches a desirable level of distinctiveness, and perhaps with a preset minimum number of moves to ensure that the resulting particle set is close enough to the target distribution. In the CRI implementation, the number of moves is set to be 20.

Furthermore, one can update all self-normalized statistics in the way as described earlier to reflect the additional one more pseudo-posterior means to the sequence.

The initial parameter estimation is carried out for all calibration groups using the data up to the end of January 2013. Relevant quantities (parameter estimates, the 1,000 parameter particles and corresponding weights and sample likelihoods) are saved for periodic updating for all future months. Additional implementation details on the calibration are given in Section 3.

2 Input Variables and Data

Subsection 2.1 describes the input variables used in the quantitative model. Currently, the same set of input variables is common to all of the economies under the CRI's coverage. Future enhancements to the CRI system will allow different input variables for different economies. The effect of each of the variables on the PD output will be discussed in the empirical analysis of Section 4.

Subsection 2.2 gives the data sources and relevant details of the data sources. There are two categories of data sources: current and historical. Data sources used for current data need to be updated in a timely manner so that daily updates of PD forecasts are meaningful. They also need to be comprehensive in their current coverage of firms. Data sources that are comprehensive for current data may not necessarily have comprehensive historical coverage for different economies. Thus, other data sources are merged in order to obtain comprehensive coverage of historical and current data.

Subsection 2.3 indicates the fields from the data sources that are used to construct the input variables. For some of the fields, proxies need to be used for a firm if the preferred field is not available for that firm.

Subsection 2.4 discusses the definition and sources of defaults and of other exits used in the CRI.

2.1 Input Variables

Following the notation that was introduced in Section 1, firm i's input variables at time $t = n\Delta t$ are represented by the vector $X_i(n) = (W(n), U_i(n))$ consisting of a vector $W(n)$ that is common to all firms in the same economy, and a firm-specific vector $U_i(n)$ which is observable from the date the firm's first FS is released, until the month end before the month in which the firm exits, if it does exit.

In Duan et al. [2012], different variables that are commonly used in the literature were tested as candidates for the elements of $W(n)$ and $U_i(n)$. The 2 common variables and 10 firm-specific variables, as described below, were selected as having the greatest predictive power for corporate defaults in the United States. In the current stage of development, this same set of 12 input variables is used for all economies. Future development will include variable selection for firms in different economies.

- Common variables

  The vector $W(n)$ contains two elements, which are:

  1. Stock index return: the trailing one-year simple return on a major stock index of the economy;
  2. Interest rate: a representative 3-month short-term interest rate.

- Firm-specific variables

  The 10 firm-specific input variables are transformations of measures of 6 different firm characteristics. The 6 firm characteristics are:

  1. volatility-adjusted leverage;
  2. liquidity;
  3. profitability;
  4. relative size;
  5. market mis-valuation/future growth opportunities; and
  6. idiosyncratic volatility.

Volatility-adjusted leverage is measured as the DTD in a Merton-type model. The calculation of DTD used by the CRI allows a meaningful DTD for financial firms, a critical sector that must be excluded from most DTD computations. This calculation is detailed in Section 3.

Liquidity is measured as a ratio of cash and short-term investments to total assets. Profitability is measured as a ratio of net income to total assets. Relative size is measured as the logarithm of the ratio of market capitalization to the economy's median market capitalization.

Duan et al. [2012] transformed these first four characteristics into level and trend versions of the measures. For each of these characteristics, the level is computed as the one-year average of the measure, and the trend is computed as the current value of the measure minus the one-year average of the measure. The level and trend of a measure have seldom been used in the academic or industry literature for default prediction, and Duan et al. [2012] found that using the level and trend significantly improves the predictive power of the model for short-term horizons.

To understand the intuition behind using level and trend of a measure as opposed to using just the current value, consider the case of two firms with the same current value for all measures. If the level and trend transformations were not performed, only the current values would be used and the two firms would have identical PD. Suppose that for the first firm the DTD had reached its current level from a high level, and for the second firm the DTD had reached its current level from a lower level (see Fig. 2). The first firm's leverage is increasing (worsening) and the second firm's leverage is decreasing (improving). If there is a momentum effect in DTD, then firm 1 should have a higher PD than firm 2.

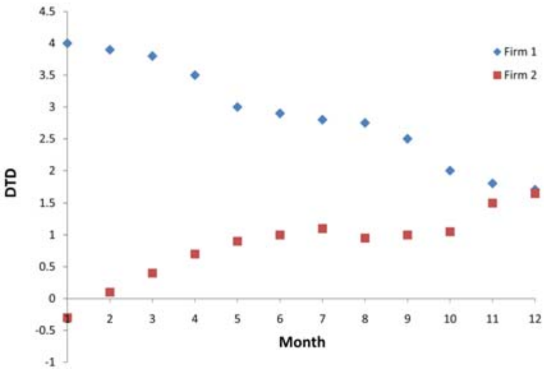

Figure 2: Two firms with all current values equal to each other, but DTD trending in the opposite direction.

Duan et al. [2012] found evidence of the momentum effect in DTD, liquidity, profitability and size. For the other two firm characteristics, applying the level and trend transformation did not improve the predictive power of the model.

One of the remaining two firm characteristics is the market mis-valuation/future growth opportunities characteristic, which is taken as the market-to-book asset ratio and measured as a ratio of market capitalization and total liabilities to total assets. One can see whether the market mis-valuation effect or the future growth opportunities effect dominates this measure by looking at whether the parameter for this variable is positive or negative. This will be further discussed in the empirical analysis of Section 4.

The last firm characteristic is the idiosyncratic volatility which is taken as SIGMA, following Shumway [2001]. SIGMA is computed by regressing the daily returns of the firm's market capitalization against the daily returns of the economy's stock index, for the previous 250 days. SIGMA is defined to be the standard deviation of the residuals of this regression. Using daily returns is to ensure that SIGMA provides an accurate and timely measure of idiosyncratic risk of individual companies. Shumway [2001] reasons that SIGMA should be logically related to bankruptcy since firms with more variable cash flows and therefore more variable stock returns relative to a market index are likely to have a higher probability of bankruptcy.

Finally, the vector $U_i(n)$ contains 10 elements, consisting of:

1. Level of DTD.
2. Trend of DTD.
3. Level of (Cash + Short-term investments) / Total assets, abbreviated as CASH/TA.
4. Trend of CASH/TA.
5. Level of Net income / Total assets, abbreviated as NI/TA.
6. Trend of NI/TA.
7. Level of log (Firm market capitalization / Economy's median market capitalization), abbreviated as SIZE.

8. Trend of SIZE.
9. Current value of (Market capitalization + Total liabilities) / Total asset, abbreviated as M/B.
10. Current value of SIGMA.

The data fields that are needed to compute DTD and short-term investments are described in Subsection 2.3. The remaining data fields required are straightforward and standard. The computation for DTD is explained in Section 3.

2.2 Data Sources

There are two data sources that are used for the daily PD forecast updates: Thomson Reuters Datastream and the Bloomberg Data License Back Office Product. Many of the common factors such as short-term interest rates and macroeconomic data are retrieved from Datastream.

Firm-specific data comes from Bloomberg's Back Office Product which delivers daily update files by region via FTP after respective market closes. All relevant data is extracted from the FTP files and uploaded into the CRI database for storage. From this, the necessary fields are extracted and joined with previous months of data.

The Back Office Product includes daily market capitalization data based on closing share prices and also includes new FSes as companies release them. Firms will often have multiple versions of FSes within the same period, with different accounting standards, filing statuses (most recent, preliminary, original, reclassified or restated), currencies or consolidated/unconsolidated indicators. A major challenge lies in prioritizing these FSes to decide which data should be used. The priority rules are described in section 3.

The firm coverage of the Back Office Product is of sufficient quality that over 33,000 firms can be updated on a daily basis in the 121 economies under the CRI's coverage. While the current coverage is quite comprehensive, historical data from the Back Office Product can be sparse for certain economies. For this reason, various other databases are merged in order to fill out the historical data. The other databases used for historical data are: a database from the Taiwan Economics Journal (TEJ) for Taiwanese firms; a database provided by Korea University for South Korean firms; data from Prowess for Indian firms; and the Compustat for United States.

With all of the databases merged together and for the 121 economies under CRI's coverage, around 65,000 exchange-listed firms are in the CRI database. The historical coverage of the firm data goes back to the early 1990s. In order to be included in our coverage, a company needs to have common equity traded on a stock exchange. Of these 121 economies, 78 economies have their own stock exchange (see Table A.2). For the other 43 economies under the CRI coverage, we cover companies domiciled in the economy that are quoted on a foreign exchange, either because those economies do not have a stock exchange or because data issues are preventing us from including the companies listed on the local exchange. For these reasons, we exclude eight economies for the CRI products calibrated on 28 February 2017: Angola, Dominican Republic, Iraq, Madagascar, Niger Republic, Qatar, Republic of Zambia, and Sudan.

2.3 Constructing Input Variables

The chosen stock indices and short-term interest rates for the 78 economies with their own stock exchange under the CRI's current coverage are listed in Tables A.5 and A.6, respectively. All economies are listed by their three letter ISO code given in Table A.4.

Most of the firm-specific variables can be readily constructed from standard fields from firms' FSes in addition to daily market capitalization values. The only two exceptions are the DTD and the liquidity measure.

The calculation for DTD is explained in section 3. In the calculation, several variables are required. One variable is a proxy for a one-year risk-free interest rate, and the choices for each of the 78 economies are listed in Table A.7. Total assets, long-term borrowing and total liabilities are also required, but can be obtained from standard FS fields easily.

Total current liabilities are also required, and due to the relatively large numbers of firms that are missing this value, proxies have to be found. The preferred Bloomberg field for this is BS_CUR_LIAB. If this is missing, then the sum of BS_ST_BORROW, BS_OTHER_ST_LIAB, BS_CUST_ACCPT_LIAB_CUSTDY_SEC (customers' acceptance and liabilities/custody securities) and BS_SEC_SOLD_REPO_AGRMNT is used. If one, two or three of these are missing, zero is inserted into those fields, but at least one of the four fields is required.

The liquidity measure requires different fields for financial and non-financial firms. For non-financial firms, the numerator of the ratio (Cash + Short-term investments) is taken as the sum of BS_CASH_NEAR_CASH_ITEM and BS_MKT_SEC_OTHER_ST_INVEST (marketable securities and other short-term investments). If BS_MKT_SEC_OTHER_ST_INVEST is missing, substitute zero (but BS_CASH_NEAR_CASH_ITEM is required).

It was found that this sum frequently overstated the liquidity for financial firms. In place of BS_MKT_SEC_OTHER_ST_INVEST, financial firms use the sum of ARD_SEC_PURC_UNDER_AGR_TO_RESELL (securities purchased under agreement to re-sell), ARD_ST_INVEST and BS_INTERBANK_ASSET. If one or two of these are missing, zero is inserted for those fields, but at least one field is required. The "ARD" prefix indicates that these are "as reported" numbers directly from the FSes. As such, for some firms these fields may need to be adjusted to the same units before adding them to other fields.

To summarize, the firm-specific variables include: DTD, Cash/TA, NI/TA, SIZE, M/B, and SIGMA, and the statistics grouped by economy are listed in Table A.8.

2.4 Data for Corporate Events

The CRI database contains 5822 default events and 44641 other exits events from 1990 to the present. The corporate events come from numerous sources, including Bloomberg, Compustat, CRSP, Moodys reports, TEJ,exchange websites and news sources. Moreover, in order to enhance default coverage, from December 2015, the CRI team has started to use "defaults" reported by major credit rating agencies as an additional data source.

The default events that are recognized by the CRI can be classified under one of the following events:

(1) Bankruptcy filing, receivership, administration, liquidation or any other legal impasse to the timely settlement of interest and/or principal payments;

(2) A missed or delayed payment of interest and/or principal, excluding delayed payments made within a grace period;

(3) Debt restructuring/distressed exchange, in which debt holders are offered a new security or package of securities that result in a diminished financial obligation (e.g., a conversion of debt to equity, debt with lower coupon or par amount, debt with lower seniority, debt with longer maturity).

The more precise sub-categories of default corporate actions are listed in Table A.9.

Delisting due to other reasons such as failure to meet listing requirements, inactive stock prices or M&A are counted as "other exits" and are not considered as default. Especially, if a firm has stale stock price for more than a year but has no record on experiencing any credit events, we will assume that it has been suspended and exited from its stock exchange. If two credit events of the same type happen in a row or a default event happens followed by another event of either type, we only keep the first event assuming that the series of events arise from the same source of financial distress. However, if firms are delisted from an exchange and then experience a default event within 365 calendar days of the delisting, we will only keep the default event, and any information between the two dates won't be used. Technical defaults such as covenant violations are not included in our definition of default. The exit events that are not considered as defaults in the CRI system are listed in Table A.10.

In addition to the aforementioned events, there are still cases that require special attention and will be assessed on a case-by-case basis, e.g., subsidiary default. As a general rule, the CRI does not consider related party-default (e.g., subsidiary bankruptcy) as a default event. However, when a non-operating holding parent company relies heavily on its subsidiary, bankruptcy by the subsidiary will cause a considerable economic impact on the parent company. Such cases will be reviewed, and final classifications will be made.

Complete statistics of the total number of firms, number of defaults, and number of other exits in each of the 78 economies from 1994 to 2015 are listed in Table A.11.

3 Implementation Details

Section 1 described the modeling framework underlying the current implementation of the CRI system. It focused on theory rather than the details encountered in an operational implementation. The present section describes how the CRI system handles more specific issues.

Subsection 3.1 describes implementation details related to data, mainly dealing with data cleaning and missing data. Subsection 3.2 describes the specific computation of DTD used by the CRI system that leads to meaningful DTD for financial firms. Subsection 3.3 explains how the calibration previously described in Subsection 1.2 can be implemented. Subsection 3.4 gives the implementation details relevant to the daily output. This includes an explanation of the various modifications needed to compute daily PDs so that the daily PDs are consistent with the usual month end PD and a description of the computation of the aggregate PDs provided by the CRI.

3.1 Data Treatment for Calibration

Fitting data to monthly frequency: Historical end of month data for every firm in an economy is required to calibrate the model. For daily data such as market capitalization, interest rates and stock index values, the last day of the month for which there is valid data is used.

Up to the October 2012 calibration, FS variables data were used, starting from the period end of the statement lagged by 3 months. This is to ensure that predictions are made based on information that was available at the time the prediction was made. However, this treatment can be over-conservative, and many companies actually release their FSes quicker than 3 months. Therefore, we implement a new logic, and we start using the values in an FS as soon as its latest revision was put into the CRI database, unless the FS' release was delayed for more than 3 months. If there was no revision to an FS, the originally released FS is used. Whenever the latest revision is available more than 3 months after the period end, we revert to the previous logic. We start including the FS before the latest revision is actually available as a compromise, to avoid situations like later minor revisions of the FS holding back more up-to-date information. It should be noted that the new approach was only applied for FS input into the CRI database after February 2011, as the revision dates were not accurately recorded before this date. The CRI considers FS variables to be valid for one year without restriction, after they were first used.

Priority of FSes with the same period end: As described in Subsection 2.2, data provided in Bloomberg's Back Office Product can include numerous versions of FSes within the same period. If there are multiple FSes with the same period end, priority rules must be followed in order to determine which to use. The formulation and implementation of these rules are major challenges and areas of continuing development.

The first rule is to prioritize by consolidated/unconsolidated status. This rule applies to all economies, however, special treatment is imposed on firms in the "diversified financial services" sector in South Korea and Taiwan. In this sector of the two economies, firms issue unconsolidated FSes more frequently than consolidated ones. As a result, this prioritization rule can lead to cases where the FSes chosen switch between unconsolidated and consolidated ones on a regular basis. In South Korea and Taiwan, where corporate structures are biased toward large holding companies, this switching may substantially distort the DTD calculation for these holding companies. Therefore, as of October 2013 calibration, in the case of South Korea, and November 2013 calibration, in the case of Taiwan, if a company has released at least one consolidated FS over the last 12 months, all unconsolidated FS will be ignored.

If, after the first prioritization rule has been applied, there are still multiple FSes, the second rule is applied. This is prioritization by fiscal period. In most economies, annual statements are required to be audited, whereas other fiscal periods are not necessarily audited. The order of priority from highest to lowest is, therefore: annual, semi-annual, quarterly, cumulative, and finally other fiscal periods. We have observed that the capital structure breakdown reported by Australian domiciled-banks differs between annual and semi-annual reports, leading to DTD calculations that are not meaningful. Because of this, as of October 2013 calibration, we only use data from annual FSes for Australian banks.

The third prioritization rule is based on filing status. The "Most Recent" statement is used before the "Original" statement, which is used before the "Preliminary" statement.

The final prioritization rule is based on the accounting standard. As more and more countries adopt the International Financial Reporting Standards (IFRS) as their mandatory accounting standard, FSes that are reported using IFRS are given higher priority than they were before. The revised rule is implemented from the 2014 October calibration and is described as follows. For the countries with mandatory IFRS adoption, FSes under IFRS are now given the highest priority after their respective mandatory adoption dates. Before the mandatory adoption dates and for countries without mandatory IFRS adoption, FSes under the Generally Accepted Accounting Principles (GAAP) have the highest priority. If an FS does not indicate its accounting standard, it will not be used.

Having all the prioritization descriptors in place, we rank all the FSes available in the database from the highest priority to the lowest. If there are FSes where all the financial information needed in our model is present, the FS with the highest ranking will be chosen. If instead there is no such FS, we will pick the values variable by variable. For example, the total liability is taken from the highest ranked FS with this information available, while the total asset can be from another FS, which ranks the highest among those bearing this information and having the same FS period end. This treatment is to get as much information as possible and to accommodate the fact that Bloomberg occasionally only revises the variables that have changed values, leaving the other fields NaN.

One variable that requires special attention is the net income. Net income is a flow variable and needs to be adjusted based on the fiscal period of the FS. More specifically we transform the net income into a monthly net income by dividing the net income by the number of months that the FS covers. For example, the monthly net income can be computed from the annual net income divided by 12, the semi-annual net income divided by 6 and the quarterly net income divided by 3. When the monthly net income can be obtained from different sources simultaneously, the quarterly net income will have the highest priority (followed by the cumulative quarterly, semiannual, annual, and others) because it covers a more recent period of time.

Treatment of stale market capitalization prices: The market capitalization of a firm is required in a few input variables: DTD, SIZE, M/B, and SIGMA. For most firms, the market capitalization is available from Bloomberg on a daily basis.

A check on the trading volume of shares is used to remove stale prices. Specifically, if there are more than two consecutive days of identical market capitalization prices, subsequent identical prices are removed only if the trading volume is equal to zero. This is to avoid, for example, cases where the shares of a company are under a trading suspension but the market capitalization data is incorrectly carried forward.

An exception is for Indian companies, where it is common for some companies to have market capitalizations reported only once a month with several consecutive months having identical prices and positive trading volume. These prices are very likely not to be accurate reflections of the firms' value. So, the trading volume is not checked for Indian firms and market capitalizations are excluded after more than two repeated prices.

For some firms, the market capitalization data is not available for some periods. To fill in the blanks, we use the shares outstanding obtained from the previously available market capitalization divided by the price on that day as a proxy. If the market capitalization data is missing for more than a year, we use the share price multiplied by the shares outstanding listed on the balance sheet and then multiplied again by the adjustment factor that Bloomberg provides to account for splits, dividends, etc. If there is still market capitalization missing in the data, then shares outstanding from other data sources including Compustat and Korean University Database are used.

Currency conversion: Currency conversions are required if the market capitalization or any of the FS variables are reported in a currency different than the currency of the economy. If a currency conversion is required, the foreign exchange rate used is the one reported at the relevant market close. For firms traded in most of the Asian economies and Asia-Pacific, the Tokyo closing rate is used; for firms traded in Europe and Middle East, the London closing rate is used; and for firms traded in North and Latin America, the New York closing rate is used. For market capitalizations, the FX rate used is for the date that the market capitalization is reported. For FS variables, the FX rate used is for the date of the period end of the statement.

Treatment for mergers and acquisitions (M&A): M&A events are common occurrences in the economic world. For our purpose, we define the M&A events as the cases where a firm ("acquirer") acquires partial or full ownership of another firm ("target"). Once an M&A deal is completed, the market capitalization of the acquirer changes immediately, reflecting the restructure of the acquirer. However, its FSes do not usually immediately reflect the new situation due to the fact that they are only released on a periodic basis. As a result, the DTD and market-to-book ratio, which are important inputs for the PD computation, will be distorted due to a mismatch in the market capitalization and the FS variables. In order to ensure the accuracy and reliability of our PD estimates, some special treatments are taken for PD calculations to companies whose financials are presumably significantly affected by the M&A events. The treatments are only applied to the acquirers.

The treatment starts with the screening of the important M&A deals. Only the important M&A deals are treated, assuming that the unimportant ones would not significantly affect a firm's corporate structure. An M&A deal is considered important if it satisfies the following three criteria :

1. Upon the deal's completion, the acquirer owns 20% or more of the target company.
2. The size of the deal is material to the acquirer. This is measured in terms of total assets. If α is the percentage of the target that is being acquired, the size is considered material if the product of α and the total assets of the target is greater than or equal to 20% of the total assets of the acquirer.

3. The change in market capitalization is material, with the largest absolute daily market capitalization return, within 20 days of the M&A completion day, larger than or equal to 5%.

One thing to note in implementation is that some targets stopped producing financial statements years before the M&A events. As a result, they may not have a valid value of total asset (needed for testing criterion 2) on the deal completion date. In this case, we use their last available value within 2 years before the deal completion as a substitute. If the last available value is beyond the 2-year range, we think that the data is not informative enough to reflect the financial situation upon deal completion and thus skip this particular case.

In order to mitigate the mismatching problem between the market capitalization and FS variables, we make the simplest and most conservative treatments, which are in line with the fundamental accounting standards. The treatment period will begin on the deal completion date and end when the first financial statement that reflects the post-M&A situation becomes available, which varies across economies and can range from 3 months to a few years. After identifying the important M&A deals, which must have had an ownership level of equal or more than 20%, we treat them in two different ways:

1. If the acquirer owns 20-50% (excluding 50%) of the target upon deal completion, the "Equity Method" is used to treat the financial statement variables. Under the "Equity Method", the total asset of the acquirer will increase by a proportion, which is the percentage of ownership acquired in this deal, of the targets equity. Its net income will increase by the same proportion of the target's net income. In contrast, other financial statement variables will stay the same.
2. If the acquirer owns 50-100% (including 50%) of the target upon deal completion, the "Acquisition Method" is used to adjust the financial statement variables. By using this method, we assume that the financial manager of the acquirer consolidates the financial statements of both entities. As a consequence, the financial statement variables, including total liability, total asset, and cash and marketable securities, take the simple sum of the values from both entities. The net income will still increase by a proportion (the percentage of ownership acquired in this deal) of the targets net income, simply because it is the profit attributed to the shareholders.

After constructing the hypothetical financial statement data in the above-mentioned way, we use them to compute the DTD and the historical monthly PDs wherever applicable. Note that we do not let the hypothetical values enter the model's calibration process. With enough data points in the database to robustly calibrate the model parameters at the economy or region level, we can afford to disregard a small portion of data for the M&A period during which we believe them to be mismatched. After getting the model parameters, however, we not only use the hypothetical values to re-calibrate the firm-specific DTD parameters and re-calculate the DTD values, we also use them to adjust other variables with financial information. This is to guarantee that the PDs during the treatment period are properly calculated.

Treatment for missing values and outliers: Missing values and outliers are dealt with by a three-step procedure. In the first step, the 10 firm-specific input variables are computed for all firms and all months. In this step, the extreme values will be calculated, and the missing values will be determined. In the second step, outliers are eliminated by winsorization. In the final step, missing values are replaced under certain conditions. Note that the macroeconomic variables do not go through this process.

The first step is to compute the input variables and to determine which are missing. As mentioned previously, FS variables are carried forward for one year after the date that they are first used. The date that they are first used is generally three months after the period end of the statement. If no FS is available for the company within this year, then the FS variable will be missing. For market capitalization, if there is no valid market capitalization value within the calendar month, then the value is set to missing.

For illiquid stocks, if there has been no valid market capitalization value for a firm within the last 90 calendar days, then the market capitalization is deemed to not properly reflect the value of the firm. The firm is considered to have exited with a non-default event. Once the firm starts trading again and a new FS is released, the firm can enter back into the calibration. With regard to historical PDs, the PDs can be reported again once there are enough valid variables.

With regard to the level variables, their values in the current and the last 11 months are averaged to compute the level. A minimum of 6 observations in the 12-month range are required to calculate the level variables. If fewer than 6 observations exist in this case, the level variables will bear missing values. However, this condition is not enforced during the initial 6 months after the firm releases the first financial statement.

To compute the trend variables, the level is subtracted from the current month value. If the current month value is missing, the trend variable is set to be the last valid value during the previous one year.

The value of M/B is set to be missing if any of the following values are missing: market capitalization, total liabilities or total assets of the firm. For the computation of SIGMA, at least 50 valid returns over the last 250 days of possible returns are required for the regression. If there are less than 50 valid returns, SIGMA is set to be missing.

In this way, the 8 trend and level variables as well as M/B and SIGMA are computed and identified as missing or present. Winsorization can then be performed as a second step to eliminate outliers. The volume of outliers is too large to be able to determine whether each one is valid or not, so winsorization applies a floor and a cap on each of the variables. The historical 0.1 percentile and 99.9 percentile for all firms in the economy are recorded for each of the 10 variables. Any values that exceed these levels are set to equal these boundary values.

With a winsorization level of 0.1 and 99.9 percentile, the boundary values still may not be reasonable. For example, NI/TA levels of nearly -25, meaning an annual net income -25 times larger than the total assets of a firm, has been observed at this stage. In these cases, a more aggressive winsorization level is applied, until the boundary values are reasonable. Thus, the winsorization level is economy- and variable-specific, and will depend on the data quality for that economy and variable. Winsorization levels different from the default of 0.1 percentile and 99.9 percentile are indicated in Table A.8.

A third and final step can be taken to deal with missing values. If during a particular month, no variable is missing for a particular firm, the PD can then be computed. If 6 or more of these 10 variables are missing, there is deemed to be too many missing observations and no replacement shall be made.

If between 1 and 5 variables are missing out of the 10, the first step is to trace back for at most 12 months to use previous values of these variables instead. If this does not succeed in replacing all of the variables, a replacement by sector medians is done. A firm's sector during a certain month is classified as either financial or non-financial, which is based on its Bloomberg industry sector code during that month. As of January 2015, the sector median replacement is no longer implemented in the calibration process but still in the PD computation. One special case is that the sector replacement is not done if it results in a relative change in the historical PD of 10% or more when the initial PD was at or above 100 bps, or an absolute change in the historical PD of 10 bps or more when the initial PD was below 100 bps.

One thing to note is that in the initial phase of a company - 6 months or even longer after its IPO - the data availability and quality are relatively low due to, for example, the delay in the issuance of FSes or illiquid trading. As observed in our data, replacing the missing values during this period with a sector median sometimes results in extreme spikes and falls in the company's PD. These extreme values are not easily detected, because in the beginning of a company's history, there are not many previous PD values to compare to as can be done later in the company's history. In order to avoid this, as of the 2015 January calibration, we set the rule to start treating the missing values only from the month when both the DTD level and trend are available and finite. By doing so, we make the PDs in the beginning of a company's history more reflective of its true credit quality.

Inclusion/exclusion of companies for calibration: Firms are included within an economy for calibration when the primary listing of the firm is on an exchange in the economy. This ensures that all firms within the economy are subject to the same disclosure and accounting rules. There are a relatively small number of firms that are listed in multiple economies. For example, Bank of China Ltd is listed both in Hong Kong Stock Exchange and China's Shanghai Stock Exchange. Based on Bloomberg's classification of its primary listing, Bank of China Ltd is assigned to the calibration group of Asia-Pacific rather than China.

In the US, firms traded on the OTC markets or the Pink Sheets are not considered as exchange listed so are not included in calibration or in the reporting of PD forecasts. Many of these firms are small or start-up firms. Including this large group of companies would skew the calibration and the aggregate results. The TSX Venture Exchange in Canada also contains only small and start-up firms, so firms listed here are also excluded.

Other exclusions include Taiwan's Taipei Exchange, Vietnam's Hanoi UPCoM, Switzerland's OTC-X BEKB, Brazil's Soma and Romania's RASDAQ. To identify the smaller markets outside of the US and Canada is challenging due to data availability. However, continuing work is being done in the CRI system to exclude firms that are not listed on major exchanges within a country.

3.2 Distance-to-Default Computation

The DTD computation used in the CRI system is not a standard one. Standard computations exclude financial firms, which is of course a critical part of any economy. Thus, the standard DTD computation must be extended to give meaningful estimates for financial firms as well. Duan and Wang [2012] have provided a review of different DTD calculations with several examples for financial and non-financial firms.

The description of the specialized DTD computation starts with a brief description of the Merton [1974] model. Merton's model makes the simplifying assumption that firms are financed by equity and a single zero-coupon bond with maturity date T and principal L. The asset value of the firm V_t follows a geometric Brownian motion:

$$\mathrm{d}V_t = \mu V_t \mathrm{d}t + \sigma V_t \mathrm{d}B_t. \tag{35}$$

Here, B_t is the standard Brownian motion, μ is the drift of the asset value in the physical measure, and σ is the volatility of the asset value. Following the Merton [1974] model, the probability of the company's default at time T evaluated at time t is $\Pr_t(V_T \leq L)$, from Eq. (35), we can derive $\Pr_t(V_T \leq L) = N(-\mathrm{DTD}_t)$, where DTD at time t is defined as:

$$\mathrm{DTD}_t = \frac{\log\left(\frac{V_t}{L}\right) + \left(\mu - \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}. \tag{36}$$

The standard KMV assumptions given in Crosbie and Bohn [2003] are to set the time to maturity $T-t$ at a value of one year, and the principal of the zero-coupon bond L to a value equal to the firm's current liabilities plus one half of its long-term debt. Here, the current liabilities and long-term debt are taken from the firm's FSes. If the firm is missing the current liabilities field, then various substitutes for this field can be used, as described in Subsection 2.3.

This is a poor assumption of the debt level for financial firms, since they typically have large liabilities, such as deposit accounts, that are neither classified as current liabilities nor long-term debt. Thus, using these standard assumptions means ignoring a large part of the debt of financial firms.

To properly account for the debt of financial firms, Duan [2010] included a fraction δ of a firm's other liabilities. The other liabilities are defined as the firm's total liabilities minus both the short and long-term debt. The debt level L then becomes the current liabilities plus half of the long-term debt plus the fraction δ multiplied by the other liabilities, so that the debt level is a function of δ. The standard KMV assumptions are then a special case where $\delta = 0$.

The fraction δ can be optimized along with μ and σ in the transformed-data maximum likelihood estimation method developed in Duan [1994, 2000]. As asset value is unobservable, it has to be implied from market equity value. Noted that equity holders receive the excess value of the firm above the principal of the zero-coupon bond and have limited liability, so the equity value at maturity is: $\max(V_T - L, 0)$. This is just a call option payoff on the asset value with a strike value of L. Thus, the Black-Scholes option pricing formula can be used to calculate the equity value at times t before T,

$$E_t = V_t N(d_+) - e^{-r(T-t)} L N(d_-), \tag{37}$$

where r is the risk-free rate, $N(\cdot)$ is the standard normal cumulative distribution function, and

$$d_\pm = \frac{\log\left(\frac{V_t}{L}\right) + \left(r \pm \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}. \tag{38}$$

Then we can express the likelihood function of the observed equity values by viewing the equity values as the transformed data from pricing formula in Eq. (37). It should be noted that the transformation involves the unknown asset volatility. By standard transformation theory, the likelihood of observed equity values must equal the product of the likelihood of the asset values (implied by equity values) and the Jacobian of the inverse transformation (from the equity value back to the asset value). Moreover, following Duan et al. [2012], the firm's market value of assets is standardized by its book value A_t, so that the scaling effect from a major investment or financing by the firm will not distort the time series from which the parameter values are estimated. Thus, the log-likelihood function based on equity prices is:

$$\begin{aligned}
\mathcal{L}(\mu, \sigma, \delta) = & -\frac{n-1}{2}\log(2\pi) - \frac{1}{2}\sum_{t=2}^{n}\log(\sigma^2 h_t) - \sum_{t=2}^{n}\log\left(\frac{\hat{V}_t(\sigma,\delta)}{A_t}\right) \\
& - \sum_{t=2}^{n}\log[N(\hat{d}_+(\hat{V}_t(\sigma,\delta),\sigma,\delta))] \\
& - \frac{1}{2\sigma^2}\sum_{t=2}^{n}\frac{1}{h_t}\left[\log\left(\frac{\hat{V}_t(\sigma,\delta)}{A_t} \times \frac{A_{t-1}}{\hat{V}_{t-1}(\sigma,\delta)}\right) - \left(\mu - \frac{\sigma^2}{2}\right)h_t\right]^2,
\end{aligned} \tag{39}$$

where n is the number of days with observations of the equity value in the sample, $\hat{V}_t$ is the implied asset value found by solving Eq. (37), $\hat{d}_+$ is computed with Eq. (38) using the implied asset value, and h_t is the number of trading days as a fraction of the year between observations $t-1$ and t. Notice that the implied asset value and $\hat{d}_+$ are dependent on δ by virtue of the dependence of L on δ.

Implementation of DTD computation: The DTD at the end of each month is needed for every firm in order to calibrate the forward intensity model. A moving window, consisting of the last one year of data before each month end is used to compute the month end DTD. Daily market capitalization data based on closing prices is used for the equity value in the implied asset value computation of Eq. (37). If there are fewer than 50 days of valid observations for the DTD input variables (market capitalization, FS variables, and interest rate), the DTD value is set to be missing. An observation is valid if there is positive trading volume that day. If the trading volume is not available, the observation is assumed to be valid if the value for the market capitalization changes often enough. The precise criterion is as follows: if the market capitalization does not change for three days or more in a row, the first day is taken as a valid observation, and the remaining days with the same value are set to be missing.

A straightforward idea for the DTD computation is to first estimate the three variables μ, σ and δ via maximizing the log-likelihood function (39) over $\sigma \geq 0$ and $0 \leq \delta \leq 1$, and then to calculate the DTD from Eq. (36). Let $(\hat{\mu}, \hat{\sigma}, \hat{\delta})$ be an optimal solution to the maximization problem. By direct calculation, it is not hard to see that

$$\hat{\mu} = \frac{\hat{\sigma}^2}{2} + \frac{1}{\sum_{t=2}^{n} h_t} \log \left(\frac{\hat{V}_n(\hat{\sigma}, \hat{\delta})}{A_n} \times \frac{A_1}{\hat{V}_1(\hat{\sigma}, \hat{\delta})} \right). \tag{40}$$

In view of this, maximizing the three-dimensional function $\mathcal{L}(\mu, \sigma, \delta)$ can be equivalently reduced to maximizing the two-dimensional function $\tilde{\mathcal{L}}(\sigma, \delta)$ taking the form

$$\begin{aligned} \tilde{\mathcal{L}}(\sigma, \delta) = & -\frac{n-1}{2} \log(2\pi) - \frac{1}{2} \sum_{t=2}^{n} \log(\sigma^2 h_t) - \sum_{t=2}^{n} \log \left(\frac{\hat{V}_t(\sigma, \delta)}{A_t} \right) \\ & - \sum_{t=2}^{n} \log N(d_+) - \frac{1}{2\sigma^2} \left\{ \sum_{t=2}^{n} \frac{1}{h_t} \times \left[\log \left(\frac{\hat{V}_t(\sigma, \delta)}{A_t} \times \frac{A_{t-1}}{\hat{V}_{t-1}(\sigma, \delta)} \right) \right]^2 \right. \\ & \left. - \frac{1}{\sum_{t=2}^{n} h_t} \left[\log \left(\frac{\hat{V}_n(\hat{\sigma}, \hat{\delta})}{A_n} \times \frac{A_1}{\hat{V}_1(\hat{\sigma}, \hat{\delta})} \right) \right]^2 \right\}. \end{aligned} \tag{41}$$

However, with quarterly FSes there will never be more than three changes in the corporate structure (defined in this model by L and A_t) throughout the year, leading to possibly unstable estimates of δ. This problem is mitigated by performing a two-stage optimization for σ and δ.

In the first stage, the maximization of $\tilde{\mathcal{L}}(\sigma, \delta)$ for each firm is performed over both σ and δ. For each firm, at the first month in which DTD can be computed, the maximization is constrained in $\sigma \geq 0$ and $0 \leq \delta \leq 1$. Thereafter, at month n, the maximization is still constrained in $\sigma \geq 0$ while δ is constrained in the interval $[\max(0, \hat{\delta}_{n-1} - 0.05), \min(1, \hat{\delta}_{n-1} + 0.05)]$, where $\hat{\delta}_{n-1}$ is the estimate of δ made in the previous month. In other words, a 10% band around the previous estimate of δ (where that band is floored with 0 and capped with 1) is applied so that the estimates do not fluctuate too much from month to month.

However, for many firms, the estimate of δ would frequently lie on the boundary of the constraining interval, meaning that the estimates of δ were not stable. Therefore, a second stage is implemented to impose greater stability. Within the same calibration group, all firms in the same sector (Bloomberg 10-industry sectors classification) are assumed to share the same estimate of δ, chosen to be the average of all its individual estimates. However, for some small economies, especially in their early years, the average of δ is still observed to be not stable due to some sector or even the whole calibration group has only few individual estimates of δ. To well handle such cases, a threshold rule at each time of estimation is applied under the following conditions: a) If a sector has fewer than 10 individual estimates, the shared estimate of δ will be set to the average of whole calibration group instead of the sector average; b) furthermore, if the whole calibration group still has fewer than 10 individual estimates, the shared estimate of δ is deemed not available. Accordingly, with δ being fixed to be the sector average on the calibration group level, the original maximization of $\tilde{\mathcal{L}}(\sigma, \delta)$ is reduced to a one-dimensional maximization in σ for each firm.

Since the first stage is done to obtain a stable sector-average estimate of δ, the criteria used to include a firm-month is more strict. In the first stage, a two-year window of FS variables, market capitalization, and interest rate is used instead of one year, and a minimum of 250 days of valid observations of the DTD input variables are required instead of 50. If a firm has less than 250 days of valid observations within the last two years of a particular month end, δ will not be estimated for that firm and that month end.

It was found that after applying the two-stage procedure described above, the estimate of μ was frequently unstable and could lower the explanatory power of DTD. For example, suppose a firm has a large drop in its implied asset value in January 2011, so that the estimated μ is negative for the DTD calculation at the end of December 2011. If there is little change in the company in January 2012, then the drop in implied asset value in January 2011 is no longer within the observation window for the DTD calculation at the end of January 2012. There will be a large increase in the estimated μ, resulting in a substantial improvement of the DTD just because of the moving observation window. To avoid this problem, we now set μ to be equal to $\sigma^2/2$. So in calculating DTD, the second term in the numerator of Eq. (36) is eliminated.

In summary, the DTD for each firm is computed using the sector average within a calibration group for δ in that month, and the estimate of σ based on the last year of data for the firm.

Carrying out this two-stage procedure would take about 70 hours of computation time on a single PC, given the millions of firm months that are required. However, each of the stages is parallelizable. In the first stage, the DTD can be computed independently between firms. In the second stage, once the sector averages of the δ have been computed for each month, the DTD can again be computed independently between firms. In the current CRI system, by using the NUS' high-performance computing facility, the DTD computational time has been greatly reduced thanks to the application of parallel computing.

3.3 Calibration

Implementation: As shown in Section 1, the calibration of the forward intensity model involves multiple maximum pseudo-likelihood estimations, where the pseudo-likelihood functions are given in Eq. (13). The maximizations are on the logarithm of these expressions, and the default parameters' maximization is performed independently from the non-default exit parameters. Parameter estimates for the entire horizon up to five years for the default and non-default exits can be obtained directly from the NS function.

A few input variables have an unambiguous effect on a firm's probability of default. Increments of both the level and trend of DTD, CASH/TA, and NI/TA should indicate that a firm is becoming more creditworthy and should lead to a decreasing PD. For large and relatively clean data sets such as the US, an unconstrained optimization leads to parameter values which mostly have the expected sign. For each of the DTD level and trend, CASH/TA level and trend, and NI/TA level, the default parameters at all horizons are negative. A negative default parameter at a horizon means that if the variable increases, the forward intensity will decrease (based on Eq. (6)), so that the conditional default probability at that horizon will decrease.

Grouping for economies: There are not enough defaults in some small economies and calibrations of these individual economies are not statistically meaningful. In order to ensure that there are enough defaults for calibration, the 78 economies are categorized into groups according to similarities in their stage of development and their geographic locations. Within these groups, the economies are combined and calibrated together.

As of January 2015, Canada and the US remain in the North America calibration group, and the developed economies of Asia-Pacific (Australia, Hong Kong, Japan, Singapore, South Korea, Taiwan and New Zealand) form another calibration group. China and India, the two major emerging economies of Asia Pacific are each calibrated as individual groups. All the European countries covered by the CRI are in a single calibration group, which now includes Bosnia and Herzegovina, Serbia and Montenegro. The other emerging economies of Asia Pacific, Latin America, Middle-East, and Africa form the "emerging markets" calibration group, which now includes Bangladesh, Oman, Jamaica, and Tunisia. Detailed grouping can be found in Table A.4.

All economies in the same calibration group share the same coefficients for all variables except for the 3-month interest rate variable. The 3-month interest rate variable is entered as the current value minus the historical month-end mean in order to reflect the contemporary change relative to the historical average. Its coefficient is allowed to vary, because different economies with different currencies have different dependencies on their interest rates, the levels of which can also differ significantly across economies.

We allow for a unique coefficient on the interest rate variable for each economy. However, certain treatments and exceptions apply due to various reasons. For New Zealand, it does not have enough default events to identify a separate coefficient. In this case, the actual interest rates are replaced with zeros throughout the whole time series. This is to disable the effect of interest rate in the particular calibration, but it will not induce bias based on the nature of the demeaned interests. For the eurozone economies, all of them use the demeaned Germany's 3-month Bubill rate after the respective dates they joined the eurozone. This aims to reflect more of the monetary rather than the sovereign credit conditions in those economies. Before joining the eurozone, the interest rate variable is set to be 0 for each of those economies except Germany, because none of them has enough default events before that date. Among the non-eurozone economies, Denmark, Norway, Sweden, and UK have their own respective coefficients on the interest rate variable, but Iceland, Switzerland along with all the others share the same one. In the Emerging Markets group, only Indonesia, Malaysia, the Philippines, and Thailand have their own economy-specific coefficients on the interest rate variable. The Latin American subgroup has a universal coefficient for all the member economies, and all the others in the Emerging Markets group share their coefficient.

One thing to note is that in addition to the unique coefficient on the interest rate variable, Indonesia also has its own coefficient for the relative size level as of October 2013.

Relative size: For the calibration data set, the median market cap of firms in an economy for each month end includes the market cap from the last trading day of each firm in the month. If a firm does not trade in a particular month, the firms market cap is not included in the median. For certain economies, many firms are illiquid and the median market cap experiences large variations due to the change in composition of firms rather than the market value of the firms. Another problem is data quality at the beginning of the historical sample: if a data provider starts including the market cap for a large number of firms in one month compared to the previous, there can be a large jump in the median market cap.

To avoid this problem, we use a combination of the economy's stock index and the economy's median market cap as the divisor in the Relative Size variable:

1. We choose a recent month where there is a more complete set of firms in the economy that have trading activity, and calculate the ratio of the economy's median market cap to stock index value at the end of the month.
2. For each month, the divisor for the Relative Size variable of firms in the economy is taken as the month end stock index multiplied by that ratio.

3.4 Daily Output

Individual firms' PD: In computing the pseudo-log-likelihood functions in Eq. (13), only the end of month data is needed. The data needs to be extended to daily values in order to produce daily PDs.

For the level variables, the last 12 end-of-month observations (before averaging) are combined with the current value. The current value is scaled by a fraction equal to the current day of the month divided by the number of calendar days in the month. The earliest monthly value is scaled by one minus this fraction. The sum is then divided by the number of valid monthly observations, with the current value and the earliest monthly value jointly having the weight of one observation if either or both are not missing. Not performing this scaling can lead to an artificial jump in PD at the beginning of the month. When performing the scaling, the change in level is more gradual throughout the month.

SIGMA is computed by regressing the daily returns of the firm's market capitalization against the daily returns of the economy's stock index for the previous 250 days.

Aggregating PDs: The CRI provides term structures of the probability distributions for the number of defaults as well as the expected number of defaults for different groups of firms. The companies are grouped by economy (using each firm's country of domicile), by sector (using the firm's Bloomberg industrial sector code) and sectors within economies.

To compute the probability distribution of the number of defaults, we use an algorithm which was originally reported in Anderson et al. [2003]. It assumes conditional independence and uses a fast recursive scheme to compute the necessary probability distribution. With the individual firms' PDs, the expected number of defaults is trivial to compute and is simply the sum of the individual PDs within each group. Note that while this algorithm is currently used to produce the probability distribution of the number of defaults within an economy or sector, it can easily be generalized to compute loss distributions for a portfolio manager, in which case the portfolio's exposure to each firm should be aggregated.

As of 8th July 2014, the display of the aggregate PDs on the RMI-CRI website started to adopt the simple median of the individual PDs within each group. This change will mitigate the effect from extreme outliers and synchronize with the aggregate display of the newly launched AS. It should be noted that the aggregate PDs using mean values are still accessible through the data downloading section on the website.

Inclusion of firms in aggregation: As explained in Subsection 3.1, firms are included in an economy for calibration if the firms' primary listing is on an exchange in that economy. This is to ensure that all firms in an economy are subject to the same disclosure and accounting requirements. In contrast, a firm is included in an economy's aggregate results if the firm is domiciled in that economy. This is because users typically associate firms with their economy of domicile rather than the economy where their primary listing is, if they are different. For example, the Bank of China has its primary listing in Hong Kong, but its economy of domicile is China so the Bank of China is included in the aggregation forecasts for China, and is included under China when searching for the individual PDs.

Treatment of companies after a default event: When a company experiences a default event, the CRI system discontinues the PD calculation for that company. However, if the company resumes operations after some time, it will be treated as a new company, and we continue to generate PD. The new company's PDs are not affected by the FS or market cap data prior to the event. So, the PDs calculated are independent of the PDs that were generated before the default event. On our website, the PDs are however displayed on a single graph for the convenience of our users.

4 Empirical Analysis

This section presents an empirical analysis of the CRI outputs for the 78 economies with their own exchange that are currently being covered. In Subsection 4.1, an overview is given of the default parameter estimates. Subsection 4.2 explains and provides the accuracy ratios for the different countries under the CRI coverage.

4.1 Parameter Estimates

With 60 months of forecast horizons, 13 variables and 6 different groups of economies, tables of the parameter estimates occupy over 20 pages and are not included in this Technical Report. In Figs. B.1 and B.2, the parameter estimates are from calibrations performed in March 2017 using data up until the end of February 2017. As an example, plots of the default parameters for the US are given in Figs. B.1 and B.2 in Appendix B. In this part, a brief overview is given of the general traits and patterns seen in the default parameter estimations of the economies covered by the CRI.

Recall that if a default parameter for a variable at a particular horizon is estimated to be positive (negative) from the maximum pseudo-likelihood estimate, then an increasing value in the associated variable will lead to an increasing (decreasing) value of the forward intensity at that horizon, which in turn means an increasing (decreasing) value for the conditional default probability at that horizon.

For the stock index one-year trailing return variable, most groups have default parameters that are slightly negative in the shorter horizons and then become positive in the longer horizons. When the equity market performs well, this is only a short-term positive for firms and in the longer term, firms are actually more likely to default. This seemingly counterintuitive result could be due to correlation between the market index and other firm-specific variables. For example, Duffie et al. [2009] suggested that a firm's DTD can overstate its creditworthiness after a strong bull market. If this is the case, then the stock index return serves as a correction to the DTD levels at these points in time.

As expected we observe a different relationship between the short-term interest rate and default across economies. This observation possibly indicates different lead-lag relationships between credit conditions and the raising and cutting of short-term interest rates.

DTD is a measure of the volatility-adjusted leverage of a firm. Low or negative DTD indicates high leverage and high DTD indicates low leverage. Therefore, PD would be expected to increase with decreasing DTD. Indeed, the DTD level has negative default parameters across calibration groups.

The ratio of the sum of cash and short-term investments to total assets (CASH/TA) measures liquidity of a firm. This indicates the availability of a firm's funds and its ability to make interest and principal payments. For almost all economies, the default parameters for CASH/TA level in shorter horizons are significantly negative. The magnitude of the default parameters typically decreases for longer horizons, indicating that CASH/TA level is a better indicator of a firm's ability to make payments in the short term than the long term.

The ratio of net income to total assets (NI/TA) measures profitability of a firm. The relationship between PD and NI/TA is as expected: the default parameters for NI/TA level is negative for all economies and all horizons.

The logarithm of the market capitalization of a firm over the median market capitalization of firms within the economy (SIZE) does not have a consistent effect on PD across different economies. For example, in the US the default parameters for SIZE level are positive for almost all horizons, suggesting that the complexity of larger firms outweighs the potential benefits, such as diversified business lines and funding sources. On the other hand, in China the default parameters for SIZE level are negative across almost all horizons. These differences may reflect differences in the business environments in the respective economies.

The default parameters associated with DTD Trend, CASH/TA Trend, SIZE Trend and NI/TA Trend are negative across almost all economies and horizons. The trend variables reflect momentum. The momentum effect is a short-term effect, and evidence of this is seen in the lower magnitude of the default parameters at longer horizons than at shorter horizons. The exception is the NI/TA Trend, which for some calibration groups has a higher magnitude at longer horizons.

The ratio of the sum of market capitalization and total liabilities to total assets (M/B) can either indicate the market mis-valuation effect or the future growth effect. This default parameter is negative for the US in the shorter term, indicating that higher M/B implies lower PD, and the future growth effect dominates during this period. On the other hand, in China and in the Developed Asia-Pacific calibration group, the default parameter for M/B is positive, indicating that for these economies, the market mis-valuation effect dominates.

Shumway [2001] argued that a high level of the idiosyncratic volatility (SIGMA) indicates highly variable stock returns relative to the market index, which is equivalent to highly variable cash flows. Empirically, the sign on SIGMA is different across countries and across prediction horizons.

4.2 Prediction Accuracy

In-sample testing: Various tests are carried out to test the prediction accuracy of the RMI-CRI PD forecasts. These tests are conducted in-sample.

A single calibration is conducted for the in-sample tests, using data to the end of the data sample. As an example, one-year PD forecasts are made for 31 December, 2000 by using the data at or before 31 December, 2000 and the parameters from the calibration. These PD forecasts can be compared to actual defaults that occurred at any time in 2001.

Accuracy ratio: The accuracy ratio (AR) is one of the most popular and meaningful tests of the discriminatory power of a rating system (BCBS, 2005). The AR and the equivalent Area Under the Receiver Operating Characteristic (AUROC) are described in Duan and Shrestha [2011]. In short, if defaulting firms had been assigned among the highest PD of all firms before they defaulted, then the model has discriminated well between safe and distressed firms. This leads to higher values of AR and AUROC. The range of possible AR values is in [0,1], where 0 is a completely random rating system and 1 is a perfect rating system. The range of possible AUROC values is in [0.5, 1]. AUROC and AR values are related by: AR = 2×AUROC - 1.

The AR and AUROC values for different horizons are available in Table B.1 of this technical report. Only economies with more than 20 defaults entering into the AR and AUROC computation are listed.

The AUROC values have been provided only for the purpose of comparison, if other rating systems report their results in terms of AUROC. The discussion will focus only on AR. The model is able to achieve strong AR results mostly greater than 0.80 at the one and six-month horizons for developed economies. There is a drop in AR at one and two-year horizons, but the AR are still mostly acceptable.

The AR in some emerging market economies such as China, India, Indonesia, and the Philippines are noticeably weaker than the results in the developed economies. This can be due to a number of issues. The quality of data is worse in emerging markets, in terms of availability and data errors. This may be due to lower reporting and auditing standards. Also, variable selection is likely to play a more important role in emerging markets. The variables were selected based on the predictive power in the US. Performing variable selections specific to the calibration group are expected to improve predictive accuracy, especially in emerging market economies. Finally, there could be structural differences in how defaults and bankruptcies occur in emerging market economies. If the judicial system is weak and there are no repercussions for default, firms may be less reluctant to default.

Aggregate defaults: The time series of aggregate predicted number of defaults and actual number of defaults in each calibration group are also available in Fig. B.3 to B.8. For India in particular, these figures show that there is room for improvement in the predictive power of the model.

5 Corporate Vulnerability Index

In July 2012, CRI launched the Corporate Vulnerability Index (CVI), which is a new suite of indices to produce bottom-up measures of credit risk in economies, regions and portfolios of special interest. The suite of CVIs is available in three distinctive types:

1. Value-weighted CVI (CVI_{vw}) RMI-CRI PDs are aggregated with each firm weighted by its market capitalization so that the size of each firm is taken into account.
2. Equally-weighted CVI (CVI_{ew}) RMI-CRI PDs are aggregated with each firm equally weighted. This captures the prevalence of credit risk by focusing on the number of firms at risk.
3. Tail CVI (CVI_{tail}) In taking the 5th percentile of the highest RMI-CRI PDs, the most vulnerable firms in a group are measured.

The CVIs are a set of indicators that gauge economic and financial environments in a new dimension. They are best viewed as stress indicators that reflect heightened credit risks in the corporate sector from three different angles.

Index Construction The primary inputs to the CVI are RMI-CRI 1-year PDs for individual exchange-listed firms.

- Value-weighted CVI (CVI_{vw}) CVI_{vw} is an aggregation of individual PDs weighted by each firm's market capitalization. In other words, at time t, given an interested group or portfolio G,

  $$\text{CVI}_{\text{vw}}(t) = \sum_{i=1}^{I} \omega_{it} p_i(t, 12),$$

  where $p_i(t, 12)$ is firm i's default probability within 12 months viewed from t, $i \in \{1, 2, ..I\}$. Also, the weight for firm i at time t is ω_{it}, and $\omega_{it} = \frac{MC_{it}}{\sum_{i=1}^{I} MC_{it}}$, in which, MC_{it} is firm i's market capitalization at time t. If a firm does not trade on a particular day, the market capitalization from the previous valid day (within 20 trading days) is used. The market-capitalization weighting is applied to all economies and groups of economies, but is not applied to portfolios such as the S&P 500 index. The S&P 500 index is a float-adjusted index where the shares available to investors are used instead of the total shares outstanding, and our weighting scheme of CVI_{vw}(SPP) is consistent with the S&P 500 index.

- Equally-weighted CVI (CVI_{ew}) The equally-weighted CVI is computed by aggregating each firm's PD with equal weights applied to each firm. In other words,

  $$\text{CVI}_{\text{ew}} = \frac{1}{I} \sum_{i=1}^{I} p_i(t, 12).$$

- Tail CVI (CVI_{tail}) The tail CVI provides a measure of the relatively more distressed firms in a group. It is the highest 5th percentile of PDs. The tail CVI can also be interpreted as the conditional median of the 10 percent tail, which is a more robust measure of "tail average" than the conditional mean of the 10 percent tail.

Inclusion of Firms A firm's PD is computed with the model parameters from its primary exchange. The construction of CVI, however, is based on the firm's country of domicile. In regions like the eurozone, some of the public holidays do not coincide. In this case, the aggregation is computed by using PDs from the previous trading day for firms that are listed in countries that have a public holiday, and PDs from the current trading day for firms that are listed in countries that do not have a public holiday. And firms are included in the eurozone CVI only if their countries of domicile are part of the eurozone at time t. For CVI of the S&P 500 portfolio, the constituents typically coincide with the constituents of the S&P 500 index for each point in time, and missing any PD value for a company in the S&P 500 is filled in with the most recently available PD.

6 Actuarial Spread

In July 2014, CRI launched a new credit risk measure, the Actuarial Spread (AS), which are the counterparts of market credit default swap (CDS) with contract horizons ranging from 1 year to 5 years but valued based on RMI-CRI's PDs in the forward horizons. Since then, the computation and publication of the AS have been implemented on a daily basis in addition to those of the PDs. Much like the par spread in a standard credit default swap (CDS) contract, the AS leverages the term structure of the physical PDs of the CRI and is essentially the premium rate that purely reflects the actuarial present value of a default protection. It provides a new metric of credit risk that the financial practitioners are more familiar with.

The construction of the AS relies on the features of a standard CDS contract. To fulfill a CDS contract, the protection buyer pays premiums on a regular basis to the seller until the contract matures or the reference entity defaults. In exchange, the protection buyer receives at the default time a contingent lump sum payment, the amount of which is based on the recovery rate on the reference instrument. Such a CDS contract terminates on its maturity date if there is no default up to its maturity; otherwise, it ceases on a default day, if any. Note that, if a default occurs during a payment period, the premium for the protection from the first accrual day to the default day is also assumed to be paid by the CDS buyer on the default day. Considering no effect from the market liquidity and using the physical PDs that CRI generates, the AS is calculated in a way that the expected present value of the contingent claim upon default is equal to the expected present value of the series of premiums up until the stop of a CDS contract. To familiarize the details of its theoretical formulation, please refer to Duan [2014]. As opposed to the continuous model introduced in Duan [2014], this technical report provides a discrete representation of the model for implementation purpose. For easy comparison, it adopts the same notations in the journal article as much as it possibly can.

A typical CDS contract adopts one day as the fundamental period of time. For this, we abbreviate the interval $((d-1)\cdot\Delta t,\, d\cdot\Delta t]$ in a forward time axis by the term day $d \in \mathbb{N}$ where $\Delta t = 1/365$ reflects the 365 day count convention. Consider t is the trading day of a CDS contract terminating on the day $T > t$. If the reference entity defaults at on a random day τ where $t+1 \le \tau \le T$, he will in return get a lump sum payment, which is 1 minus the recovery rate R_τ, from a unit-notional CDS and cease to make the scheduled payment beyond the default point. We assume the premiums are scheduled to be paid on the days $t_1, t_2, ..., t_k$ with $t_k = T$, where each payment period is roughly three months. Note that a payment day t_{i-1} is also the first day of the coming accrual period, which ends on the day before next payment day, denoted and defined by $t'_i = t_i - 1$. However, a trading day t may also occur after a payment day, say t_{i-1}, and we denote the exact start date of its remaining accrual period by $t_{i-1} \vee (t+1) = \max\{t_{i-1}, t+1\}$ for a general purpose.

Another actual/360 day count convention is usually adopted to define the length in year of an accrual period, for which we denote $A(s,q)$ the period length in year from the day s to the day $q > s$ (both inclusive). For example, if a quarterly accrual period from t_{i-1} to t'_i (both inclusive) has 91 days, then $A(t_{i-1}, t'_i) = 91/360$ is applicable.

Compared to the risk-neutral probability measure used in the CDS pricing, the AS is essentially its counterpart based on a physical probability measure P. We denote it by $S_t^{(a)}(T-t)$ with its days to maturity $(T-t)$. Following the assumption that there is no arbitrage for CDS buyer and seller, the AS is defined to satisfy the equation:

$$\begin{aligned} & E_t^p\left[(1-R_\tau)D_t\left(\tau-t\right)\cdot\mathbb{1}_{\left\{t<\tau\le t_k'\right\}}\right] \\ = \quad & S_t^{(a)}(T-t)\sum_{i=1}^{k}\Big\{ \qquad A(t_{i-1}\vee(t+1),t_i')\cdot E_t^p\left[D_t\left(t_i-t\right)\cdot\mathbb{1}_{\left\{t_i'<\tau\right\}}\right] \\ & \qquad +E_t^p\left[A(t_{i-1}\vee(t+1),\tau)\cdot D_t\left(\tau-t\right)\cdot\mathbb{1}_{\left\{t_{i-1}'<\tau\le t_i'\right\}}\right]\Big\}, \end{aligned}$$

where E_t^P is an expectation operator with respect to the physical probability measure P, τ refers to the random default day, $D_t(\tau-t)$ is the random money market discount factor starting from the day t to another day τ and k is the number of the CDS premium payments.

The real-time LIBOR rates up to one year and Swap rates beyond are generally available from the market. With the combination, one can bootstrap the implied LIBOR rates beyond one year. As the AS is calculated based on days, a linear interpolation is further performed to obtain the implied LIBOR rates up to each forward day (in continuously compounded annualized form), which then serve the role of the discount factor $D_t(\cdot)$. Let $r_t(s,q)$ be the day-t risk-free annualized forward discount rate between the day $t+s$ and the day $t+q$ (both inclusive) with $q\ge s\ge 1$. In particular, $r_t(1,q)$ refers to the day-t risk-free spot discount rate covering the days $t+1,\ldots,t+q$. The standard term structure theory implies that

$$r_t(1,q)=-\frac{1}{q}\ln\left(E_t^P\left[D_t(q)\right]\right).$$

Further we let $r_t(q,q)=r_t(1,q)\cdot q-r_t(1,q-1)\cdot(q-1)$ for $q\ge 2$, which refers to the day-t instantaneous forward rate for the day $t+q$. As will be seen later, defining $r_t(s,q)$ this way is to make it consistent with the definition of the forward default/other exit intensity in terms of the day count convention. With the RMI-CRI PDs serving as the physical probability measure P and the use of a standard recovery rate of $\bar{R}_t=40\%$, the AS is rewritten as

$$S_t^{(a)}(T-t)= \frac{(1-\bar{R}_t)\cdot E_t^p\left[e^{-r_t(1,\tau-t)(\tau-t)/365}\cdot\mathbb{1}_{\left\{t<\tau\le t_k'\right\}}\right]}{\sum_{i=1}^{k}\left\{A(t_{i-1}\vee(t+1),t_i')\cdot e^{-r_t(1,t_i-t)(t_i-t)/365}\cdot E_t^p\left[\mathbb{1}_{\left\{t_i'<\tau\right\}}\right]\ +\ E_t^p\left[A(t_{i-1}\vee(t+1),\tau)\right]\cdot e^{-r_t(1,\tau-t)(\tau-t)/365}\cdot\mathbb{1}_{\left\{t_{i-1}'<\tau\le t_i'\right\}}\right\}}, \tag{42}$$

where the actual/365 day count convention is used for the discount factor and integration.

To obtain the physical probability of defaults and their term structures, we apply CRI's forward intensity model. Define $f_t(u)$ to be the day-t forward default intensity over the day $t+u$, which will be used to calculate the probability of default of a firm conditioning on its survival up to the day $t+(u-1)$. The forward intensity for other exits, or $h_t(u)$, can be similarly defined. These two intensities are expressed as exponential linear functions of 13 covariates, including an intercept term, 2 macroeconomic variables and 10 firm-specific variables, in the form of

$$f_t(u)=\exp\{\alpha_0(u)+\alpha_1(u)x_{1,t}+\ldots+\alpha_{12}(u)x_{12,t}\},$$

and

$$h_t(u)=\exp\{\beta_0(u)+\beta_1(u)x_{1,t}+\ldots+\beta_{12}(u)x_{12,t}\}.$$

The coefficients $\alpha_i(u)$ and $\beta_i(u)$ are functions of forward starting time, which are further modelled by Nelson-Siegel term structure functions, such as

$$\alpha_i(u;\varrho_{i,0},\varrho_{i,1},\varrho_{i,2},d_i)=\varrho_{i,0}+\varrho_{i,1}\frac{1-\exp(-u\Delta t/d_i)}{u\Delta t/d_i}+\varrho_{i,2}\left[\frac{1-\exp(-u\Delta t/d_i)}{u\Delta t/d_i}-\exp(-u\Delta t/d_i)\right], \tag{43}$$

for $i = 0, 1, 2, \ldots, 12$. Recall that, except for the intercept terms $\alpha_0(u)$ and $\beta_0(u)$, the other covariates are stochastic and their long-term levels are restricted to zeros; namely, $\varrho_{i,0} = 0$ for $i = 1, 2, \ldots, 12$. With $f_t(u)$ and $h_t(u)$ in place, we are ready to define $\psi_t(s,q) = \frac{\sum_{u=s}^{q}[f_t(u)+h_t(u)]}{q-(s-1)}$, for $q \geq s \geq 1$, which is a standardized forward termination intensity covering the days $t+s, \ldots, t+q$.

One important feature of the CDS is that when the reference entity ceases to exist due to reasons other than default, such as mergers and acquisitions, the CDS protection is typically shifted to the merged or acquiring entity. Naturally, we should take into account the fact that the successor entity will then face subsequent default or other exits. There indeed are a number of ways to model the relationship between the termination probability of the reference entity and the successor entity (see [Duan, 2014]). In CRI's implementation, we further assume that the successor has the forward default and other exit intensities identical to those of the original reference entity.

Let $P_t(s, q; r_t(1,u), s \leq u \leq q)$ denote the day-t discounted forward probability of the reference entity of the CDS being terminated, including successions, over the days $t+s, \ldots, t+q$. Under the assumptions above, Duan [2014] has derived its analytical solution, which can be re-written in the discrete form below

$$P_t(s, q; r_t(1,v), s \leq v \leq q) = \sum_{v=s}^{q} e^{-\sum_{u=s}^{v}[r_t(u,u)+f_t(u)]\Delta t} f_t(v)\Delta t. \tag{44}$$

By temporarily setting the forward interest rate to 0 in Eq. (44), the first term of denominator in Eq. (42) can be presented in the form of

$$E_t^P(1_{\{t_i' < \tau\}}) = 1 - P_t(1, t_i' - t; r_t(1,u) = 0 \text{ for } 1 \leq u \leq t_i' - t). \tag{45}$$

The solutions to the two remaining two terms of Eq. (42) can be expressed as

$$\begin{aligned}
& E_t^p \left[e^{-r_t(1,\tau-t)(\tau-t)/365} \cdot \mathbb{1}_{\left\{t<\tau\leq t_k'\right\}} \right] \\
= \quad & \sum_{q=1}^{t_k'-t} e^{-[r_t(1,q)+\psi_t(1,q)]\cdot(q/365)} \cdot f_t(q) \cdot \Delta t \\
+ \quad & \sum_{q=1}^{t_k'-t} e^{-[r_t(1,q)+\psi_t(1,q)]\cdot(q/365)} \cdot h_t(q) \cdot P_t(q, t_k' - t; r_t(1,v), q \leq v \leq t_k' - t) \cdot \Delta t
\end{aligned}$$

and

$$
\begin{aligned}
& E_t^p\left[A(t_{i-1} \vee (t+1), \tau)\right] \cdot e^{-r_t(1,\tau-t)(\tau-t)/365} \cdot \mathbb{1}_{\{t'_{i-1}<\tau\le t'_i\}} \\
= \quad & \sum_{q=t_{i-1}\vee(t+1)}^{t'_i} A(t_{i-1} \vee (t+1), q) \cdot e^{-[r_t(1,q-t)+\psi_t(1,q-t)]\cdot(q-t)/365} \cdot f_t(q-t) \cdot \Delta t \\
+ \quad & \sum_{q=t_{i-1}\vee(t+1)}^{t'_i} A(t_{i-1} \vee (t+1), q) \cdot e^{-[r_t(1,q-t)+\psi_t(1,q-t)]\cdot(q-t)/365} \cdot h_t(q-t) \\
& \qquad \cdot P_t(q-t, t'_i - t; r_t(1,v), q-t \le v \le t'_i - t) \cdot \Delta t
\end{aligned}
$$

With the formulas mentioned above, we compute the AS, or $S_t^{(a)}(T-t)$, and provide it to the public on a daily basis.

7 Ongoing Developments

The CRI can develop a number of directions. We now comment on obvious ones that in our view are likely to bring meaningful and measurable benefits. Besides modifications to the current modeling framework of the forward intensity, a change in modeling platform will be undertaken if another model proves more promising in terms of accuracy and robustness of results. For this type of development, we also rely on the collective efforts by the worldwide credit research community to challenge and improve the existing modeling platform.

Within the current modeling framework, future developments involve, for example, the CRI plans to implement DTD estimations by a novel density-tempered expanding-data sequential Monte Carlo method. Another challenging example includes variable and structural–break selections where Artificial Intelligence automatically identifies time window, crucial risk factors, and breakpoints regarding defaults in a way that we would consider "smart". Also, we are designing a more comprehensive treatment scheme to handle missing data.

Finally, a series of new applications and tools using the RMI-CRI PDs as an input are currently being developed. More specifically, the CRI is actively working with users and exploring different possibilities of taking advantage of the world-class research infrastructure at the institute to propagate real world applications in credit rating and testing. The CRI has developed a tool for stress testing the financial stability for economies around the world. The CRI has also developed a methodology to address default correlations within a portfolio. The CRI remains committed to making its vast resources available for academic research.

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Acknowledgements

The RMI Credit Research Initiative is premised on the concept of credit ratings as a "public good". Being a non-profit undertaking allows a high level of transparency and collaboration that other commercial credit rating systems cannot replicate. The research and support infrastructure is in place and researchers from around the world are invited to contribute to this initiative. Any methodological improvements that researchers develop will be incorporated into the CRI system. In essence, the initiative operates as a "selective wikipedia" where many can contribute but implementation control is retained.

If you have feedback on this technical report or wish to work with us in this endeavor, please contact us at rmicri@nus.edu.sg.

A APPENDIX: DATA

Table A.1: All countries under the CRI coverage

Region	Economy
Asia Pacific (Developed) (7)	Australia, Hong Kong, Japan, New Zealand, Singapore, South Korea, Taiwan.
Asia Pacific (Emerging) (15)	Bangladesh, Cambodia, China, India, Indonesia, Kazakhstan, Macau, Malaysia, Mongolia, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand, Vietnam.
North America (4)	Bermuda, Canada, Greenland, United States.
Western Europe (28)	Austria, Belgium, Cyprus, Denmark, Faeroe Islands, Finland, France, Germany, Gibraltar, Greece, Guernsey, Iceland, Ireland, Italy, Isle of Man, Jersey, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, Reunion, Spain, Sweden, Switzerland, United Kingdom.
Eastern Europe (20)	Azerbaijan, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Latvia, Lithuania, Macedonia, Montenegro, Poland, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Turkey, Ukraine.
Latin America & Caribbean (19)	Argentina, Bahamas, Belize, Brazil, British Virgin Islands, Cayman Islands, Chile, Colombia, Curacao, Dominican Republic, Falkland Islands, Jamaica, Mexico, Peru, Panama, Puerto Rico, Uruguay, U.S. Virgin Islands, Venezuela.
Middle East & Africa (28)	Angola, Bahrain, Cameroon, Egypt, Gabon, Ghana, Iraq, Israel, Jordan, Kuwait, Madagascar, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Niger Republic, Oman, Qatar, Saudi Arabia, Sierra Leone, South Africa, Sudan, Tanzania, Togo, Tunisia, United Arab Emirates, Zambia.

Table A.2: The 78 countries under the CRI coverage for which we cover companies listed on the exchange.

Region	Economy
Asia Pacific (Developed) (7)	Australia, Hong Kong, Japan, New Zealand, Singapore, South Korea, Taiwan.
Asia Pacific (Emerging) (11)	Bangladesh, China, India, Indonesia, Kazakhstan, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam.
North America (2)	Canada, United States.
Western Europe (20)	Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.
Eastern Europe (18)	Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Montenegro, Poland, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Turkey, Ukraine.
Latin America & Caribbean (8)	Argentina, Brazil, Colombia, Chile, Jamaica, Mexico, Peru, Venezuela.
Middle East & Africa (12)	Bahrain, Egypt, Israel, Jordan, Kuwait, Morocco, Nigeria, Oman, Saudi Arabia, South Africa, Tunisia, United Arab Emirates.

Table A.3: The 43 countries under the CRI coverage for which we cover companies domiciled in the economy but listed on a foreign exchange included in Table A.2. The gray boxes indicate that these economies also have their own local stock exchange.

Angola	Georgia	Namibia	Uruguay
Azerbaijan	Gibraltar	Niger Republic	
Bahamas	Greenland	Panama	
Belize	Guernsey	Papua New Guinea	
Bermuda	Iraq	Puerto Rico	
British Virgin Islands	Isle of Man	Qatar	
Cambodia	Jersey	Republic of Ghana	
Cameroon	Liechtenstein	Republic of Zambia	
Cayman Islands	Macau	Reunion	
Curacao	Madagascar	Sierra Leone	
Dominican Republic	Mauritius	Sudan	
Faeroe Islands	Monaco	Tanzania	
Falkland Islands	Mongolia	Togolese Republic	
Gabon	Mozambique	United States Virgin Islands	

Table A.4: The ISO codes of 78 economies covered by the CRI and the corresponding calibration groups and stock exchanges.

ISO Code	Economy	Calibration Group	Stock Exchange
ARE	United Arab Emirates	Emerging	Abu Dhabi Securities Exchange
			Dubai Financial Market
			National Association of Securities Dealers
ARG	Argentina	Emerging	Buenos Aires Stock Exchange
AUS	Australia	Developed Asia-Pacific	Australian Securities Exchange
			National Stock Exchange of Australia
			SIM Venture Securities Exchange
AUT	Austria	Europe	Vienna Stock Exchange
BEL	Belgium	Europe	Brussels Stock Exchange
BGD	Bangladesh	Emerging	Dhaka Stock Exchange
BGR	Bulgaria	Europe	Bulgarian Stock Exchange
BHR	Bahrain	Emerging	Bahrain Stock Exchange
BIH	Bosnia and Herzegovina	Europe	Banja Luka Stock Exchange
			Sarajevo Stock Exchange
BRA	Brazil	Emerging	BM&FBOVESPA
CAN	Canada	North America	Canadian Securities Exchange
			TSX Venture Exchange
			Toronto Stock Exchange
CHE	Switzerland	Europe	Berne Stock Exchange
			Six Swiss Exchange
CHL	Chile	Emerging	Santiago Stock Exchange
CHN	China	China	Shanghai Stock Exchange
			Shenzhen Stock Exchange
COL	Colombia	Emerging	Colombia Stock Exchange
CYP	Cyprus	Europe	Cyprus Stock Exchange
CZE	Czech Republic	Europe	Prague Stock Exchange
DEU	Germany	Europe	Berlin Stock Exchange
			BOAG Borsen AG
			Dusseldorf Stock Exchange
			Frankfurt Stock Exchange
			Munich Stock Exchange
			Stuttgart Stock Exchange
DNK	Denmark	Europe	Copenhagen Stock Exchange
			First North Denmark
EGY	Egypt	Emerging	Egyptian Exchange
			Nile Stock Exchange
ESP	Spain	Europe	Barcelona Stock Exchange
			Madrid Stock Exchange
EST	Estonia	Europe	Tallinn Stock Exchange
FIN	Finland	Europe	Helsinki Stock Exchange
			NASDAQ OMX NORDIC
FRA	France	Europe	Euronext Paris
GBR	United Kingdom	Europe	Icap Securities and Derivatives Exchange
			London International Financial Futures and Options Exchange
			London Stock Exchange

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Table A.4 – *Continued from previous page*

ISO Code	Economy	Calibration Group	Stock Exchange
			Professional Liability Underwriting Society Market Group
GRC	Greece	Europe	Alternative Market of Athens Exchange
			Athens Stock Exchange
HKG	Hong Kong	Developed Asia-Pacific	Hong Kong Exchanges and Clearing Limited
HRV	Croatia	Europe	Zagreb Stock Exchange
HUN	Hungary	Europe	Budapest Stock Exchange
IDN	Indonesia	Emerging	Indonesian Stock Exchange
IND	India	India	Bombay Stock Exchange
			MCX Stock Exchange Limited
			National Stock Exchange of India Limited
IRL	Ireland	Europe	Irish Stock Exchange
ISL	Iceland	Europe	Iceland Stock Exchange
ISR	Israel	Europe	Tel Aviv Stock Exchange
ITA	Italy	Europe	Borsa Italiana S.p.A
			Hi-Multilateral Trading Facilities Sim S.p.A
JAM	Jamaica	Emerging	Jamaica Stock Exchange
JOR	Jordan	Emerging	Amman Stock Exchange
JPN	Japan	Developed Asia-Pacific	Fukuoka Stock Exchange
			JASDAQ Securities Exchange
			Nagoya Stock Exchange
			Osaka Securities Exchange
			Sapporo Stock Exchange
			Tokyo Stock Exchange
KAZ	Kazakhstan	Emerging	Kazakhstan Stock Exchange JSC
KOR	South Korea	Developed Asia-Pacific	Korea New Exchange
			Korea Stock Exchange
			Korean Securities Dealers Automated Quotations
KWT	Kuwait	Emerging	Kuwait Stock Exchange
LKA	Sri Lanka	Emerging	Colombo Stock Exchange
LTU	Lithuania	Europe	OMX Vilnius Stock Exchange
LUX	Luxembourg	Europe	Luxembourg Stock Exchange
LVA	Latvia	Europe	OMX Riga Stock Exchange
MAR	Morocco	Emerging	Casablanca Stock Exchange
MEX	Mexico	Emerging	Mexican Stock Exchange
MKD	Macedonia	Europe	Macedonian Stock Exchange Inc.
MLT	Malta	Europe	Malta Stock Exchange
MNE	Montenegro	Europe	Montenegro Stock Exchange
MYS	Malaysia	Emerging	Kuala Lumpur Stock Exchange
NGA	Nigeria	Emerging	Nigerian Stock Exchange
NLD	Netherlands	Europe	Euronext Amsterdam Stock Exchange
NOR	Norway	Europe	Oslo Stock Exchange
NZL	New Zealand	Developed Asia-Pacific	New Zealand Exchange
OMN	Oman	Emerging	Muscat Securities Market
PAK	Pakistan	Emerging	Karachi Stock Exchange
			Pakistan Stock Exchange

Continued on next page

Table A.4 – *Continued from previous page*

ISO Code	Economy	Calibration Group	Stock Exchange
PER	Peru	Emerging	Lima Stock Exchange
PHL	Philippines	Emerging	Philippine Stock Exchange
POL	Poland	Europe	Warsaw Stock Exchange
PRT	Portugal	Europe	Euronext Lisbon Stock Exchange
ROM	Romania	Europe	Bucharest Stock Exchange
			Sibiu Stock Exchange
RUS	Russian Federation	Europe	Moscow Exchange
			Moscow Interbank Currency Exchange
			Russian Trading System
SAU	Saudi Arabia	Emerging	Saudi Stock Exchange
SGP	Singapore	Developed Asia-Pacific	Singapore Exchange
SRB	Serbia	Europe	Belgrade Stock Exchange
SVK	Slovakia	Europe	Bratislava Stock Exchange
SVN	Slovenia	Europe	Ljubljana Stock Exchange
SWE	Sweden	Europe	AktieTorget Stock Exchange
			First North Stockholm
			Nordic Growth Market
			Stockholm Stock Exchange
THA	Thailand	Emerging	Stock Exchange of Thailand
TUN	Tunisia	Emerging	Tunis Stock Exchange
TUR	Turkey	Europe	Istanbul Stock Exchange
TWN	Taiwan	Developed Asia-Pacific	Taiwan Stock Exchange
UKR	Ukraine	Europe	First Stock Trading System
			Russian Trading System Ukraine
USA	United States	North America	NASDAQ Capital Market
			NASDAQ Global Market
			NASDAQ Global Select Market
			New York Stock Exchange
			NYSE Arca
			NYSE MKT LLC
			Bats Stock Exchange
VEN	Venezuela	Emerging	Caracas Stock Exchange
VNM	Vietnam	Emerging	Hanoi Stock Exchange
			Ho Chi Minh City Stock Exchange
ZAF	South Africa	Emerging	Johannesburg Stock Exchange

The stock exchanges covered by the CRI database are collected from Bloomberg system and labeled as primary exchange.

Table A.5: The stock indices used for each economy in computing the first common variable.

Economy	Stock Index	Period Used*
ARE	FTSE NASDAQ DUB UAE 20	06/28/2006 - Present
ARG	Buenos Aires Stock Exchange Merval Index	
AUS	All Ordinaries Index	
AUT	Austrian Traded ATX Index	
BEL	Belgian Stk Mkt Ret Index	
BGD	DSEX Index	01/28/2013 - Present
	Dhaka Stock Exchange General I	- 01/27/2013
BGR	Bulgaria Stock Exchange Sofix Index	10/24/2000 - Present
BHR	BB All Share Index	07/08/2004 - Present
BIH	SASE Free Market 10 Index	12/31/2004 - Present
BRA	Brazil Bovespa Stock Index	
CAN	S&PTSX Composite Index	
CHE	SPI Swiss Performance Index	
CHL	Santiago Stock Exchange IPSA Index	
CHN	Shanghai SE Composite Index	12/19/1990 - Present
COL	FTSE All World Series Colombia Local	01/01/1999 - Present
CYP	Cyprus Stock Exchange General Index	09/03/2004 - Present
	Cyprus Stock Exchange General	04/02/1996 - 09/02/2004
CZE	Prague Stock Exchange Index	04/05/1994 - Present
DEU	CDAX Performance Index	
DNK	OMX Copenhagen 20 Index	
EGY	EGX 100 Index	05/01/2006 - Present
ESP	IBEX 35 Index	
EST	OMX Tallinn OMXT	06/03/1996 - Present
FIN	OMX Helsinki Index	
FRA	CAC 40 Index	
GBR	FTSE 100 Index	
GRC	Athex Composite Share Price Index	
HKG	Hang Seng Index	
HRV	Croatia Zagreb CROBEX	06/14/2002 - Present
HUN	Budapest Stock Exchange Index	01/02/1991 - Present
IDN	Jakarta Composite Index	
IND	BSE Sensex 30 Index	
IRL	ISEQ Overall Index	
ISL	OMX Iceland All-Share PR	12/31/1992 - Present
ISR	Tel Aviv 100 Index	12/31/1991 - Present
ITA	Italy Stock Market BCI Comit Globale	
JAM	Jamaica Stock Exchange Market Index	
JOR	MSCI Jordan Index	
JPN	Nikkei 500	
KAZ	Kazakhstan Stock Exchange Index KASE	07/12/2000 - Present
KOR	KOSPI Index	
KWT	Kuwait SE Weighted Index	01/02/2012 - Present
	Kuwait Global General Index	- 01/01/2012
LKA	Sri Lanka Colombo Stock Exchange All-Share Index	
LTU	OMX Vilnius OMXV	01/04/2000 - Present
LUX	Luxembourg Stock Exchange Luxx Index	01/04/1999 - 01/04/1999
	Luxembourg Stock Exchange 13 'Dead'	01/02/1998 - 01/03/1999
LVA	OMX Riga OMXR	01/03/2000 - Present
MAR	MASI Free Float All Shares Index	03/31/1995 - Present

Continued on next page

Table A.5 – *Continued from previous page*

Economy	Stock Index	Period Used*
	CFG 25 CFG 25	12/31/1993 - 03/30/1995
MEX	Mexico Bolsa Index	01/19/1994 - Present
MKD	Macedonian Stock Exchange MBI 10	12/30/2004 - Present
MLT	Malta Stock Exchange	12/27/1995 - Present
MNE	Montenegro Stock Exchange Index	01/04/2015 - Present
	Montenegro Stock Exchange 20	03/03/2003 - 03/31/2015
MYS	FTSE Bursa Malaysia KLCI	
NGA	Nigeria Stock Exchange All Share	01/30/1998 - Present
NLD	AEX-Index	
NOR	OBX Price Index	
NZL	NZX All Index	03/30/1992 - Present
OMN	MSM30 Index	03/31/1992 - Present
PAK	Karachi All Share Index	03/11/1998 - Present
PER	S&PBVL Peru General Index TR PEN	01/05/2015 - Present
	Bolsa de Valores de Lima General Sector Index	01/02/1990 - 04/30/2015
PHL	Philippine Stock Exchange Index	
POL	WSE WIG Index	04/16/1991 - Present
PRT	PSI General Index	
ROM	Bucharest BET Plus Index	06/23/2014 - Present
	BSE Composite Index	04/17/1998 - 06/22/2014
RUS	MICEX Index	09/22/1997 - Present
SAU	Tadawul All Share Index	01/31/1994 - Present
SGP	Straits Times Index	1/10/2008 - Present
	Straits Times Old Index	01/04/1985 - 01/09/2008
SRB	BELEXline Index	10/01/2004 - Present
SVK	Slovak Share Index	09/14/1993 - Present
SVN	HSBC Slovenia Dollar	12/29/1995 - Present
SWE	OMX Stockholm All-Share	
THA	Stock Exchange Of Thai Index	
TUN	Tunis SE TUNINDEX	04/30/1999 - Present
TUR	Istanbul Stock Exchange National 100 Index	
TWN	Taiwan Stock Exchange Weighted Index	
UKR	Ukraine PFTS Index	01/12/1998 - Present
USA	S&P 500 Index	
VEN	Caracas Stock Exchange Stock Market Index	12/30/1993 - Present
VNM	Ho Chi Minh Stock Index	07/28/2000 - Present
ZAF	MSCI South Africa Index	12/31/1992 - Present

* A blank Period Used column indicates that there is only a single index that is used throughout the whole period.

Table A.6: The interest rates used for each economy as the second common variable.

Economy	Short-Term Interest Rate	Period Used*
ARE	UAE Ibor 3 Month	05/15/2000 - Present
ARG	Argentina Deposit Tate 90 Day	04/01/1991 - Present
AUS	Australia Dealer Bill 90 Day	
AUT	Germany 3 Month Bubill	01/01/1999 - Present
	-	- 12/31/1998
BEL	Germany 3 Month Bubill	01/01/1999 - Present
	-	- 12/31/1998
BGD	Bangladesh 3 Month Bill Auction Cut Off Yield	
BGR	Bulgaria Interbank 3 Month	02/17/2003 - Present
BHR	Bahrain Ibor 3 Month	12/14/2006 - Present
BIH	-	
BRA	Andima Brazil Govt Bond Fixed Rate 3 Months	04/03/2000 - Present
	Brazil CDB (Up To 30 Days)	10/10/1994 - 04/02/2000
CAN	Canada Treasury Bill 3 Month	01/02/1990 - Present
CHE	Swiss Interbank 3m (ZRC:SNB)	
CHL	Chile TAB UF Interbank Rate 90 Days	11/02/1992 - Present
CHN	China Time Deposit Rate, 3 Month	05/17/1993 - Present
COL	Colombia CD Rate 90-Day	
CYP	Germany 3 Month Bubill	01/01/2008 - Present
	-	- 12/31/2007
CZE	Czech Republic Interbank 3 Month	04/22/1992 - Present
DEU	Germany 3 Month Bubill	05/25/1993 - Present
	Germany Interbank 3 Month	01/02/1986 - 05/24/1993
DNK	Denmark Interbank 3 Month	
EGY	Egypt 91 Day T-Bill	07/06/2004 - Present
ESP	Germany 3 Month Bubill	01/01/1999 - Present
	-	- 12/31/1998
EST	Germany 3 Month Bubill	01/01/2011 - Present
	-	- 12/31/2010
FIN	Germany 3 Month Bubill	01/01/1999 - Present
	-	- 12/31/1998
FRA	Germany 3 Month Bubill	01/01/1999 - Present
	-	- 12/31/1998
GBR	UK Treasury Bill Tender 3 Month	01/04/1995 - Present
GRC	Germany 3 Month Bubill	01/01/2001 - Present
	-	- 12/31/2000
HKG	Hong Kong Exchange Fund Bill 3 Month	06/10/1991 - Present
HRV	Croatia Zibor Rate 3 Month	06/02/1997 - Present
HUN	Hungary Interbank 3 Month	09/07/1995 - Present
IDN	Indonesia Interbank 3 Months	07/10/2003 - Present
	Indonesia SBI/DISC 90 Day'dead'	- 07/09/2003
IND	India Treasury Bill 3 Month	05/20/2013 - Present
	India T-Bill Secondary 91 Day	01/15/1993 - 05/19/2013
IRL	Germany 3 Month Bubill	01/01/1999 - Present
	-	- 12/31/1998
ISL	Iceland Interbank 3 - Month	08/04/1998 - Present
	Iceland 90 - Day Cb Notes	- 08/03/1998
ISR	Israel T-Bill Secondary 3 Mnth	05/30/1995 - Present
ITA	Germany 3 Month Bubill	01/01/1999 - Present
	-	- 12/31/1998

Continued on next page

Table A.6 – *Continued from previous page*

Economy	Short-Term Interest Rate	Period Used*
JAM	Jamaica 3 Months Repo Rate	07/17/2008 - Present
JOR	Jordanian Dinar Interbank Offered Rate 3 Months	09/20/2006 - Present
	Jordan Re-discount rate	03/12/2001 - 09/19/2006
JPN	Japan Treasury Discount Bills 3 Month	07/10/1992 - Present
	Japan Government Bond Interest Rate - 1 Year	- 07/09/1992
KAZ	Kazakhstan KIBOR/KIBID 90 Days Interbank	09/29/2001 - Present
KOR	Korea Commercial Paper 91d	06/14/1993 - Present
KWT	Kuwait Interbank 3 Month	
LKA	Sri Lanka Treasury Bill 3 Month	
LTU	Germany 3 Month Bubill	01/01/2015 - Present
	-	- 12/31/2014
LUX	Germany 3 Month Bubill	01/01/1999 - Present
	-	- 12/31/1998
LVA	Germany 3 Month Bubill	01/01/2014 - Present
	-	- 12/31/2013
MAR	Morocco Deposit Rate 3 Month	06/06/2003 - Present
MEX	Mexico Cetes 2nd Mkt. 90 Day	06/26/1996 - Present
	Mexico CETES 91 Day Avg.Ret.At Auc.	- 06/25/1996
MKD	Macedonia Skibor 3 Months	07/02/2007 - Present
MLT	Germany 3 Month Bubill	01/01/2008 - Present
	-	- 12/31/2007
MNE	-	
MYS	Malaysia Deposit 3 Month	
NGA	Nigeria Interbank Offered Rate 3 Month	01/30/2004 - Present
NLD	Germany 3 Month Bubill	01/01/1999 - Present
	-	- 12/31/1998
NOR	Norway Govt Treasury Bills 3 Month	06/27/1995 - Present
	Norway Interbank 3 Month (Effective)	- 06/26/1995
NZL	-	
OMN	OMR 3 Month Deposit	07/16/2002 - Present
PAK	PKR 3 Month Repo	10/29/1999 - Present
PER	Peru Savings Rate	07/01/1991 - Present
PHL	Philippine Treasury Bill 91d	
POL	Poland Interbank 3 Month (EOD)	06/04/1993 - Present
PRT	Germany 3 Month Bubill	01/01/1999 - Present
	-	- 12/31/1998
ROM	Romanian Interbank 3 Month	08/01/1995 - Present
RUS	MosPime 3 Months Rate	04/18/2005 - Present
	Russia Moscow Interbank Non Co	08/14/2000 - 04/17/2005
	Russia Interbank 31 To 90 Day	09/01/1994 - 08/13/2000
SAU	Saudi Interbank 3 Month	
SGP	Monetary Authority of Singapore Benchmark Govt Bill Yield 3 Month	09/20/2013 - Present
	Singapore T-Bill 3 Month	- 09/19/2013
SRB	National Bank of Serbia Belibor 3M Rate (Interbank Rate)	01/28/2005 - Present
SVK	Germany 3 Month Bubill	01/01/2009 - Present
	-	- 12/31/2008
SVN	Germany 3 Month Bubill	01/01/2007 - Present
	-	- 12/31/2006
SWE	Sweden T Bill 3 Month	05/25/1993 - Present
	Sweden Treasury Bill 90 Day	- 05/24/1993
THA	Thailand Bibor Fixings 3 Month	05/30/2002 - Present

Continued on next page

Table A.6 – *Continued from previous page*

Economy	Short-Term Interest Rate	Period Used*
	Thailand Repo 3 Month (BOT)'Dead'	03/11/1994 - 05/29/2002
TUN	Tu Policy Rates: TMM (Avg.)	12/15/1994 - Present
TUR	Turkish Interbank 3 Month	08/01/2002 - Present
TWN	Taiwan Money Market 90 Day	
UKR	Ukraine Interbank 3 Months	03/01/2001 - Present
USA	US Generic Govt 3 Month Yield	
VEN	Venezuela 90 Day Deposit Rate	01/10/1997 - Present
	Venezuela Overnight	11/28/1994 - 01/09/1997
VNM	Vietnam Interbank 3 Month	12/11/1998 - Present
ZAF	SA T-Bill 91 Days (Tender Rates)	

* A blank Period Used column indicates that there is only a single interest rate that is used throughout the whole period.

Table A.7: The interest rates used for each economy in the DTD calculation.

Economy	Interest Rate Name	Period Used*
ARE	UAE IBOR 1 Year	05/15/2000 - Present
ARG	Argentina Deposit 90 Day (PA.)	04/01/1991 - Present
AUS	Australia Govt Bonds Generic Mid Yield 1 Year	
AUT	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Austria VIBOR 12 Month	06/10/1991 - 12/31/1998
BEL	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Belgium Treasury Bill 1 Year	04/02/1991 - 12/31/1998
BGD	Bangladesh 12 Month Bill Auction Cut Off Yield	
BGR	Bulgaria Interbank 3 Month	02/17/2003 - Present
BHR	Bahrain IBOR 1 Year	12/14/2006 - Present
BIH	BP Real Interest Rate (%) NADJ	06/30/1998 - Present
BRA	Andima Brazil Govt Bond Fixed Rate 1 Year	04/03/2000 - Present
	Brazil CDB (Up To 30 Days)	10/10/1994 - 04/02/2000
CAN	Canada Treasury Bill 1 Year	01/02/1990 - Present
CHE	Swiss Interbank 1 Year (ZRC:SNB)	
CHL	Chile Tab UF Interbank Rates 360 Days	08/01/1996 - Present
	Chile Tab UF Interbank Rate 90 Days	11/02/1992 - 07/31/1996
CHN	China Household Savings Deposits 1 Year Rate	01/02/1992 - Present
COL	Colombia Government Generic Bond 1 Year Yield	01/03/2001 - Present
	Colombia CD Rate 360-Day	07/12/1993 - 01/02/2001
CYP	German Government Bonds 1 Year BKO	01/01/2008 - Present
	Cyprus, Treasury Bill Rate - 13 Week	01/15/1993 - 12/31/2007
CZE	Czech Republic Interbank 3 Month	04/22/1992 - Present
DEU	German Government Bonds 1 Year BKO	01/10/1995 - Present
	Germany Interbank 12 Month	11/02/1990 - 01/09/1995
DNK	Denmark Government Bonds 1 Year Note Generic Bid Yield	06/19/2008 - Present
	Denmark Euro-Krone 1 Year (FT/ICAP/TR)	06/14/1985 - 06/18/2008
EGY	Egypt 364 Day T-Bill	07/06/2004 - Present
ESP	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Spain 12 Month Treasury Bill Yield	11/30/1992 - 12/31/1998
	Spain Interbank 12 Month	12/19/1991 - 11/29/1992
EST	German Government Bonds 1 Year BKO	01/01/2011 - Present
	Estonia, Interest Rates, Prices, Production, & LABOUR, Interest Rates, Deposit Rate	02/15/1993 - 12/31/2010
FIN	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Finland Interbank Close 12 Month	04/02/1992 - 12/31/1998
FRA	German Government Bonds 1 Year BKO	01/01/1999 - Present
	France Treasury Bill 1 Year Intraday	- 12/31/1998
GBR	UK Govt Bonds 1 Year Note Gene	09/12/2001 - Present
	UK Govt. Liab. Nom. Spot Curve 12 Month	- 09/11/2001
GRC	German Government Bonds 1 Year BKO	01/01/2001 - Present
	Greece Treasury Bill 1 Year	01/02/1990 - 12/31/2000
HKG	HKMA Hong Kong Exchange Fund Bills 12 Month	10/28/1991 - Present
HRV	Croatia ZIBOR Rate 3 Month	06/02/1997 - Present
HUN	Hungary Central Bank Base Rate	10/15/1990 - Present
IDN	INDONESIA SBI 90 DAY	07/10/2003 - Present
	INDONESIA SBI/DISC 90 DAY'DEAD'	01/01/1985 - 07/09/2003
IND	India Treasury Bill 1 Year	05/20/2013 - Present
	INDIA T-BILL SECONDARY 1 YEAR	01/01/1993 - 05/19/2013
IRL	German Government Bonds 1 Year BKO	01/01/1999 - Present

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Table A.7 – *Continued from previous page*

Economy	Interest Rate Name	Period Used*
	Dublin Interbank Offered Rates	04/10/1991 - 12/31/1998
ISL	Iceland Interbank 12 - Month	02/01/2000 - Present
	Iceland Interbank 3 - Month	08/04/1998 - 01/31/2000
	Iceland 90 - Day CD Notes	- 08/03/1998
ISR	Israel T-Bill Secondary 1 Year	11/15/1994 - Present
ITA	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Italy Bots Treasury Bill 12 Month Gross Yields	09/05/1994 - 12/31/1998
	Italy T-Bill Auct. Gross 12 Month	- 09/04/1994
JAM	Jamaica 12 Months Repo Rate	07/17/2008 - Present
JOR	Jordan Re-Discount Rate	03/12/2001 - Present
JPN	Japan Treasury Bills 12 Month	12/14/1999 - Present
KAZ	Kazakhstan KIBOR/KIBID 90 Days Interbank	09/29/2001 - Present
KOR	Korea Monetary Stab. Bonds 1 Year	01/03/1992 - Present
KWT	Kuwait Interbank 1 Year	
LKA	Sri Lanka Fixed Deposit 1 Year	
LTU	German Government Bonds 1 Year BKO	01/01/2015 - Present
	Vilnius Interbank 12 Month	03/29/2000 - 12/31/2014
LUX	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Long Term Government Bond Yields - Maastricht Definition (Avg.)	- 12/31/1998
LVA	German Government Bonds 1 Year BKO	01/01/2014 - Present
	Treasury Bill Rate 1 Year	04/03/1996 - 12/31/2013
MAR	Morocco Deposit Rate 1 Year	06/06/2003 - Present
MEX	Mexico Cetes 2nd Mkt. 360 Day	06/26/1996 - Present
	Mexico Cetes 91 Day Avg.Ret.At Auc.	- 06/25/1996
MKD	Macedonia SKIBOR 3 Months	07/02/2007 - Present
MLT	German Government Bonds 1 Year BKO	01/01/2008 - Present
	Long Term Government Bond Yields - Maastricht Definition (Avg.)	01/15/1985 - 12/31/2007
MNE	Treasury Bill Rate - 182-Day (EP)	07/16/2004 - Present
MYS	Bank Negara Malaysia 1 Year Govt Securities Indicative YTM	06/21/2005 - Present
	Malaysia Deposit 1 Year	- 06/20/2005
NGA	Nigeria Interbank Offered Rate 12 Month	09/29/2011 - Present
	Nigeria Interbank Offered Rate 3 Month	01/30/2004 - 09/28/2011
NLD	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Netherland Interbank 1 Year	- 12/31/1998
NOR	Norway Govt Treasury Bills 12 Month	07/01/1997 - Present
	Norway Interbank 1 Year	- 06/30/1997
NZL	New Zealand Dollar Deposit 1 Year	
OMN	OMR 12 Month Deposit	07/16/2002 - Present
PAK	PKR 12 Month Repo	10/29/2004 - Present
PER	Peru Savings Rate	07/01/1991 - Present
PHL	Philippine Treasury Bill 364d	
POL	Poland Interbank 1 Year (EOD)	10/11/1995 - Present
PRT	German Government Bonds 1 Year BKO	01/01/1999 - Present
ROM	Romanian Interbank 12 Month	08/01/1995 - Present
RUS	Mospime 3 Months Rate	04/18/2005 - Present
	Russia Moscow Interbank Non Co	08/14/2000 - 04/17/2005
	Russia Interbank 31 To 90 Day	09/01/1994 - 08/13/2000
SAU	Saudi Interbank 1 Year	

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Table A.7 – *Continued from previous page*

Economy	Interest Rate Name	Period Used*
SGP	Monetary Authority of Singapore Benchmark Govt Bill Yield 3 Month	09/20/2013 - Present
	Singapore T-Bill 3 Month	- 09/19/2013
SRB	Serbia Treasury Bill Auction Results 12 Months Average Accepted Yield	08/26/2009 - Present
SVK	German Government Bonds 1 Year BKO	01/01/2009 - Present
	Slovak Rep. Interbank 1 Year	08/09/1994 - 12/31/2008
SVN	German Government Bonds 1 Year BKO	01/01/2007 - Present
	Slovenia Treasury Bill 3 Month'dead'	10/29/1998 - 12/31/2006
SWE	Sweden T Bill 3 Month	05/25/1993 - Present
	Sweden Treasury Bill 90 Day	- 05/24/1993
THA	Thailand Govt Bond 1 Year Note	08/07/2000 - Present
	Thailand Deposit 12 Month (KT)	01/02/1991 - 08/06/2000
TUN	TU BCT Key Interest Rate	12/15/1994 - Present
TUR	Turkish Interbank 12 Month	08/01/2002 - Present
TWN	Taiwan Deposit 12 Month	
UKR	Ukraine Interbank 3 Months	03/01/2001 - Present
USA	US Treasury Constant Maturities 1 Year	
VEN	Venezuela Savings Deposit Rate	01/03/2000 - Present
	Venezuela Overnight	11/28/1994 - 01/02/2000
VNM	Vietnam Interbank 3 Month	12/11/1998 - Present
ZAF	South African Prime Overdraft 1 Year Rate	

* A blank Period Used column indicates that there is only a single interest rate that is used throughout the whole period.

Table A.8: Summary Statistics of input variables (based on data from January 1990 to February 2017).

DTD Level

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
Argentina	-1.69	1.11	2.45	3.93	30.85	2.8	2.51	15535
Australia	-1.43	1.74	3	4.56	25.75	3.44	2.46	331788
Austria	-3.07	2.01	3.49	5.62	41.6	4.89	6.28	23663
Bahrain	-0.82	1.74	3.23	6.27	25.48	4.53	3.93	2019
Bangladesh	-2.02	1.61	2.66	4.09	20.25	3.04	2.11	15774
Belgium	-3.07	2.65	4.63	7.31	41.6	5.41	4.37	34321
Bosnia and Herzegovina	-3.07	1.53	2.67	4.94	41.22	3.7	3.65	3816
Brazil	-2.02	0.62	2.08	4.01	30.85	2.64	3.03	56167
Bulgaria	-1.93	1.12	2.15	3.77	41.6	2.91	3.17	9739
Canada	-1.18	1.92	3.37	5.29	25.52	3.91	2.85	251073
Chile	-2.02	3.36	5.53	8.28	30.85	6.46	4.79	28221
China	0.11	3.11	4.22	5.77	17.34	4.68	2.3	345298
Colombia	-2.02	2.19	4.1	6.47	30.85	4.61	3.34	6172
Croatia	-2.9	1.12	2.51	4.37	23.5	3.01	2.65	12594
Cyprus	-1.4	0.88	1.73	2.98	41.6	2.42	2.74	15378
Czech Republic	-3.07	1.38	2.72	4.65	41.6	3.23	2.92	5908
Denmark	-3.07	1.84	3.36	5.3	41.6	4.02	3.64	46966
Egypt	-2.02	1.63	2.62	3.88	16.11	2.96	2	21804
Estonia	-0.54	1.9	3.45	5.96	21.62	4.37	3.54	3030
Finland	-3.07	2.41	3.75	5.38	41.6	4.05	2.52	33346
France	-3.07	1.91	3.32	5.16	41.6	3.88	3.28	182732
Germany	-3.07	1.66	3.1	4.88	41.6	3.62	3.12	206128
Greece	-3.07	1.24	2.33	3.78	41.6	2.69	2.44	62131
Hong Kong	-1.43	1.72	2.83	4.39	25.75	3.39	2.57	260221
Hungary	-3.07	1.29	2.65	4.3	27.56	3.14	2.72	8219
Iceland	-1.49	1.93	3.32	4.99	17.98	3.72	2.57	4363
India	-3.3	0.79	1.81	3.14	26.16	2.33	2.59	556306
Indonesia	-2.02	0.87	2.02	3.62	30.85	2.69	3.26	74237
Ireland	-1.44	1.91	3.45	5.3	35.26	3.88	2.89	9866
Israel	-3.07	1.11	2.27	3.68	41.6	2.63	2.3	83880
Italy	-3.07	1.6	2.97	4.66	41.6	3.39	2.86	70922
Jamaica	-0.87	1.13	2.59	3.83	15.18	2.76	2.17	3189
Japan	-1.43	2.23	3.36	4.89	25.75	3.83	2.43	928880
Jordan	-1.07	2.6	3.92	5.89	24.77	4.54	2.79	27458
Kazakhstan	-1.48	0.17	1.45	3.45	30.85	2.76	4.6	1017
Kuwait	-2.02	2.04	3.05	4.43	19.86	3.51	2.2	25666
Latvia	-1.14	1.08	2.54	4.26	37.28	3.07	2.9	2692
Lithuania	-1.3	1.45	3.22	5.54	20.73	3.86	3.31	5156
Luxembourg	-3.07	2.99	5.29	8.37	35.53	6.62	5.13	2910
Macedonia	-1.59	1.39	2.26	4.37	24.9	3.58	3.77	2462
Malaysia	-2.02	1.7	3.06	5.07	30.85	3.87	3.3	221380
Malta	-0.63	2.81	4.47	7.12	17.85	5.39	3.62	1767
Mexico	-2.02	2	3.97	6.64	30.85	4.68	3.9	21588
Montenegro	-1	1.34	2.47	3.86	41.6	3.27	3.95	1531
Morocco	-1.04	2.52	3.76	5.68	24.85	4.31	2.85	9557
Netherlands	-3.07	2.48	4.17	6.23	41.6	4.64	3.33	39713
New Zealand	-1.09	2.89	5.3	7.88	25.75	5.8	3.9	21536
Nigeria	-2.02	0.83	2.18	3.63	30.85	2.89	3.74	17632
Norway	-2.82	1.27	2.55	4.12	29.21	2.86	2.29	48266
Oman	-0.18	2.96	4.5	7.27	30.85	5.56	3.89	4344
Pakistan	-2.02	0.58	2.09	3.87	30.85	2.44	2.5	32442
Peru	-2.02	1.88	3.41	5.31	29.75	4.07	3.24	11341
Philippines	-2.02	1.35	2.74	4.68	30.85	3.39	3.23	45423
Poland	-2.86	1.34	2.47	3.75	41.6	2.75	2.12	75745
Portugal	-3.07	1.01	2.37	4.21	41.6	2.91	2.97	14650
Romania	-3.07	0.85	1.98	3.56	33.06	2.44	2.54	10874
Russian Federation	-3.07	0.58	1.78	3.39	41.6	2.29	2.87	22943
Saudi Arabia	-0.91	3.28	4.8	6.97	30.85	5.5	3.08	20693
Serbia	-3.07	0.46	1.54	3.17	41.6	2.36	3.65	3731
Singapore	-1.43	1.6	2.86	4.68	25.75	3.48	2.73	138500
Slovakia	-2.78	1.16	2.25	3.84	41.6	4.89	8.91	1421
Slovenia	-2.57	1.72	3.76	6.38	41.6	4.56	4.81	6209
South Africa	-2.02	1.26	2.92	5.19	30.85	3.65	3.49	85369
South Korea	-1.43	1.39	2.42	3.77	25.75	2.9	2.69	363279
Spain	-3.07	1.97	3.58	5.48	41.6	4.34	4.47	39390
Sri Lanka	-2.02	1.64	2.77	4.32	30.85	3.29	2.57	26540
Sweden	-3.07	1.79	3.27	5.07	41.6	3.71	2.85	97716
Switzerland	-3.07	2.7	4.41	6.53	40.7	4.9	3.29	61268
Taiwan	-1.24	2.96	4.15	5.73	25.75	4.68	2.85	169915
Thailand	-1.75	1.89	3.23	5.08	30.85	3.81	2.96	119259
Tunisia	-1.41	2.21	3.58	5.86	23.62	4.36	3.2	8874
Turkey	-3.07	1.58	2.87	4.77	41.6	3.67	3.58	56711
Ukraine	-3.07	0.37	1.37	2.49	28.11	1.62	2.12	4586
United Arab Emirates	-0.79	1.82	2.8	4.05	19.28	3.28	2.25	8040
United Kingdom	-3.07	2.27	3.94	6.31	41.6	4.79	3.98	416497
United States	-1.18	1.9	3.25	5.04	25.52	3.77	2.76	1642497
Venezuela	-1.8	0.67	1.51	2.76	18.63	2.41	3.24	3555
Vietnam	-1.85	1.21	2.08	3.33	30.85	2.54	2.08	55139

DTD Trend

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
Argentina	-9.89	-0.51	0	0.45	8.85	-0.04	1.13	15535
Australia	-7.05	-0.55	-0.03	0.44	6.14	-0.07	1.07	331788
Austria	-13.77	-0.69	-0.05	0.52	9.35	-0.22	2.3	23663
Bahrain	-9.89	-0.53	0.02	0.52	8.85	-0.03	1.36	2019
Bangladesh	-4.89	-0.28	0.02	0.38	8.85	0.08	0.76	15774
Belgium	-13.77	-0.7	-0.02	0.64	9.35	-0.07	1.7	34321
Bosnia and Herzegovina	-13.77	-0.55	-0.03	0.33	9.35	-0.07	1.39	3816
Brazil	-9.89	-0.44	0	0.41	8.85	-0.03	1.09	56167
Bulgaria	-13.77	-0.49	0	0.42	9.35	-0.07	1.32	9739
Canada	-7.03	-0.6	-0.03	0.48	5.53	-0.09	1.18	251073
Chile	-9.89	-0.88	0	0.79	8.85	-0.05	2.13	28221
China	-6.13	-0.64	-0.02	0.55	5.46	-0.08	1.15	345298
Colombia	-9.89	-0.65	0	0.68	8.85	-0.02	1.53	6172
Croatia	-7.88	-0.56	-0.02	0.42	9.35	-0.05	1.04	12594
Cyprus	-13.77	-0.41	-0.06	0.26	9.35	-0.14	1.03	15378
Czech Republic	-13.77	-0.57	-0.06	0.38	9.35	-0.15	1.28	5908
Denmark	-13.77	-0.6	-0.01	0.52	9.35	-0.05	1.46	46966
Egypt	-9.29	-0.5	-0.05	0.39	8.85	-0.07	0.92	21804
Estonia	-11.26	-0.68	0.02	0.69	9.35	-0.02	1.46	3030
Finland	-13.77	-0.51	0.03	0.6	9.35	0.03	1.11	33346
France	-13.77	-0.55	0	0.51	9.35	-0.03	1.3	182732
Germany	-13.77	-0.56	-0.03	0.46	9.35	-0.06	1.28	206128
Greece	-13.77	-0.53	-0.08	0.34	9.35	-0.1	1.05	62131
Hong Kong	-7.05	-0.54	0	0.5	6.14	-0.04	1.1	260221
Hungary	-13.77	-0.41	0.01	0.46	9.35	-0.02	1.06	8219
Iceland	-9.69	-0.77	-0.06	0.44	6.81	-0.17	1.39	4363
India	-8.66	-0.37	-0.01	0.37	6.6	-0.01	0.94	556306
Indonesia	-9.89	-0.43	0	0.41	8.85	-0.05	1.27	74237
Ireland	-13.77	-0.6	0	0.52	8.73	-0.08	1.23	9866
Israel	-13.77	-0.43	0	0.44	9.35	0	1.02	83880
Italy	-13.77	-0.6	-0.04	0.48	9.35	-0.08	1.19	70922
Jamaica	-9.89	-0.38	0	0.43	6.07	0.02	0.95	3189
Japan	-7.05	-0.5	0	0.47	6.14	-0.01	0.96	928880
Jordan	-9.89	-0.53	0	0.5	8.85	-0.04	1.21	27458
Kazakhstan	-9.89	-0.52	-0.05	0.36	8.85	-0.21	1.83	1017
Kuwait	-9.05	-0.47	0	0.43	8.85	-0.04	1.02	25666
Latvia	-13.77	-0.48	0	0.44	6.76	-0.06	1.24	2692
Lithuania	-10.09	-0.64	0	0.62	9.35	-0.01	1.45	5156
Luxembourg	-11.05	-0.75	0.01	0.69	8.6	-0.05	1.7	2910
Macedonia	-12.69	-0.54	-0.06	0.39	6.93	-0.09	1.24	2462
Malaysia	-9.89	-0.52	0	0.47	8.85	-0.04	1.22	221380
Malta	-11.01	-0.81	-0.02	0.71	9.35	-0.06	1.9	1767
Mexico	-9.89	-0.6	0.02	0.65	8.85	-0.02	1.5	21588
Montenegro	-13.77	-0.38	0	0.26	9.35	-0.16	1.44	1531
Morocco	-9.89	-0.55	-0.03	0.43	8.85	-0.1	1.15	9557
Netherlands	-13.77	-0.7	-0.02	0.59	9.35	-0.07	1.32	39713
New Zealand	-7.05	-0.76	0	0.71	6.14	-0.04	1.62	21536
Nigeria	-9.89	-0.53	-0.04	0.39	8.85	-0.1	1.65	17632
Norway	-13.77	-0.53	-0.01	0.44	9.35	-0.06	1.02	48266
Oman	-9.89	-0.66	0.04	0.71	8.85	0.02	1.9	4344
Pakistan	-8.12	-0.29	0.04	0.42	7.78	0.06	0.81	32442
Peru	-9.89	-0.6	0	0.58	8.85	0	1.54	11341
Philippines	-9.89	-0.46	0	0.47	8.85	-0.02	1.32	45423
Poland	-13.77	-0.48	-0.03	0.39	9.35	-0.06	0.92	75745
Portugal	-13.77	-0.52	-0.04	0.41	9.35	-0.06	1.09	14650
Romania	-10.08	-0.36	0.03	0.44	9.35	0.04	0.96	10874
Russian Federation	-13.77	-0.5	0	0.45	9.35	-0.1	1.31	22943
Saudi Arabia	-9.89	-0.81	-0.02	0.7	8.85	-0.06	1.51	20693
Serbia	-11.53	-0.31	0	0.28	9.35	-0.04	1.01	3731
Singapore	-7.05	-0.53	-0.02	0.44	6.14	-0.06	1.09	138500
Slovakia	-13.77	-0.43	0.01	0.43	9.35	-0.34	2.97	1421
Slovenia	-13.77	-0.76	-0.1	0.45	9.35	-0.27	1.86	6209
South Africa	-9.89	-0.58	-0.04	0.44	8.85	-0.11	1.31	85369
South Korea	-7.05	-0.43	0	0.44	6.14	-0.01	0.99	363279
Spain	-13.77	-0.56	0	0.58	9.35	-0.04	1.71	39390
Sri Lanka	-9.89	-0.4	0.01	0.48	8.85	0.05	1.07	26540
Sweden	-13.77	-0.52	0	0.49	9.35	-0.02	1.13	97716
Switzerland	-13.77	-0.67	0.01	0.68	9.35	0	1.41	61268
Taiwan	-7.05	-0.59	0	0.59	6.14	0	1.15	169915
Thailand	-9.89	-0.57	0	0.54	8.85	-0.02	1.19	119259
Tunisia	-9.89	-0.65	-0.09	0.48	8.85	-0.1	1.3	8874
Turkey	-13.77	-0.58	0	0.59	9.35	0	1.42	56711
Ukraine	-13.77	-0.52	-0.02	0.37	5.1	-0.13	1.06	4586
United Arab Emirates	-7.22	-0.48	-0.03	0.35	8.85	-0.11	0.9	8040
United Kingdom	-13.77	-0.82	-0.06	0.57	9.35	-0.2	1.82	416497
United States	-7.03	-0.52	0	0.48	5.53	-0.04	1.04	1642497
Venezuela	-8.54	-0.4	-0.01	0.4	8.85	-0.01	1.1	3555
Vietnam	-9.89	-0.38	0	0.36	8.85	-0.01	0.8	55139

CASH/TA Level

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
Argentina	0	0.02	0.06	0.11	0.98	0.08	0.08	17652
Australia	0	0.04	0.13	0.36	0.98	0.24	0.26	370859
Austria	0	0.03	0.07	0.15	1	0.12	0.14	25738
Bahrain	0	0.09	0.18	0.26	0.91	0.2	0.14	5039
Bangladesh	0	0.01	0.07	0.2	0.82	0.14	0.17	19991
Belgium	0	0.03	0.07	0.17	1.04	0.14	0.18	38458
Bosnia and Herzegovina	0	0.01	0.02	0.08	0.78	0.07	0.12	11278
Brazil	0	0.02	0.08	0.17	0.98	0.12	0.14	71656
Bulgaria	0	0.01	0.04	0.1	0.92	0.08	0.12	15416
Canada	0	0.01	0.06	0.21	1	0.16	0.21	261550
Chile	0	0.01	0.04	0.08	0.98	0.07	0.1	39466
China	0	0.08	0.14	0.25	0.88	0.19	0.15	352359
Colombia	0	0.02	0.06	0.1	0.98	0.09	0.12	8924
Croatia	0	0.01	0.02	0.06	0.62	0.06	0.09	19786
Cyprus	0	0.01	0.05	0.15	0.92	0.11	0.14	20058
Czech Republic	0	0.02	0.05	0.11	1	0.09	0.13	8200
Denmark	0	0.03	0.08	0.18	1.04	0.14	0.17	53452
Egypt	0	0.04	0.1	0.21	0.98	0.15	0.14	23413
Estonia	0	0.03	0.05	0.12	0.52	0.09	0.09	3078
Finland	0	0.04	0.08	0.16	1.04	0.13	0.15	35449
France	0	0.04	0.09	0.18	1.04	0.14	0.16	193095
Germany	0	0.03	0.08	0.2	1.04	0.15	0.18	218426
Greece	0	0.02	0.05	0.13	0.91	0.1	0.12	64956
Hong Kong	0	0.07	0.14	0.26	0.98	0.19	0.17	267799
Hungary	0	0.02	0.06	0.13	0.65	0.09	0.1	9383
Iceland	0	0.02	0.04	0.08	0.56	0.06	0.06	5825
India	0	0.01	0.03	0.07	0.92	0.07	0.1	803706
Indonesia	0	0.03	0.08	0.17	0.93	0.11	0.12	88802
Ireland	0	0.05	0.1	0.24	0.97	0.17	0.18	11032
Israel	0	0.04	0.11	0.23	1.04	0.19	0.23	91274
Italy	0	0.03	0.07	0.14	1.04	0.11	0.12	73617
Jamaica	0	0.05	0.12	0.28	0.97	0.2	0.21	7184
Japan	0	0.08	0.14	0.23	0.98	0.18	0.14	948510
Jordan	0	0.01	0.05	0.18	0.98	0.13	0.16	37303
Kazakhstan	0	0.08	0.12	0.18	0.98	0.14	0.1	2114
Kuwait	0	0.03	0.07	0.19	0.98	0.14	0.17	31600
Latvia	0	0.01	0.03	0.12	0.46	0.07	0.09	4917
Lithuania	0	0.01	0.03	0.08	0.48	0.06	0.08	5611
Luxembourg	0	0.04	0.1	0.14	0.96	0.12	0.13	3975
Macedonia	0	0.01	0.06	0.18	0.77	0.11	0.13	4184
Malaysia	0	0.03	0.08	0.17	0.98	0.12	0.14	227460
Malta	0	0.03	0.07	0.17	0.5	0.12	0.13	2271
Mexico	0	0.03	0.06	0.12	0.81	0.09	0.09	26949
Montenegro	0	0	0.01	0.07	0.47	0.06	0.09	4140
Morocco	0	0.01	0.05	0.11	0.72	0.08	0.1	13921
Netherlands	0	0.02	0.05	0.13	1.04	0.1	0.14	40789
New Zealand	0	0.01	0.03	0.12	0.98	0.11	0.19	23806
Nigeria	0	0.02	0.08	0.21	0.98	0.14	0.16	22902
Norway	0	0.04	0.09	0.19	1.04	0.16	0.19	54273
Oman	0	0.02	0.07	0.16	0.98	0.12	0.15	17977
Pakistan	0	0.01	0.05	0.14	0.98	0.1	0.13	38664
Peru	0	0.02	0.04	0.13	0.98	0.09	0.11	17828
Philippines	0	0.02	0.09	0.19	0.98	0.14	0.16	54410
Poland	0	0.03	0.07	0.14	1.04	0.11	0.14	78974
Portugal	0	0.01	0.03	0.07	0.69	0.06	0.08	17765
Romania	0	0.01	0.03	0.1	0.7	0.08	0.11	14644
Russian Federation	0	0.02	0.07	0.15	1.04	0.12	0.14	36369
Saudi Arabia	0	0.04	0.1	0.21	0.98	0.17	0.2	20371
Serbia	0	0.03	0.11	0.26	1.04	0.17	0.18	19859
Singapore	0	0.06	0.13	0.24	0.98	0.18	0.15	146998
Slovakia	0	0.02	0.05	0.13	0.64	0.09	0.11	3255
Slovenia	0	0.01	0.03	0.08	0.99	0.06	0.07	9278
South Africa	0	0.03	0.08	0.16	0.98	0.12	0.14	92825
South Korea	0	0.04	0.09	0.19	0.98	0.14	0.14	362718
Spain	0	0.02	0.05	0.11	1.04	0.09	0.11	47115
Sri Lanka	0	0.02	0.05	0.11	0.98	0.09	0.13	28130
Sweden	0	0.04	0.1	0.23	1.04	0.17	0.2	103891
Switzerland	0	0.05	0.11	0.2	1.04	0.16	0.16	65541
Taiwan	0	0.05	0.11	0.21	0.98	0.15	0.13	171384
Thailand	0	0.02	0.06	0.14	0.98	0.11	0.12	126061
Tunisia	0	0.03	0.06	0.13	0.74	0.1	0.12	9714
Turkey	0	0.02	0.06	0.15	1.04	0.11	0.14	77136
Ukraine	0	0.01	0.02	0.06	1	0.06	0.12	9631
United Arab Emirates	0	0.07	0.14	0.23	0.98	0.17	0.14	11306
United Kingdom	0	0.03	0.1	0.23	1.04	0.18	0.21	455825
United States	0	0.03	0.08	0.25	1	0.18	0.23	1736181
Venezuela	0	0.04	0.08	0.2	0.98	0.14	0.15	5180
Vietnam	0	0.03	0.08	0.19	0.97	0.14	0.16	58732

CASH/TA Trend

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
Argentina	-0.38	-0.01	0	0.01	0.44	0	0.04	17652
Australia	-0.44	-0.03	0	0.01	0.48	-0.01	0.1	370859
Austria	-0.54	-0.01	0	0.01	0.54	0	0.04	25738
Bahrain	-0.38	-0.02	0	0.01	0.44	0	0.06	5039
Bangladesh	-0.38	-0.01	0	0	0.44	0	0.05	19991
Belgium	-0.54	-0.01	0	0.01	0.54	0	0.05	38458
Bosnia and Herzegovina	-0.36	0	0	0	0.43	0	0.03	11278
Brazil	-0.38	-0.01	0	0.01	0.44	0	0.05	71656
Bulgaria	-0.52	0	0	0	0.54	0	0.05	15416
Canada	-0.45	-0.02	0	0.01	0.46	0	0.07	261550
Chile	-0.38	-0.01	0	0.01	0.44	0	0.04	39466
China	-0.31	-0.03	0	0.01	0.33	-0.01	0.05	352359
Colombia	-0.38	-0.01	0	0.01	0.44	0	0.05	8924
Croatia	-0.54	0	0	0	0.54	0	0.03	19786
Cyprus	-0.54	-0.01	0	0	0.54	0	0.05	20058
Czech Republic	-0.54	0	0	0.01	0.54	0	0.04	8200
Denmark	-0.54	-0.01	0	0.01	0.54	0	0.06	53452
Egypt	-0.38	-0.02	0	0.01	0.44	0	0.05	23413
Estonia	-0.25	-0.01	0	0.01	0.16	0	0.03	3078
Finland	-0.54	-0.01	0	0.01	0.54	0	0.05	35449
France	-0.54	-0.01	0	0.01	0.54	0	0.05	193095
Germany	-0.54	-0.01	0	0.01	0.54	0	0.06	218426
Greece	-0.54	-0.01	0	0.01	0.54	0	0.05	64956
Hong Kong	-0.44	-0.02	0	0.01	0.48	0	0.07	267799
Hungary	-0.37	-0.01	0	0.01	0.54	0	0.05	9383
Iceland	-0.33	-0.01	0	0.01	0.24	0	0.03	5825
India	-0.39	0	0	0	0.4	0	0.04	803706
Indonesia	-0.38	-0.01	0	0.01	0.44	0	0.04	88802
Ireland	-0.54	-0.01	0	0.01	0.54	0	0.06	11032
Israel	-0.54	-0.02	0	0.01	0.54	0	0.09	91274
Italy	-0.54	-0.01	0	0.01	0.54	0	0.04	73617
Jamaica	-0.38	-0.01	0	0.01	0.44	0	0.06	7184
Japan	-0.44	-0.01	0	0.01	0.48	0	0.04	948510
Jordan	-0.38	-0.01	0	0.01	0.44	0	0.05	37303
Kazakhstan	-0.27	-0.02	0	0.02	0.44	0	0.05	2114
Kuwait	-0.38	-0.01	0	0.01	0.44	0	0.06	31600
Latvia	-0.21	-0.01	0	0.01	0.32	0	0.04	4917
Lithuania	-0.31	-0.01	0	0.01	0.31	0	0.03	5611
Luxembourg	-0.26	-0.01	0	0.01	0.31	0	0.04	3975
Macedonia	-0.54	0	0	0	0.48	0	0.04	4184
Malaysia	-0.38	-0.01	0	0.01	0.44	0	0.05	227460
Malta	-0.31	-0.01	0	0.01	0.2	0	0.03	2271
Mexico	-0.38	-0.01	0	0.01	0.44	0	0.04	26949
Montenegro	-0.23	0	0	0	0.29	0	0.03	4140
Morocco	-0.38	-0.01	0	0.01	0.44	0	0.04	13921
Netherlands	-0.54	-0.01	0	0.01	0.54	0	0.05	40789
New Zealand	-0.44	-0.01	0	0	0.48	0	0.06	23806
Nigeria	-0.38	-0.01	0	0.01	0.44	0	0.06	22902
Norway	-0.54	-0.02	0	0.01	0.54	0	0.07	54273
Oman	-0.38	-0.01	0	0.01	0.44	0	0.06	17977
Pakistan	-0.38	-0.01	0	0	0.44	0	0.04	38664
Peru	-0.38	-0.01	0	0.01	0.44	0	0.04	17828
Philippines	-0.38	-0.01	0	0.01	0.44	0	0.06	54410
Poland	-0.54	-0.01	0	0.01	0.54	0	0.06	78974
Portugal	-0.53	-0.01	0	0	0.54	0	0.03	17765
Romania	-0.49	-0.01	0	0.01	0.51	0	0.04	14644
Russian Federation	-0.54	-0.01	0	0.01	0.54	0	0.07	36369
Saudi Arabia	-0.38	-0.02	0	0.01	0.44	0	0.07	20371
Serbia	-0.54	-0.01	0	0	0.54	-0.01	0.07	19859
Singapore	-0.44	-0.02	0	0.01	0.48	0	0.06	146998
Slovakia	-0.3	-0.01	0	0	0.16	0	0.03	3255
Slovenia	-0.23	0	0	0	0.26	0	0.03	9278
South Africa	-0.38	-0.01	0	0.01	0.44	0	0.06	92825
South Korea	-0.44	-0.02	0	0.01	0.48	0	0.06	362718
Spain	-0.54	-0.01	0	0.01	0.54	0	0.04	47115
Sri Lanka	-0.38	-0.01	0	0.01	0.44	0	0.05	28130
Sweden	-0.54	-0.02	0	0.01	0.54	0	0.08	103891
Switzerland	-0.54	-0.01	0	0.01	0.54	0	0.05	65541
Taiwan	-0.44	-0.01	0	0.01	0.48	0	0.04	171384
Thailand	-0.38	-0.01	0	0.01	0.44	0	0.05	126061
Tunisia	-0.28	-0.01	0	0.01	0.25	0	0.03	9714
Turkey	-0.54	-0.02	0	0.01	0.54	0	0.06	77136
Ukraine	-0.37	0	0	0	0.43	0	0.03	9631
United Arab Emirates	-0.38	-0.02	0	0.01	0.44	-0.01	0.06	11306
United Kingdom	-0.54	-0.02	0	0.01	0.54	-0.01	0.08	455825
United States	-0.45	-0.02	0	0.01	0.46	0	0.06	1736181
Venezuela	-0.38	-0.01	0	0.01	0.44	0	0.04	5180
Vietnam	-0.38	-0.02	0	0.02	0.44	0	0.05	58732

NI/TA Level

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
Argentina	-0.04	0	0	0.01	0.03	0	0.01	17652
Australia	-0.72	-0.02	0	0	0.12	-0.02	0.08	369029
Austria	-0.64	0	0	0	0.1	0	0.02	25841
Bahrain	-0.04	0	0	0.01	0.03	0	0.01	5039
Bangladesh	-0.04	0	0	0.01	0.03	0	0.01	19917
Belgium	-0.68	0	0	0.01	0.1	0	0.02	38404
Bosnia and Herzegovina	-0.13	0	0	0	0.09	0	0.01	11370
Brazil	-0.04	0	0	0.01	0.03	0	0.01	71628
Bulgaria	-0.32	0	0	0.01	0.1	0	0.02	15463
Canada	-0.53	-0.01	0	0	0.18	-0.01	0.05	262138
Chile	-0.04	0	0	0.01	0.03	0	0.01	39526
China	-0.08	0	0	0.01	0.12	0	0.01	352048
Colombia	-0.04	0	0	0.01	0.03	0	0.01	8924
Croatia	-0.27	0	0	0	0.1	0	0.01	19801
Cyprus	-0.93	-0.01	0	0	0.1	-0.01	0.03	20117
Czech Republic	-0.29	0	0	0	0.04	0	0.01	8200
Denmark	-0.93	0	0	0	0.1	0	0.04	53605
Egypt	-0.04	0	0	0.01	0.03	0.01	0.01	23413
Estonia	-0.09	0	0	0.01	0.05	0	0.01	3081
Finland	-0.48	0	0	0.01	0.1	0	0.01	35497
France	-0.93	0	0	0	0.1	0	0.03	193584
Germany	-0.93	0	0	0	0.1	0	0.03	218686
Greece	-0.93	0	0	0.01	0.1	0	0.02	65027
Hong Kong	-0.72	0	0	0.01	0.12	0	0.03	267764
Hungary	-0.93	0	0	0.01	0.04	0	0.04	9372
Iceland	-0.13	0	0	0.01	0.02	0	0.01	5837
India	-0.04	0	0	0.01	0.03	0	0.01	803680
Indonesia	-0.04	0	0	0.01	0.03	0	0.01	88774
Ireland	-0.81	0	0	0.01	0.1	0	0.03	11025
Israel	-0.93	0	0	0	0.1	-0.01	0.08	91215
Italy	-0.24	0	0	0	0.1	0	0.01	73833
Jamaica	-0.04	0	0	0.01	0.03	0.01	0.01	7246
Japan	-0.72	0	0	0	0.12	0	0.01	948591
Jordan	-0.04	0	0	0	0.03	0	0.01	37316
Kazakhstan	-0.04	0	0	0.01	0.03	0	0.01	2114
Kuwait	-0.04	0	0	0.01	0.03	0	0.01	31600
Latvia	-0.12	0	0	0.01	0.1	0	0.01	4917
Lithuania	-0.04	0	0	0.01	0.04	0	0.01	5611
Luxembourg	-0.04	0	0	0.01	0.1	0	0.01	3915
Macedonia	-0.5	0	0	0	0.04	0	0.03	4184
Malaysia	-0.04	0	0	0.01	0.03	0	0.01	227465
Malta	-0.02	0	0	0	0.04	0	0	2313
Mexico	-0.04	0	0	0.01	0.03	0	0.01	26955
Montenegro	-0.06	0	0	0	0.02	0	0.01	4168
Morocco	-0.04	0	0	0.01	0.03	0	0.01	13925
Netherlands	-0.93	0	0	0.01	0.1	0	0.05	40882
New Zealand	-0.72	0	0	0.01	0.12	-0.01	0.06	23798
Nigeria	-0.04	0	0	0.01	0.03	0	0.01	22915
Norway	-0.93	0	0	0	0.1	0	0.03	54313
Oman	-0.04	0	0	0.01	0.03	0	0.01	17977
Pakistan	-0.04	0	0	0.01	0.03	0	0.01	38529
Peru	-0.04	0	0	0.01	0.03	0	0.01	17828
Philippines	-0.04	0	0	0.01	0.03	0	0.01	53743
Poland	-0.93	0	0	0.01	0.1	0	0.03	79068
Portugal	-0.21	0	0	0	0.1	0	0.01	17800
Romania	-0.93	0	0	0.01	0.1	0	0.04	14625
Russian Federation	-0.23	0	0	0.01	0.1	0	0.01	36378
Saudi Arabia	-0.04	0	0	0.01	0.03	0	0.01	21572
Serbia	-0.12	0	0	0.01	0.07	0	0.01	20447
Singapore	-0.72	0	0	0.01	0.12	0	0.03	146717
Slovakia	-0.03	0	0	0	0.05	0	0.01	3321
Slovenia	-0.07	0	0	0	0.02	0	0.01	9278
South Africa	-0.04	0	0	0.01	0.03	0	0.01	92677
South Korea	-0.72	0	0	0.01	0.12	0	0.02	370628
Spain	-0.93	0	0	0	0.1	0	0.03	47175
Sri Lanka	-0.04	0	0	0.01	0.03	0	0.01	28142
Sweden	-0.93	-0.01	0	0.01	0.1	-0.01	0.04	103937
Switzerland	-0.93	0	0	0.01	0.1	0	0.02	65644
Taiwan	-0.37	0	0	0.01	0.06	0	0.01	171399
Thailand	-0.04	0	0	0.01	0.03	0	0.01	126063
Tunisia	-0.04	0	0	0	0.02	0	0.01	9748
Turkey	-0.93	0	0	0.01	0.1	0	0.03	77075
Ukraine	-0.1	0	0	0.01	0.1	0	0.01	9579
United Arab Emirates	-0.04	0	0	0.01	0.03	0	0.01	11306
United Kingdom	-0.93	-0.01	0	0.01	0.1	-0.01	0.06	455942
United States	-0.53	0	0	0.01	0.18	0	0.03	1736278
Venezuela	-0.04	0	0	0	0.03	0	0.01	5180
Vietnam	-0.04	0	0	0.01	0.03	0.01	0.01	58713

NI/TA Trend

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
Argentina	-0.03	0	0	0	0.03	0	0.01	17652
Australia	-0.55	0	0	0	0.42	0	0.06	369029
Austria	-0.48	0	0	0	0.44	0	0.02	25841
Bahrain	-0.03	0	0	0	0.03	0	0	5039
Bangladesh	-0.03	0	0	0	0.03	0	0	19917
Belgium	-0.27	0	0	0	0.44	0	0.01	38404
Bosnia and Herzegovina	-0.19	0	0	0	0.13	0	0.01	11370
Brazil	-0.03	0	0	0	0.03	0	0.01	71628
Bulgaria	-0.48	0	0	0	0.44	0	0.02	15463
Canada	-0.36	0	0	0	0.3	0	0.04	262138
Chile	-0.03	0	0	0	0.03	0	0.01	39526
China	-0.11	0	0	0	0.09	0	0.01	352048
Colombia	-0.03	0	0	0	0.03	0	0	8924
Croatia	-0.46	0	0	0	0.44	0	0.02	19801
Cyprus	-0.48	0	0	0	0.44	0	0.02	20117
Czech Republic	-0.27	0	0	0	0.26	0	0.01	8200
Denmark	-0.48	0	0	0	0.44	0	0.02	53605
Egypt	-0.03	0	0	0	0.03	0	0.01	23413
Estonia	-0.31	0	0	0	0.11	0	0.02	3081
Finland	-0.48	0	0	0	0.44	0	0.01	35497
France	-0.48	0	0	0	0.44	0	0.02	193584
Germany	-0.48	0	0	0	0.44	0	0.02	218686
Greece	-0.48	0	0	0	0.44	0	0.02	65027
Hong Kong	-0.55	0	0	0	0.42	0	0.03	267764
Hungary	-0.27	0	0	0	0.44	0	0.02	9372
Iceland	-0.12	0	0	0	0.13	0	0.01	5837
India	-0.15	0	0	0	0.13	0	0.01	803680
Indonesia	-0.03	0	0	0	0.03	0	0.01	88774
Ireland	-0.48	0	0	0	0.44	0	0.03	11025
Israel	-0.48	0	0	0	0.44	0	0.06	91215
Italy	-0.48	0	0	0	0.44	0	0.01	73833
Jamaica	-0.03	0	0	0	0.03	0	0.01	7246
Japan	-0.55	0	0	0	0.42	0	0.01	948591
Jordan	-0.03	0	0	0	0.03	0	0.01	37316
Kazakhstan	-0.03	0	0	0	0.03	0	0.01	2114
Kuwait	-0.03	0	0	0	0.03	0	0.01	31600
Latvia	-0.29	0	0	0	0.1	0	0.02	4917
Lithuania	-0.12	0	0	0	0.12	0	0.01	5611
Luxembourg	-0.12	0	0	0	0.15	0	0.01	3915
Macedonia	-0.43	0	0	0	0.34	0	0.02	4184
Malaysia	-0.03	0	0	0	0.03	0	0.01	227465
Malta	-0.04	0	0	0	0.03	0	0	2313
Mexico	-0.03	0	0	0	0.03	0	0.01	26955
Montenegro	-0.05	0	0	0	0.06	0	0	4168
Morocco	-0.03	0	0	0	0.03	0	0	13925
Netherlands	-0.48	0	0	0	0.44	0	0.03	40882
New Zealand	-0.55	0	0	0	0.42	0	0.05	23798
Nigeria	-0.03	0	0	0	0.03	0	0.01	22915
Norway	-0.48	0	0	0	0.44	0	0.03	54313
Oman	-0.03	0	0	0	0.03	0	0.01	17977
Pakistan	-0.03	0	0	0	0.03	0	0	38529
Peru	-0.03	0	0	0	0.03	0	0.01	17828
Philippines	-0.03	0	0	0	0.03	0	0.01	53743
Poland	-0.48	0	0	0	0.44	0	0.02	79068
Portugal	-0.48	0	0	0	0.44	0	0.01	17800
Romania	-0.48	0	0	0	0.44	0	0.03	14625
Russian Federation	-0.48	0	0	0	0.33	0	0.01	36378
Saudi Arabia	-0.03	0	0	0	0.03	0	0.01	21572
Serbia	-0.13	0	0	0	0.1	0	0.01	20447
Singapore	-0.55	0	0	0	0.42	0	0.03	146717
Slovakia	-0.06	0	0	0	0.07	0	0.01	3321
Slovenia	-0.07	0	0	0	0.06	0	0.01	9278
South Africa	-0.03	0	0	0	0.03	0	0.01	92677
South Korea	-0.55	0	0	0	0.42	0	0.02	370628
Spain	-0.48	0	0	0	0.44	0	0.02	47175
Sri Lanka	-0.03	0	0	0	0.03	0	0.01	28142
Sweden	-0.48	0	0	0	0.44	0	0.03	103937
Switzerland	-0.48	0	0	0	0.44	0	0.01	65644
Taiwan	-0.55	0	0	0	0.37	0	0.01	171399
Thailand	-0.03	0	0	0	0.03	0	0.01	126063
Tunisia	-0.03	0	0	0	0.02	0	0	9748
Turkey	-0.48	0	0	0	0.44	0	0.02	77075
Ukraine	-0.14	0	0	0	0.16	0	0.01	9579
United Arab Emirates	-0.03	0	0	0	0.03	0	0	11306
United Kingdom	-0.48	0	0	0	0.44	0	0.04	455942
United States	-0.36	0	0	0	0.3	0	0.02	1736278
Venezuela	-0.03	0	0	0	0.03	0	0	5180
Vietnam	-0.03	0	0	0	0.03	0	0.01	58713

SIZE Level

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
Argentina	-5.79	-1.29	0.23	1.64	6.4	0.19	2.01	17836
Australia	-4.36	-1.29	-0.16	1.48	7.02	0.25	2.09	389840
Austria	-6.61	-0.88	0.46	1.95	4.93	0.48	2.02	28424
Bahrain	-3.66	-0.87	0	1.41	3.36	0.13	1.44	4261
Bangladesh	-5.77	-1.35	-0.3	1.07	4.97	-0.19	1.73	24005
Belgium	-6.61	-1.21	0.33	1.88	7.99	0.34	2.3	46105
Bosnia and Herzegovina	-6.61	-1.39	-0.14	0.96	5.21	-0.12	1.87	13502
Brazil	-5.79	-1.71	-0.07	1.31	6.4	-0.2	2.35	70894
Bulgaria	-6.61	-1.57	-0.18	1.05	7.99	-0.24	1.84	22530
Canada	-6.27	-1.67	-0.3	1.24	6.02	-0.2	2.19	294256
Chile	-5.79	-1.03	0.12	1.36	6.38	0.08	1.8	38366
China	-2.43	-0.61	-0.12	0.46	4.13	-0.02	0.9	391310
Colombia	-4.75	-1.36	0.14	1.26	4.43	-0.11	1.71	8792
Croatia	-6.61	-0.88	0.27	1.46	5.87	0.32	1.78	19141
Cyprus	-4.72	-0.99	0.12	1.22	7.98	0.19	1.78	21634
Czech Republic	-6.61	-1.85	-0.51	0.64	4.95	-0.52	2	8855
Denmark	-6.61	-0.34	0.85	2.26	7.39	1	2	55875
Egypt	-5.64	-1.26	-0.09	1.45	5.4	0.09	1.82	25619
Estonia	-3.63	-0.66	0.24	1.33	5.17	0.3	1.69	3351
Finland	-6.37	-1.69	-0.34	1.21	6.39	-0.22	1.99	37020
France	-6.61	-1.28	0.18	1.98	7.67	0.44	2.36	227996
Germany	-6.61	-0.54	1.14	2.9	7.99	1.14	2.71	266382
Greece	-6.61	-0.47	0.51	1.67	7.56	0.69	1.71	67665
Hong Kong	-4.36	-1.41	-0.39	1	7.02	-0.1	1.85	303874
Hungary	-6.61	-1.29	0.43	2.21	6.23	0.47	2.45	9976
Iceland	-6.61	-2.13	-1.17	-0.16	2.49	-1.17	1.52	6242
India	-5.11	-1.49	-0.02	1.83	8.14	0.3	2.36	669992
Indonesia	-5.79	-1.01	0.19	1.49	6.09	0.29	1.85	88561
Ireland	-6.38	-1.78	-0.53	1.11	5.09	-0.34	2.04	11899
Israel	-6.61	-0.73	0.35	1.68	7.99	0.55	1.86	108949
Italy	-6.61	-0.94	0.24	1.74	6.35	0.41	1.96	78892
Jamaica	-5.79	-1.58	-0.01	1.06	6.4	-0.23	1.78	7761
Japan	-4.36	-0.81	0.25	1.54	7.02	0.47	1.74	998584
Jordan	-3.88	-0.81	0	1.18	6.25	0.27	1.54	37312
Kazakhstan	-5.61	-1.79	0.04	1.22	3.14	-0.28	1.84	1911
Kuwait	-5	-0.42	0.49	1.37	5.15	0.59	1.39	31084
Latvia	-5.34	-1.15	0.04	2.34	5.89	0.57	2.21	5071
Lithuania	-4.75	-0.87	0.2	1.22	4.2	0.16	1.6	6935
Luxembourg	-6.61	-1.93	-0.37	0.53	4.83	-0.54	2.14	4623
Macedonia	-6.61	-1.08	0.23	1.38	5.28	0.18	1.82	5921
Malaysia	-4.96	-0.27	0.65	1.76	6.4	0.81	1.6	241541
Malta	-4.05	-0.97	-0.09	1.14	2.31	0	1.34	2652
Mexico	-5.79	-1.07	0.22	1.61	5.11	0.17	1.93	27020
Montenegro	-6.13	-1.18	0.24	1.4	4.74	0.18	1.89	4266
Morocco	-5.79	-1.2	0.08	1.76	4.9	0.2	1.85	14324
Netherlands	-6.61	-2.02	-0.38	1.21	5.84	-0.29	2.3	43852
New Zealand	-4.36	-1.43	0.04	1.2	5.23	-0.09	1.91	25136
Nigeria	-5.79	-1.45	-0.34	1.51	6.21	-0.05	2.11	24989
Norway	-6.61	-0.96	0.14	1.43	6.64	0.27	1.78	57329
Oman	-5.57	-0.99	-0.01	1.16	4.41	-0.01	1.61	16181
Pakistan	-5.79	-0.99	0.81	2.76	6.4	0.83	2.45	65560
Peru	-5.79	-1.09	0.22	1.76	5.41	0.27	1.97	16918
Philippines	-5.79	-1.42	-0.26	1.21	5.32	-0.03	1.85	54384
Poland	-6.19	-1.59	-0.16	1.33	7.99	-0.06	2.18	102807
Portugal	-6.61	-1.69	-0.07	1.62	4.82	-0.14	2.45	18732
Romania	-6.61	-1.23	-0.01	1.29	7.99	0.1	2.07	20794
Russian Federation	-6.61	-1.88	-0.19	1.48	7.99	-0.16	2.43	33941
Saudi Arabia	-4.53	-0.75	0.15	1.48	5.34	0.44	1.56	23191
Serbia	-6.61	-1.2	0.02	1.35	6.44	0.12	1.86	20034
Singapore	-4.36	-0.68	0.32	1.6	7.02	0.56	1.73	154483
Slovakia	-4.37	-0.08	1.26	3.88	7.57	1.81	2.52	4195
Slovenia	-6.61	-1.09	0.22	1.71	7.99	0.51	2.44	11915
South Africa	-5.79	-1.43	0.27	1.97	6.4	0.27	2.29	100477
South Korea	-4.36	-0.47	0.31	1.34	7.02	0.56	1.52	430765
Spain	-6.61	-1.65	-0.19	1.34	5.53	-0.2	2.15	48438
Sri Lanka	-5.79	-0.97	-0.03	1.18	5.87	0.14	1.55	30819
Sweden	-6.61	-0.82	0.89	2.64	7.99	1.04	2.45	112533
Switzerland	-6.61	-1.11	0.17	1.44	6.36	0.23	1.97	68303
Taiwan	-4.36	-0.8	0.03	0.91	6.49	0.13	1.42	188095
Thailand	-5.35	-0.76	0.19	1.34	6.4	0.4	1.6	133542
Tunisia	-3.79	-0.8	0.18	1.31	3.32	0.25	1.32	10521
Turkey	-5.09	-1.3	-0.08	1.24	6.06	0.04	1.88	82317
Ukraine	-6.61	-0.8	0.25	1.13	6.33	0.13	1.57	8807
United Arab Emirates	-4.81	-1.01	0.03	1.11	4.25	0.07	1.57	10430
United Kingdom	-6.61	-1.19	0.22	1.88	7.99	0.45	2.27	489146
United States	-6.27	-1.92	-0.57	0.88	6.02	-0.45	2.01	1811311
Venezuela	-5.79	-1.4	0.03	1.41	6.4	-0.05	2.06	5734
Vietnam	-4.69	-1.13	-0.22	0.91	6.4	-0.02	1.66	62318

SIZE Trend

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
Argentina	-1.61	-0.16	-0.02	0.13	1.92	-0.01	0.32	17836
Australia	-1.58	-0.19	0	0.18	1.85	0.01	0.4	389840
Austria	-2.13	-0.11	-0.01	0.09	2.2	-0.02	0.28	28424
Bahrain	-0.8	-0.06	0.01	0.09	1.92	0.02	0.17	4261
Bangladesh	-1.61	-0.12	-0.02	0.09	1.92	-0.01	0.25	24005
Belgium	-2.13	-0.11	-0.02	0.07	2.2	-0.02	0.27	46105
Bosnia and Herzegovina	-2.13	-0.1	0	0.13	2.2	0.03	0.28	13502
Brazil	-1.61	-0.17	-0.01	0.14	1.92	-0.01	0.32	70894
Bulgaria	-2.13	-0.15	-0.01	0.14	2.2	0	0.38	22530
Canada	-1.9	-0.16	0	0.16	1.81	0	0.37	294256
Chile	-1.61	-0.1	-0.01	0.09	1.92	0	0.22	38366
China	-0.86	-0.09	0	0.12	1.22	0.03	0.2	391310
Colombia	-1.61	-0.09	0.01	0.1	1.92	0.01	0.23	8792
Croatia	-2.13	-0.14	-0.01	0.1	2.2	-0.01	0.26	19141
Cyprus	-2.13	-0.17	0	0.18	2.2	0.01	0.35	21634
Czech Republic	-2.13	-0.14	0	0.13	2.2	-0.01	0.26	8855
Denmark	-2.13	-0.14	-0.02	0.09	2.2	-0.03	0.28	55875
Egypt	-1.61	-0.16	-0.04	0.09	1.92	-0.03	0.29	25619
Estonia	-2.06	-0.13	-0.02	0.1	2.2	-0.01	0.29	3351
Finland	-2.13	-0.12	0	0.13	2.2	0	0.26	37020
France	-2.13	-0.12	0	0.12	2.2	0	0.29	227996
Germany	-2.13	-0.17	-0.04	0.09	2.2	-0.06	0.36	266382
Greece	-2.13	-0.18	-0.03	0.13	2.2	-0.02	0.32	67665
Hong Kong	-1.58	-0.16	-0.02	0.14	1.85	0.01	0.34	303874
Hungary	-2.13	-0.2	-0.05	0.08	2.2	-0.06	0.3	9976
Iceland	-2.13	-0.12	0	0.12	2.2	0.01	0.3	6242
India	-1.71	-0.21	-0.03	0.15	1.99	-0.02	0.36	669992
Indonesia	-1.61	-0.18	-0.03	0.13	1.92	-0.01	0.34	88561
Ireland	-2.13	-0.11	0.01	0.13	2.2	0	0.3	11899
Israel	-2.13	-0.15	-0.01	0.11	2.2	-0.02	0.32	108949
Italy	-2.13	-0.11	-0.01	0.09	2.2	0	0.24	78892
Jamaica	-1.61	-0.12	0	0.12	1.92	0.01	0.3	7761
Japan	-1.58	-0.12	-0.01	0.09	1.85	-0.01	0.21	998584
Jordan	-1.61	-0.1	0.01	0.12	1.92	0.02	0.24	37312
Kazakhstan	-1.61	-0.17	0	0.15	1.92	0.02	0.47	1911
Kuwait	-1.61	-0.13	-0.02	0.09	1.92	-0.01	0.23	31084
Latvia	-2.13	-0.14	0	0.16	2.2	0.01	0.31	5071
Lithuania	-2.13	-0.13	-0.02	0.11	2.2	-0.01	0.31	6935
Luxembourg	-2.13	-0.1	0	0.1	2.2	0.01	0.29	4623
Macedonia	-2.06	-0.12	-0.01	0.09	1.92	0	0.23	5921
Malaysia	-1.61	-0.13	-0.02	0.09	1.92	-0.01	0.25	241541
Malta	-1.42	-0.06	0.01	0.09	1.92	0.02	0.21	2652
Mexico	-1.61	-0.12	-0.01	0.09	1.92	-0.01	0.25	27020
Montenegro	-2.13	-0.13	0	0.14	2.2	0	0.4	4266
Morocco	-1.61	-0.1	-0.01	0.07	1.92	-0.01	0.19	14324
Netherlands	-2.13	-0.1	0	0.11	2.2	-0.01	0.27	43852
New Zealand	-1.58	-0.09	0.01	0.11	1.85	0.01	0.26	25136
Nigeria	-1.61	-0.18	-0.03	0.11	1.92	-0.01	0.33	24989
Norway	-2.13	-0.13	0	0.13	2.2	0	0.34	57329
Oman	-1.61	-0.1	0	0.11	1.92	0.01	0.24	16181
Pakistan	-1.61	-0.18	-0.04	0.11	1.92	-0.02	0.29	65560
Peru	-1.61	-0.14	-0.01	0.12	1.92	0	0.29	16918
Philippines	-1.61	-0.15	-0.02	0.13	1.92	0.01	0.32	54384
Poland	-2.13	-0.21	-0.04	0.12	2.2	-0.04	0.37	102807
Portugal	-2.13	-0.14	-0.02	0.09	2.2	-0.02	0.26	18732
Romania	-2.13	-0.15	0	0.16	2.2	0.03	0.38	20794
Russian Federation	-2.13	-0.19	-0.03	0.13	2.2	-0.04	0.36	33941
Saudi Arabia	-1.61	-0.11	-0.01	0.09	1.92	0	0.21	23191
Serbia	-2.13	-0.13	0	0.17	2.2	0.03	0.32	20034
Singapore	-1.58	-0.14	-0.02	0.09	1.85	-0.02	0.27	154483
Slovakia	-2.13	-0.1	0.01	0.13	2.2	0.02	0.35	4195
Slovenia	-2.13	-0.16	-0.03	0.08	2.2	-0.05	0.31	11915
South Africa	-1.61	-0.16	0	0.13	1.92	-0.02	0.35	100477
South Korea	-1.58	-0.16	-0.02	0.13	1.85	-0.01	0.33	430765
Spain	-2.13	-0.1	0	0.11	2.2	0.01	0.27	48438
Sri Lanka	-1.61	-0.11	-0.01	0.09	1.92	0	0.22	30819
Sweden	-2.13	-0.14	0	0.14	2.2	0	0.34	112533
Switzerland	-2.13	-0.1	-0.01	0.08	2.2	-0.01	0.23	68303
Taiwan	-1.58	-0.12	-0.02	0.09	1.85	-0.01	0.21	188095
Thailand	-1.61	-0.14	-0.02	0.12	1.92	0	0.27	133542
Tunisia	-1.61	-0.12	-0.03	0.05	1.77	-0.02	0.19	10521
Turkey	-2.13	-0.16	-0.03	0.12	2.2	-0.01	0.29	82317
Ukraine	-2.13	-0.23	-0.01	0.19	2.2	-0.02	0.47	8807
United Arab Emirates	-1.61	-0.13	-0.02	0.09	1.92	-0.01	0.23	10430
United Kingdom	-2.13	-0.15	0	0.13	2.2	-0.02	0.35	489146
United States	-1.9	-0.15	-0.01	0.12	1.81	-0.02	0.32	1811311
Venezuela	-1.61	-0.19	-0.03	0.12	1.92	-0.01	0.35	5734
Vietnam	-1.61	-0.15	-0.02	0.11	1.92	-0.02	0.25	62318

M/B

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
Argentina	0.18	0.85	1.05	1.39	19.85	1.56	2.33	16677
Australia	0.16	0.91	1.32	2.4	16.45	2.33	2.9	358981
Austria	0.13	0.94	1.06	1.37	23.17	1.32	1.18	25265
Bahrain	0.33	0.9	1.03	1.21	6.26	1.13	0.44	3995
Bangladesh	0.29	1.02	1.36	2.14	19.85	2.08	2.34	19793
Belgium	0.13	0.94	1.09	1.46	23.17	1.47	1.57	37296
Bosnia and Herzegovina	0.13	0.42	0.68	0.99	23.17	0.81	0.83	7249
Brazil	0.18	0.83	1.05	1.53	19.85	1.91	3.29	65460
Bulgaria	0.13	0.66	0.94	1.32	23.17	1.25	1.63	13914
Canada	0.2	0.96	1.28	2.02	65.04	2.32	4.94	259626
Chile	0.18	0.85	1.11	1.62	19.85	1.51	1.88	35458
China	0.67	1.5	2.17	3.35	60.34	2.97	3.36	343601
Colombia	0.18	0.8	1.03	1.26	7.53	1.16	0.7	7762
Croatia	0.13	0.7	0.92	1.15	23.17	1.06	1.09	17041
Cyprus	0.13	0.6	0.8	1.04	23.17	1.09	1.71	18162
Czech Republic	0.15	0.67	0.92	1.17	23.17	1.05	0.69	7021
Denmark	0.13	0.96	1.05	1.44	23.17	1.57	1.84	51770
Egypt	0.21	0.93	1.15	1.68	19.85	1.52	1.37	22732
Estonia	0.17	0.94	1.15	1.7	23.17	1.67	2.05	3054
Finland	0.19	1.01	1.23	1.75	23.17	1.67	1.69	34963
France	0.13	0.95	1.13	1.58	23.17	1.59	1.88	188375
Germany	0.13	1	1.22	1.71	23.17	1.74	2.07	214275
Greece	0.14	0.85	1.07	1.54	23.17	1.58	1.92	63696
Hong Kong	0.16	0.73	1.01	1.59	16.45	1.59	2.07	264568
Hungary	0.13	0.76	1	1.34	23.17	1.22	1.08	9051
Iceland	0.13	1.08	1.25	1.57	23.17	1.43	0.83	5331
India	0.19	0.77	1	1.54	14.63	1.58	1.97	585180
Indonesia	0.18	0.86	1.07	1.51	19.85	1.45	1.48	82083
Ireland	0.14	0.99	1.22	1.73	23.17	1.72	1.88	10794
Israel	0.13	0.91	1.04	1.37	23.17	1.64	2.55	88633
Italy	0.19	0.95	1.06	1.36	23.17	1.31	1.06	72985
Jamaica	0.18	0.87	1.04	1.41	19.85	1.35	1.13	6892
Japan	0.16	0.85	1	1.25	16.45	1.24	1.1	946203
Jordan	0.18	0.8	1.02	1.35	19.85	1.22	0.9	33908
Kazakhstan	0.23	0.87	0.98	1.15	19.85	1.23	1.31	1538
Kuwait	0.18	0.82	1.06	1.44	19.85	1.25	0.81	29329
Latvia	0.13	0.56	0.76	0.99	9.24	0.87	0.63	4210
Lithuania	0.34	0.8	0.98	1.32	7.38	1.15	0.62	5517
Luxembourg	0.29	0.73	0.98	1.35	23.17	2.28	4.98	3663
Macedonia	0.13	0.61	0.86	1	23.17	1.2	2.52	3539
Malaysia	0.18	0.77	0.99	1.4	19.85	1.35	1.4	225774
Malta	0.45	0.98	1.08	1.58	15.76	1.48	1.11	2199
Mexico	0.18	0.82	1.06	1.47	11.81	1.25	0.71	25210
Montenegro	0.13	0.3	0.47	0.84	23.17	0.76	1.42	2732
Morocco	0.25	1.06	1.25	1.82	15.95	1.6	0.93	13306
Netherlands	0.13	1	1.23	1.71	23.17	1.78	2.27	40572
New Zealand	0.16	0.99	1.29	2.04	16.45	2.06	2.5	23125
Nigeria	0.18	0.87	1.09	1.69	19.85	1.66	1.81	21590
Norway	0.13	0.95	1.12	1.68	23.17	1.74	2.13	52920
Oman	0.19	0.98	1.15	1.48	6.7	1.31	0.58	14845
Pakistan	0.18	0.86	1.03	1.42	19.85	1.39	1.36	37512
Peru	0.18	0.76	1.06	1.53	19.85	1.4	1.19	15086
Philippines	0.18	0.79	1.08	1.82	19.85	2.16	3.55	50503
Poland	0.13	0.84	1.09	1.6	23.17	1.6	2	78300
Portugal	0.13	0.89	1.02	1.25	23.17	1.14	0.66	16775
Romania	0.13	0.63	0.86	1.15	23.17	1.18	2	13743
Russian Federation	0.13	0.71	1	1.41	23.17	1.36	1.78	30334
Saudi Arabia	0.19	1.17	1.71	2.81	19.85	2.41	2.09	21341
Serbia	0.13	0.63	0.83	1.07	23.17	0.97	0.94	13684
Singapore	0.16	0.8	1.01	1.41	16.45	1.35	1.36	144699
Slovakia	0.14	0.69	0.9	1.05	3.2	0.89	0.3	2459
Slovenia	0.13	0.67	0.85	1.02	8.11	0.92	0.5	8292
South Africa	0.18	0.9	1.19	1.82	19.85	1.72	2.05	90921
South Korea	0.16	0.82	1	1.36	16.45	1.37	1.43	366943
Spain	0.13	0.96	1.11	1.47	23.17	1.4	1.15	44227
Sri Lanka	0.24	0.91	1.09	1.48	19.85	1.48	1.55	27691
Sweden	0.13	1.05	1.43	2.36	23.17	2.3	2.69	102616
Switzerland	0.16	1	1.15	1.66	23.17	1.61	1.53	64355
Taiwan	0.28	0.92	1.13	1.59	16.45	1.42	0.94	171157
Thailand	0.18	0.88	1.1	1.54	19.85	1.41	1.15	123050
Tunisia	0.2	0.96	1.08	1.41	7.85	1.34	0.72	9499
Turkey	0.13	0.93	1.18	1.76	23.17	2.11	3.67	76377
Ukraine	0.13	0.83	1.14	1.83	23.17	1.78	2.27	7305
United Arab Emirates	0.34	0.86	1.02	1.25	10.02	1.13	0.54	9965
United Kingdom	0.13	0.97	1.33	2.1	23.17	2.11	2.77	443173
United States	0.2	1.02	1.31	2.08	65.04	2.07	3.08	1732375
Venezuela	0.18	0.63	0.95	1.21	19.85	2.73	5.49	4440
Vietnam	0.18	0.82	0.95	1.18	19.85	1.11	0.69	57851

SIGMA

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
Argentina	0.02	0.09	0.11	0.15	0.69	0.13	0.06	14774
Australia	0.02	0.12	0.23	0.34	1.1	0.26	0.17	320140
Austria	0.01	0.06	0.09	0.13	1.21	0.12	0.1	24303
Bahrain	0.03	0.07	0.1	0.14	0.39	0.11	0.05	2076
Bangladesh	0.03	0.1	0.13	0.16	0.7	0.14	0.06	22914
Belgium	0.01	0.06	0.08	0.12	1.44	0.1	0.08	36892
Bosnia and Herzegovina	0.02	0.11	0.16	0.21	0.77	0.17	0.09	4216
Brazil	0.02	0.09	0.13	0.21	1.15	0.17	0.13	52421
Bulgaria	0.02	0.12	0.17	0.27	1.11	0.21	0.13	10593
Canada	0.03	0.1	0.17	0.27	1.05	0.21	0.16	266199
Chile	0.02	0.06	0.08	0.11	0.83	0.1	0.07	25261
China	0.03	0.09	0.11	0.14	0.43	0.12	0.05	389292
Colombia	0.02	0.06	0.08	0.11	0.56	0.1	0.06	5634
Croatia	0.03	0.1	0.14	0.2	1.02	0.16	0.1	12469
Cyprus	0.01	0.14	0.2	0.28	1.44	0.25	0.19	15467
Czech Republic	0.03	0.09	0.12	0.16	0.65	0.13	0.05	6400
Denmark	0.01	0.07	0.1	0.16	1.29	0.13	0.11	43613
Egypt	0.03	0.1	0.13	0.18	0.68	0.15	0.08	23751
Estonia	0.01	0.07	0.11	0.18	0.68	0.14	0.09	3059
Finland	0.01	0.08	0.11	0.15	1.44	0.13	0.09	32635
France	0.01	0.08	0.11	0.16	1.44	0.13	0.09	192512
Germany	0.01	0.09	0.14	0.26	1.44	0.24	0.25	244245
Greece	0.01	0.1	0.14	0.19	0.9	0.16	0.09	64858
Hong Kong	0.02	0.11	0.15	0.23	1.09	0.18	0.1	294913
Hungary	0.02	0.09	0.13	0.2	0.74	0.16	0.1	8167
Iceland	0.03	0.07	0.09	0.14	0.61	0.11	0.07	3829
India	0.04	0.14	0.18	0.23	1.03	0.21	0.12	601167
Indonesia	0.02	0.11	0.16	0.25	1.15	0.2	0.13	71102
Ireland	0.03	0.08	0.11	0.19	1.44	0.16	0.14	9184
Israel	0.01	0.1	0.15	0.22	1.04	0.17	0.1	96086
Italy	0.01	0.07	0.09	0.12	0.69	0.11	0.05	76288
Jamaica	0.03	0.12	0.16	0.21	0.84	0.18	0.08	5250
Japan	0.02	0.08	0.11	0.15	1.1	0.12	0.07	946366
Jordan	0.02	0.1	0.12	0.15	0.88	0.13	0.06	28885
Kazakhstan	0.02	0.1	0.14	0.21	0.95	0.19	0.14	858
Kuwait	0.02	0.11	0.14	0.18	0.57	0.15	0.06	25686
Latvia	0.03	0.09	0.13	0.22	0.85	0.17	0.11	2416
Lithuania	0.02	0.08	0.12	0.17	1.02	0.14	0.09	5771
Luxembourg	0.02	0.08	0.1	0.13	0.52	0.11	0.05	2851
Macedonia	0.01	0.08	0.12	0.17	0.65	0.14	0.08	2170
Malaysia	0.02	0.09	0.14	0.2	1.15	0.16	0.1	230396
Malta	0.02	0.05	0.07	0.09	0.59	0.09	0.08	1089
Mexico	0.02	0.07	0.09	0.13	1.15	0.11	0.07	19681
Montenegro	0.01	0.13	0.19	0.28	0.87	0.22	0.13	1503
Morocco	0.02	0.07	0.1	0.12	0.52	0.1	0.04	11555
Netherlands	0.01	0.06	0.09	0.13	1.44	0.11	0.1	41315
New Zealand	0.02	0.06	0.08	0.14	1.1	0.12	0.11	20431
Nigeria	0.02	0.1	0.14	0.17	0.6	0.14	0.06	19053
Norway	0.03	0.09	0.14	0.21	1.26	0.17	0.11	46297
Oman	0.02	0.07	0.1	0.13	1.08	0.11	0.07	10941
Pakistan	0.03	0.11	0.15	0.23	1.15	0.21	0.18	54503
Peru	0.02	0.08	0.12	0.17	0.57	0.13	0.07	9366
Philippines	0.02	0.1	0.16	0.24	0.97	0.19	0.12	43117
Poland	0.02	0.11	0.16	0.26	1.44	0.21	0.15	96024
Portugal	0.01	0.07	0.1	0.15	1.18	0.13	0.1	14088
Romania	0.01	0.12	0.18	0.25	1.27	0.2	0.13	13401
Russian Federation	0.01	0.1	0.15	0.23	1.25	0.18	0.12	22498
Saudi Arabia	0.03	0.08	0.11	0.16	0.79	0.13	0.07	22323
Serbia	0.01	0.13	0.2	0.27	0.81	0.21	0.1	7064
Singapore	0.02	0.09	0.14	0.23	1.1	0.19	0.15	137623
Slovakia	0.01	0.08	0.12	0.18	0.55	0.14	0.09	1263
Slovenia	0.01	0.07	0.1	0.16	1.34	0.14	0.14	7301
South Africa	0.02	0.09	0.13	0.23	1.15	0.19	0.18	86881
South Korea	0.02	0.11	0.15	0.21	1.1	0.17	0.08	420952
Spain	0.01	0.06	0.09	0.13	0.95	0.1	0.06	40981
Sri Lanka	0.02	0.1	0.14	0.19	1.15	0.15	0.08	28564
Sweden	0.01	0.09	0.14	0.25	1.44	0.2	0.16	103719
Switzerland	0.01	0.06	0.09	0.12	1.44	0.11	0.08	59557
Taiwan	0.02	0.08	0.1	0.12	0.62	0.1	0.04	184783
Thailand	0.02	0.09	0.12	0.18	1.15	0.15	0.09	122910
Tunisia	0.02	0.06	0.07	0.09	0.52	0.08	0.04	9015
Turkey	0.01	0.1	0.13	0.18	1.25	0.15	0.07	81112
Ukraine	0.01	0.13	0.18	0.28	1.18	0.23	0.16	3815
United Arab Emirates	0.02	0.09	0.12	0.17	0.43	0.14	0.06	7554
United Kingdom	0.01	0.08	0.12	0.19	1.44	0.15	0.1	424906
United States	0.03	0.09	0.14	0.22	1.05	0.17	0.12	1736945
Venezuela	0.02	0.13	0.18	0.25	1.15	0.2	0.11	3496
Vietnam	0.02	0.11	0.14	0.19	0.62	0.15	0.06	57995

Table A.9: Exits classified as ”Defaults”.

Default	
Action Type	**Subcategory**
Bankruptcy filing	Administration, Arrangement, Canadian Companies' Creditors Arrangement Act (CCAA), Chapter 7,11,15 (United States bankruptcy code), Conservatorship, Insolvency, Japanese Corporate Reogranization Law (CRL), Judicial management, Liquidation, Pre-negotiation Chapter 11, Protection, Receivership, Rehabilitation, Rehabilitation (Thailand 1997), Reorganization, Restructuring, Section 304, Supreme Court declaration, Winding up, Work out, Sued by creditor, Petition withdrawn
Delisting	Due to bankruptcy
Default corporate action	Bankruptcy, Coupon & principal payment, Coupon payment only, Debt restructuring, Interest payment, Loan payment, Principal payment, Alternative Dispute Resolution (ADR, Japan only), Declared sick (India only), Regulatory action (Taiwan only), Financial difficulty and shutdown (Taiwan only), Buyback option

Table A.10: Exits classified as ”Other Exits”.

Other Exits	
Action Type	**Subcategory**
Delisting	Acquired/merged, Assimilated with underlying shares, Bid price below minimum, Cancellation of listing, Failure to meet listing requirements, Failure to pay listing fees, Inactive security, Insufficient assets, Insufficient capital and surplus, Insufficient number of market makers, Issue postponed, Lack of market maker interest, Lack of public interest, Liquidated, Not current in required filings, NP/FP finished, Privatized, Reorganization, Security called for redemptions, the company's request, Scheme of arrangement, Selective capital reduction of the company, From exchange to Over-the-Counter (OTC), Privatised

Table A.11: Number of defaults and other exits of 78 economics from 1990 to 2016.

Economy: Argentina					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	1	0	0.00	0	0.00
1993	1	0	0.00	0	0.00
1994	25	0	0.00	1	4.00
1995	97	0	0.00	4	4.12
1996	100	0	0.00	5	5.00
1997	97	0	0.00	12	12.37
1998	89	1	1.12	8	8.99
1999	85	1	1.18	12	14.12
2000	79	1	1.27	5	6.33
2001	75	2	2.67	12	16.00
2002	79	7	8.86	3	3.80
2003	76	2	2.63	3	3.95
2004	72	0	0.00	1	1.39
2005	73	0	0.00	1	1.37
2006	75	0	0.00	0	0.00
2007	80	0	0.00	1	1.25
2008	80	0	0.00	5	6.25
2009	75	1	1.33	6	8.00
2010	73	1	1.37	0	0.00
2011	73	0	0.00	0	0.00
2012	74	0	0.00	1	1.35
2013	73	0	0.00	4	5.48
2014	70	0	0.00	4	5.71
2015	68	0	0.00	1	1.47
2016	73	1	1.37	0	0.00

Economy: Australia					
		Defaults		Others	
Year	Active	#	%	#	%
1990	760	0	0.00	39	5.13
1991	741	4	0.54	26	3.51
1992	765	0	0.00	20	2.61
1993	847	0	0.00	11	1.30
1994	950	0	0.00	12	1.26
1995	985	1	0.10	24	2.44
1996	1034	1	0.10	29	2.80
1997	1085	2	0.18	56	5.16
1998	1081	3	0.28	66	6.11
1999	1132	3	0.27	50	4.42
2000	1259	10	0.79	58	4.61
2001	1259	27	2.14	63	5.00
2002	1253	8	0.64	59	4.71
2003	1286	8	0.62	53	4.12
2004	1393	4	0.29	46	3.30
2005	1522	5	0.33	55	3.61
2006	1658	3	0.18	76	4.58
2007	1839	4	0.22	78	4.24
2008	1834	25	1.36	73	3.98
2009	1784	26	1.46	64	3.59
2010	1815	5	0.28	76	4.19
2011	1853	1	0.05	98	5.29
2012	1814	3	0.17	92	5.07
2013	1785	4	0.22	69	3.87
2014	1800	7	0.39	93	5.17
2015	1817	2	0.11	96	5.28
2016	1864	1	0.05	57	3.06

Economy: Austria

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	1	0	0.00	1	100.00
1991	78	0	0.00	0	0.00
1992	89	0	0.00	0	0.00
1993	100	0	0.00	0	0.00
1994	111	0	0.00	0	0.00
1995	118	0	0.00	1	0.85
1996	120	0	0.00	3	2.50
1997	123	0	0.00	4	3.25
1998	121	0	0.00	8	6.61
1999	119	0	0.00	10	8.40
2000	125	0	0.00	8	6.40
2001	127	2	1.57	6	4.72
2002	123	0	0.00	9	7.32
2003	122	0	0.00	13	10.66
2004	113	0	0.00	10	8.85
2005	111	0	0.00	8	7.21
2006	111	0	0.00	4	3.60
2007	115	0	0.00	5	4.35
2008	114	2	1.75	3	2.63
2009	111	1	0.90	3	2.70
2010	110	1	0.91	9	8.18
2011	102	0	0.00	9	8.82
2012	95	1	1.05	6	6.32
2013	91	0	0.00	4	4.40
2014	89	0	0.00	0	0.00
2015	91	0	0.00	11	12.09
2016	83	0	0.00	7	8.43

Economy: Bahrain

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	32	0	0.00	0	0.00
2005	36	0	0.00	0	0.00
2006	39	0	0.00	0	0.00
2007	40	0	0.00	1	2.50
2008	41	1	2.44	2	4.88
2009	38	0	0.00	1	2.63
2010	39	0	0.00	1	2.56
2011	38	1	2.63	2	5.26
2012	35	0	0.00	3	8.57
2013	32	0	0.00	0	0.00
2014	35	0	0.00	0	0.00
2015	35	0	0.00	2	5.71
2016	37	0	0.00	3	8.11

Economy: Bangladesh					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	161	0	0.00	0	0.00
2000	171	0	0.00	37	21.64
2001	144	0	0.00	30	20.83
2002	126	0	0.00	12	9.52
2003	125	0	0.00	22	17.60
2004	111	0	0.00	4	3.60
2005	208	0	0.00	1	0.48
2006	216	0	0.00	2	0.93
2007	226	0	0.00	2	0.88
2008	235	0	0.00	6	2.55
2009	237	0	0.00	42	17.72
2010	233	0	0.00	9	3.86
2011	231	0	0.00	3	1.30
2012	241	0	0.00	0	0.00
2013	256	0	0.00	1	0.39
2014	273	0	0.00	0	0.00
2015	285	0	0.00	0	0.00
2016	294	0	0.00	1	0.34

Economy: Belgium					
		Defaults		Others	
Year	Active	#	%	#	%
1990	114	0	0.00	1	0.88
1991	138	0	0.00	2	1.45
1992	139	0	0.00	0	0.00
1993	143	0	0.00	0	0.00
1994	149	0	0.00	1	0.67
1995	157	0	0.00	0	0.00
1996	170	0	0.00	5	2.94
1997	180	0	0.00	15	8.33
1998	191	0	0.00	16	8.38
1999	198	2	1.01	5	2.53
2000	200	0	0.00	6	3.00
2001	198	2	1.01	8	4.04
2002	190	3	1.58	11	5.79
2003	186	1	0.54	9	4.84
2004	181	1	0.55	10	5.52
2005	182	1	0.55	10	5.49
2006	192	2	1.04	6	3.13
2007	223	1	0.45	10	4.48
2008	225	0	0.00	10	4.44
2009	220	1	0.45	6	2.73
2010	218	0	0.00	11	5.05
2011	208	0	0.00	10	4.81
2012	204	1	0.49	3	1.47
2013	207	2	0.97	11	5.31
2014	197	1	0.51	16	8.12
2015	190	0	0.00	8	4.21
2016	196	1	0.51	7	3.57

Economy: Bosnia and Herzegovina

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	0	0	NaN	0	NaN
2005	0	0	NaN	0	NaN
2006	287	0	0.00	0	0.00
2007	326	0	0.00	1	0.31
2008	338	0	0.00	27	7.99
2009	316	0	0.00	114	36.08
2010	211	0	0.00	39	18.48
2011	186	0	0.00	50	26.88
2012	150	0	0.00	20	13.33
2013	144	0	0.00	18	12.50
2014	149	0	0.00	16	10.74
2015	189	0	0.00	11	5.82
2016	248	0	0.00	4	1.61

Economy: Brazil

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	266	0	0.00	0	0.00
1995	298	0	0.00	5	1.68
1996	309	0	0.00	6	1.94
1997	324	1	0.31	22	6.79
1998	357	1	0.28	32	8.96
1999	349	1	0.29	26	7.45
2000	335	2	0.60	29	8.66
2001	314	0	0.00	34	10.83
2002	296	1	0.34	23	7.77
2003	287	2	0.70	14	4.88
2004	284	0	0.00	14	4.93
2005	286	1	0.35	17	5.94
2006	301	0	0.00	14	4.65
2007	356	0	0.00	14	3.93
2008	355	1	0.28	21	5.92
2009	343	0	0.00	14	4.08
2010	344	0	0.00	19	5.52
2011	338	0	0.00	14	4.14
2012	334	6	1.80	22	6.59
2013	323	7	2.17	8	2.48
2014	315	6	1.90	10	3.17
2015	319	2	0.63	14	4.39
2016	322	3	0.93	13	4.04

Economy: Bulgaria

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	14	0	0.00	0	0.00
2001	25	0	0.00	0	0.00
2002	32	0	0.00	0	0.00
2003	36	0	0.00	1	2.78
2004	39	0	0.00	0	0.00
2005	141	1	0.71	1	0.71
2006	218	0	0.00	0	0.00
2007	242	0	0.00	8	3.31
2008	256	0	0.00	16	6.25
2009	243	0	0.00	21	8.64
2010	228	1	0.44	25	10.96
2011	208	0	0.00	20	9.62
2012	199	0	0.00	18	9.05
2013	189	0	0.00	13	6.88
2014	185	2	1.08	15	8.11
2015	179	0	0.00	10	5.59
2016	194	0	0.00	5	2.58

Economy: Canada

		Defaults		Others	
Year	Active	#	%	#	%
1990	925	0	0.00	63	6.81
1991	927	0	0.00	52	5.61
1992	984	1	0.10	22	2.24
1993	1167	0	0.00	6	0.51
1994	1335	0	0.00	8	0.60
1995	1469	0	0.00	15	1.02
1996	1658	0	0.00	35	2.11
1997	1893	6	0.32	101	5.34
1998	1992	7	0.35	202	10.14
1999	1920	13	0.68	706	36.77
2000	1340	8	0.60	182	13.58
2001	1233	20	1.62	227	18.41
2002	1052	6	0.57	95	9.03
2003	1048	13	1.24	85	8.11
2004	1078	6	0.56	77	7.14
2005	1120	2	0.18	82	7.32
2006	1167	3	0.26	93	7.97
2007	1225	3	0.24	108	8.82
2008	1206	12	1.00	98	8.13
2009	1155	13	1.13	114	9.87
2010	1147	3	0.26	82	7.15
2011	1168	5	0.43	84	7.19
2012	1154	6	0.52	89	7.71
2013	1137	3	0.26	82	7.21
2014	1148	7	0.61	88	7.67
2015	1165	7	0.60	93	7.98
2016	1142	11	0.96	73	6.39

Economy: Chile					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	145	0	0.00	0	0.00
1995	167	0	0.00	1	0.60
1996	177	0	0.00	0	0.00
1997	190	0	0.00	0	0.00
1998	193	0	0.00	4	2.07
1999	192	0	0.00	9	4.69
2000	184	0	0.00	6	3.26
2001	181	1	0.55	6	3.31
2002	179	1	0.56	5	2.79
2003	176	0	0.00	7	3.98
2004	180	0	0.00	2	1.11
2005	185	0	0.00	5	2.70
2006	186	0	0.00	7	3.76
2007	181	0	0.00	3	1.66
2008	181	0	0.00	5	2.76
2009	181	0	0.00	5	2.76
2010	181	0	0.00	8	4.42
2011	178	0	0.00	6	3.37
2012	182	0	0.00	7	3.85
2013	183	0	0.00	5	2.73
2014	181	0	0.00	2	1.10
2015	186	0	0.00	9	4.84
2016	188	0	0.00	7	3.72

Economy: China					
		Defaults		Others	
Year	Active	#	%	#	%
1990	8	0	0.00	0	0.00
1991	10	0	0.00	0	0.00
1992	45	0	0.00	0	0.00
1993	159	0	0.00	0	0.00
1994	271	1	0.37	0	0.00
1995	308	6	1.95	0	0.00
1996	518	10	1.93	0	0.00
1997	730	15	2.05	1	0.14
1998	870	34	3.91	1	0.11
1999	948	23	2.43	3	0.32
2000	1093	27	2.47	5	0.46
2001	1190	49	4.12	13	1.09
2002	1252	51	4.07	12	0.96
2003	1305	43	3.30	12	0.92
2004	1457	106	7.28	14	0.96
2005	1445	93	6.44	16	1.11
2006	1462	62	4.24	32	2.19
2007	1538	51	3.32	32	2.08
2008	1583	39	2.46	13	0.82
2009	1687	38	2.25	18	1.07
2010	2013	39	1.94	16	0.79
2011	2263	14	0.62	11	0.49
2012	2416	15	0.62	9	0.37
2013	2431	14	0.58	8	0.33
2014	2543	5	0.20	11	0.43
2015	2759	2	0.07	12	0.43
2016	2972	1	0.03	4	0.13

Economy: Colombia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	1	0	0.00	0	0.00
1995	48	0	0.00	0	0.00
1996	51	0	0.00	4	7.84
1997	52	0	0.00	6	11.54
1998	62	0	0.00	12	19.35
1999	53	0	0.00	4	7.55
2000	51	0	0.00	5	9.80
2001	54	0	0.00	6	11.11
2002	50	0	0.00	1	2.00
2003	53	0	0.00	2	3.77
2004	53	0	0.00	2	3.77
2005	60	0	0.00	7	11.67
2006	53	0	0.00	8	15.09
2007	52	0	0.00	4	7.69
2008	48	0	0.00	4	8.33
2009	49	0	0.00	3	6.12
2010	49	0	0.00	1	2.04
2011	48	0	0.00	1	2.08
2012	50	1	2.00	2	4.00
2013	49	0	0.00	1	2.04
2014	50	0	0.00	3	6.00
2015	47	0	0.00	1	2.13
2016	51	0	0.00	3	5.88

Economy: Croatia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	30	0	0.00	0	0.00
2003	47	0	0.00	2	4.26
2004	56	0	0.00	2	3.57
2005	61	0	0.00	2	3.28
2006	202	0	0.00	3	1.49
2007	224	0	0.00	4	1.79
2008	221	0	0.00	30	13.57
2009	192	0	0.00	23	11.98
2010	172	1	0.58	13	7.56
2011	163	0	0.00	10	6.13
2012	157	1	0.64	14	8.92
2013	145	0	0.00	14	9.66
2014	147	1	0.68	14	9.52
2015	138	0	0.00	11	7.97
2016	139	0	0.00	8	5.76

Economy: Cyprus

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	37	0	0.00	1	2.70
1997	43	0	0.00	0	0.00
1998	50	0	0.00	2	4.00
1999	59	0	0.00	1	1.69
2000	120	0	0.00	3	2.50
2001	144	0	0.00	5	3.47
2002	149	0	0.00	0	0.00
2003	150	0	0.00	3	2.00
2004	149	0	0.00	5	3.36
2005	146	0	0.00	6	4.11
2006	142	0	0.00	3	2.11
2007	144	0	0.00	7	4.86
2008	140	0	0.00	11	7.86
2009	129	0	0.00	9	6.98
2010	124	0	0.00	10	8.06
2011	114	0	0.00	11	9.65
2012	105	0	0.00	22	20.95
2013	86	2	2.33	21	24.42
2014	67	0	0.00	9	13.43
2015	67	0	0.00	4	5.97
2016	79	0	0.00	1	1.27

Economy: Czech Republic

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	1	0	0.00	0	0.00
1995	51	0	0.00	1	1.96
1996	148	0	0.00	0	0.00
1997	586	0	0.00	319	54.44
1998	268	1	0.37	30	11.19
1999	238	3	1.26	85	35.71
2000	152	7	4.61	24	15.79
2001	122	2	1.64	39	31.97
2002	82	1	1.22	21	25.61
2003	60	0	0.00	15	25.00
2004	48	0	0.00	11	22.92
2005	37	0	0.00	15	40.54
2006	24	0	0.00	8	33.33
2007	17	0	0.00	2	11.76
2008	16	0	0.00	0	0.00
2009	17	0	0.00	4	23.53
2010	16	0	0.00	0	0.00
2011	19	1	5.26	1	5.26
2012	17	0	0.00	1	5.88
2013	17	0	0.00	3	17.65
2014	15	0	0.00	1	6.67
2015	15	0	0.00	0	0.00
2016	19	0	0.00	2	10.53

Economy: Denmark

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	105	0	0.00	1	0.95
1991	145	0	0.00	1	0.69
1992	167	0	0.00	0	0.00
1993	173	0	0.00	0	0.00
1994	182	0	0.00	0	0.00
1995	208	0	0.00	0	0.00
1996	221	0	0.00	0	0.00
1997	226	0	0.00	5	2.21
1998	233	0	0.00	11	4.72
1999	227	0	0.00	12	5.29
2000	225	0	0.00	10	4.44
2001	219	5	2.28	15	6.85
2002	199	2	1.01	10	5.03
2003	191	1	0.52	9	4.71
2004	184	2	1.09	10	5.43
2005	180	0	0.00	9	5.00
2006	198	0	0.00	6	3.03
2007	223	1	0.45	3	1.35
2008	228	1	0.44	9	3.95
2009	219	4	1.83	6	2.74
2010	213	0	0.00	13	6.10
2011	202	2	0.99	10	4.95
2012	191	2	1.05	11	5.76
2013	181	4	2.21	10	5.52
2014	170	2	1.18	13	7.65
2015	159	1	0.63	6	3.77
2016	156	0	0.00	13	8.33

Economy: Egypt

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	0	0	NaN	0	NaN
2005	0	0	NaN	0	NaN
2006	172	0	0.00	4	2.33
2007	194	0	0.00	4	2.06
2008	205	0	0.00	2	0.98
2009	208	0	0.00	8	3.85
2010	218	0	0.00	20	9.17
2011	214	0	0.00	3	1.40
2012	217	0	0.00	5	2.30
2013	223	0	0.00	1	0.45
2014	231	0	0.00	4	1.73
2015	236	1	0.42	3	1.27
2016	240	0	0.00	1	0.42

Economy: Estonia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	17	0	0.00	0	0.00
1998	19	0	0.00	0	0.00
1999	20	0	0.00	0	0.00
2000	21	0	0.00	3	14.29
2001	18	0	0.00	3	16.67
2002	15	0	0.00	3	20.00
2003	12	0	0.00	0	0.00
2004	12	0	0.00	0	0.00
2005	15	0	0.00	1	6.67
2006	16	0	0.00	2	12.50
2007	17	0	0.00	0	0.00
2008	18	0	0.00	0	0.00
2009	18	0	0.00	2	11.11
2010	17	0	0.00	1	5.88
2011	16	0	0.00	0	0.00
2012	17	0	0.00	0	0.00
2013	17	0	0.00	0	0.00
2014	17	0	0.00	1	5.88
2015	17	0	0.00	0	0.00
2016	18	0	0.00	0	0.00

Economy: Finland

		Defaults		Others	
Year	Active	#	%	#	%
1990	17	0	0.00	1	5.88
1991	27	0	0.00	0	0.00
1992	92	0	0.00	0	0.00
1993	95	0	0.00	0	0.00
1994	99	0	0.00	1	1.01
1995	106	0	0.00	0	0.00
1996	111	0	0.00	0	0.00
1997	124	0	0.00	0	0.00
1998	134	1	0.75	5	3.73
1999	156	0	0.00	9	5.77
2000	165	0	0.00	11	6.67
2001	162	1	0.62	9	5.56
2002	153	1	0.65	5	3.27
2003	148	1	0.68	5	3.38
2004	144	0	0.00	9	6.25
2005	140	0	0.00	5	3.57
2006	141	0	0.00	7	4.96
2007	138	0	0.00	5	3.62
2008	134	1	0.75	3	2.24
2009	131	1	0.76	2	1.53
2010	129	0	0.00	3	2.33
2011	126	1	0.79	1	0.79
2012	126	0	0.00	5	3.97
2013	127	2	1.57	1	0.79
2014	131	0	0.00	4	3.05
2015	141	3	2.13	3	2.13
2016	142	0	0.00	4	2.82

Economy: France					
		Defaults		Others	
Year	Active	#	%	#	%
1990	260	0	0.00	4	1.54
1991	414	0	0.00	15	3.62
1992	651	0	0.00	6	0.92
1993	674	0	0.00	9	1.34
1994	733	0	0.00	9	1.23
1995	764	0	0.00	6	0.79
1996	822	0	0.00	15	1.82
1997	888	1	0.11	61	6.87
1998	951	0	0.00	112	11.78
1999	928	0	0.00	55	5.93
2000	998	2	0.20	54	5.41
2001	1014	9	0.89	52	5.13
2002	987	6	0.61	58	5.88
2003	943	5	0.53	37	3.92
2004	933	2	0.21	55	5.89
2005	935	4	0.43	45	4.81
2006	983	3	0.31	37	3.76
2007	1038	4	0.39	44	4.24
2008	1029	9	0.87	59	5.73
2009	996	6	0.60	51	5.12
2010	979	4	0.41	76	7.76
2011	932	1	0.11	60	6.44
2012	897	1	0.11	66	7.36
2013	865	3	0.35	58	6.71
2014	853	2	0.23	46	5.39
2015	877	2	0.23	36	4.10
2016	894	3	0.34	23	2.57

Economy: Germany					
		Defaults		Others	
Year	Active	#	%	#	%
1990	195	0	0.00	2	1.03
1991	385	0	0.00	0	0.00
1992	413	0	0.00	3	0.73
1993	439	0	0.00	5	1.14
1994	610	0	0.00	2	0.33
1995	631	0	0.00	1	0.16
1996	661	4	0.61	9	1.36
1997	696	3	0.43	19	2.73
1998	770	2	0.26	15	1.95
1999	954	2	0.21	18	1.89
2000	1101	2	0.18	24	2.18
2001	1144	27	2.36	26	2.27
2002	1152	39	3.39	75	6.51
2003	1063	18	1.69	52	4.89
2004	1029	8	0.78	30	2.92
2005	1064	4	0.38	39	3.67
2006	1217	7	0.58	33	2.71
2007	1377	5	0.36	45	3.27
2008	1488	17	1.14	59	3.97
2009	1479	11	0.74	76	5.14
2010	1528	1	0.07	80	5.24
2011	1694	4	0.24	243	14.34
2012	1488	10	0.67	411	27.62
2013	1099	16	1.46	66	6.01
2014	1049	7	0.67	74	7.05
2015	1010	7	0.69	81	8.02
2016	954	3	0.31	46	4.82

Economy: Greece

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	90	0	0.00	0	0.00
1993	97	0	0.00	0	0.00
1994	162	0	0.00	0	0.00
1995	183	0	0.00	1	0.55
1996	202	0	0.00	6	2.97
1997	211	0	0.00	3	1.42
1998	233	0	0.00	4	1.72
1999	269	0	0.00	6	2.23
2000	316	0	0.00	7	2.22
2001	327	0	0.00	13	3.98
2002	333	0	0.00	18	5.41
2003	328	0	0.00	9	2.74
2004	329	0	0.00	10	3.04
2005	325	0	0.00	20	6.15
2006	307	0	0.00	15	4.89
2007	298	0	0.00	13	4.36
2008	295	0	0.00	15	5.08
2009	284	0	0.00	12	4.23
2010	273	0	0.00	12	4.40
2011	261	0	0.00	14	5.36
2012	247	0	0.00	23	9.31
2013	224	0	0.00	16	7.14
2014	209	0	0.00	12	5.74
2015	199	1	0.50	11	5.53
2016	193	0	0.00	5	2.59

Economy: Hong Kong

		Defaults		Others	
Year	Active	#	%	#	%
1990	238	0	0.00	4	1.68
1991	318	0	0.00	4	1.26
1992	364	0	0.00	2	0.55
1993	432	0	0.00	2	0.46
1994	482	0	0.00	7	1.45
1995	509	0	0.00	5	0.98
1996	553	0	0.00	10	1.81
1997	632	0	0.00	8	1.27
1998	659	2	0.30	9	1.37
1999	698	7	1.00	6	0.86
2000	786	5	0.64	9	1.15
2001	873	10	1.15	16	1.83
2002	971	4	0.41	18	1.85
2003	1025	5	0.49	28	2.73
2004	1061	0	0.00	30	2.83
2005	1103	3	0.27	30	2.72
2006	1143	2	0.17	21	1.84
2007	1222	2	0.16	13	1.06
2008	1252	7	0.56	15	1.20
2009	1302	3	0.23	12	0.92
2010	1380	1	0.07	19	1.38
2011	1444	1	0.07	19	1.32
2012	1494	1	0.07	22	1.47
2013	1591	4	0.25	18	1.13
2014	1689	1	0.06	19	1.12
2015	1808	8	0.44	20	1.11
2016	1905	7	0.37	11	0.58

Economy: Hungary					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	32	0	0.00	0	0.00
1996	37	0	0.00	1	2.70
1997	43	0	0.00	4	9.30
1998	46	0	0.00	1	2.17
1999	55	0	0.00	0	0.00
2000	57	1	1.75	4	7.02
2001	53	0	0.00	4	7.55
2002	49	0	0.00	8	16.33
2003	43	0	0.00	2	4.65
2004	43	0	0.00	3	6.98
2005	41	0	0.00	3	7.32
2006	41	0	0.00	5	12.20
2007	37	0	0.00	3	8.11
2008	36	0	0.00	0	0.00
2009	39	0	0.00	0	0.00
2010	44	0	0.00	0	0.00
2011	48	0	0.00	3	6.25
2012	51	1	1.96	3	5.88
2013	48	0	0.00	2	4.17
2014	48	0	0.00	2	4.17
2015	47	0	0.00	5	10.64
2016	43	1	2.33	3	6.98

Economy: Iceland					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	24	0	0.00	0	0.00
1997	34	0	0.00	0	0.00
1998	51	0	0.00	0	0.00
1999	59	0	0.00	1	1.69
2000	70	0	0.00	5	7.14
2001	69	0	0.00	7	10.14
2002	66	0	0.00	11	16.67
2003	57	0	0.00	16	28.07
2004	41	0	0.00	10	24.39
2005	32	0	0.00	7	21.88
2006	29	0	0.00	3	10.34
2007	29	0	0.00	3	10.34
2008	26	2	7.69	9	34.62
2009	16	1	6.25	2	12.50
2010	13	0	0.00	3	23.08
2011	11	0	0.00	0	0.00
2012	15	0	0.00	0	0.00
2013	18	0	0.00	0	0.00
2014	19	0	0.00	1	5.26
2015	21	0	0.00	0	0.00
2016	23	0	0.00	0	0.00

Economy: India

		Defaults		Others	
Year	Active	#	%	#	%
1990	250	0	0.00	1	0.40
1991	1284	0	0.00	0	0.00
1992	1527	1	0.07	6	0.39
1993	1961	0	0.00	38	1.94
1994	2949	0	0.00	33	1.12
1995	4219	2	0.05	45	1.07
1996	4680	5	0.11	244	5.21
1997	4501	11	0.24	772	17.15
1998	3809	9	0.24	523	13.73
1999	3573	11	0.31	479	13.41
2000	3354	0	0.00	197	5.87
2001	3312	2	0.06	139	4.20
2002	3345	4	0.12	822	24.57
2003	2645	6	0.23	168	6.35
2004	2669	5	0.19	134	5.02
2005	2760	3	0.11	243	8.80
2006	2756	5	0.18	54	1.96
2007	2997	4	0.13	30	1.00
2008	3168	6	0.19	57	1.80
2009	3256	19	0.58	41	1.26
2010	3445	19	0.55	67	1.94
2011	3577	18	0.50	46	1.29
2012	3776	47	1.24	83	2.20
2013	3834	60	1.56	101	2.63
2014	3901	43	1.10	35	0.90
2015	4110	45	1.09	235	5.72
2016	4100	11	0.27	24	0.59

Economy: Indonesia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	110	0	0.00	0	0.00
1992	140	0	0.00	0	0.00
1993	163	0	0.00	2	1.23
1994	208	0	0.00	5	2.40
1995	231	0	0.00	1	0.43
1996	250	1	0.40	0	0.00
1997	283	2	0.71	4	1.41
1998	301	19	6.31	2	0.66
1999	297	24	8.08	5	1.68
2000	298	12	4.03	12	4.03
2001	316	14	4.43	8	2.53
2002	326	7	2.15	14	4.29
2003	319	3	0.94	7	2.19
2004	324	4	1.23	13	4.01
2005	322	1	0.31	13	4.04
2006	327	0	0.00	6	1.83
2007	351	2	0.57	7	1.99
2008	365	0	0.00	16	4.38
2009	377	4	1.06	14	3.71
2010	391	2	0.51	10	2.56
2011	414	0	0.00	10	2.42
2012	441	1	0.23	5	1.13
2013	474	1	0.21	12	2.53
2014	490	2	0.41	4	0.82
2015	508	1	0.20	10	1.97
2016	518	2	0.39	0	0.00

Economy: Ireland

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	30	0	0.00	0	0.00
1991	31	0	0.00	0	0.00
1992	31	0	0.00	0	0.00
1993	35	0	0.00	0	0.00
1994	37	0	0.00	3	8.11
1995	35	0	0.00	0	0.00
1996	39	0	0.00	0	0.00
1997	49	0	0.00	2	4.08
1998	50	0	0.00	2	4.00
1999	52	0	0.00	3	5.77
2000	55	0	0.00	1	1.82
2001	55	0	0.00	6	10.91
2002	49	0	0.00	6	12.24
2003	43	0	0.00	5	11.63
2004	40	0	0.00	3	7.50
2005	39	0	0.00	2	5.13
2006	44	0	0.00	2	4.55
2007	49	0	0.00	1	2.04
2008	49	0	0.00	3	6.12
2009	47	1	2.13	5	10.64
2010	41	0	0.00	4	9.76
2011	37	0	0.00	2	5.41
2012	36	0	0.00	3	8.33
2013	37	1	2.70	1	2.70
2014	38	0	0.00	1	2.63
2015	39	0	0.00	3	7.69
2016	36	0	0.00	2	5.56

Economy: Israel

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	9	0	0.00	0	0.00
1995	84	0	0.00	0	0.00
1996	629	0	0.00	6	0.95
1997	647	0	0.00	19	2.94
1998	647	0	0.00	22	3.40
1999	640	0	0.00	17	2.66
2000	665	0	0.00	38	5.71
2001	637	0	0.00	59	9.26
2002	589	1	0.17	70	11.88
2003	536	0	0.00	39	7.28
2004	535	0	0.00	16	2.99
2005	550	0	0.00	23	4.18
2006	567	0	0.00	17	3.00
2007	613	0	0.00	17	2.77
2008	599	0	0.00	25	4.17
2009	578	0	0.00	18	3.11
2010	580	1	0.17	23	3.97
2011	570	1	0.18	36	6.32
2012	537	0	0.00	49	9.12
2013	496	2	0.40	31	6.25
2014	469	1	0.21	32	6.82
2015	442	1	0.23	20	4.52
2016	429	0	0.00	12	2.80

Economy: Italy					
		Defaults		Others	
Year	Active	#	%	#	%
1990	170	0	0.00	2	1.18
1991	183	0	0.00	2	1.09
1992	187	0	0.00	2	1.07
1993	186	0	0.00	2	1.08
1994	198	0	0.00	2	1.01
1995	216	0	0.00	6	2.78
1996	222	0	0.00	6	2.70
1997	228	0	0.00	13	5.70
1998	238	0	0.00	11	4.62
1999	258	0	0.00	7	2.71
2000	296	0	0.00	16	5.41
2001	298	0	0.00	18	6.04
2002	295	1	0.34	12	4.07
2003	292	6	2.05	24	8.22
2004	270	2	0.74	10	3.70
2005	277	0	0.00	11	3.97
2006	291	0	0.00	15	5.15
2007	308	0	0.00	13	4.22
2008	303	1	0.33	15	4.95
2009	299	3	1.00	16	5.35
2010	289	0	0.00	11	3.81
2011	294	0	0.00	11	3.74
2012	294	3	1.02	15	5.10
2013	298	2	0.67	16	5.37
2014	308	1	0.32	13	4.22
2015	327	1	0.31	18	5.50
2016	330	0	0.00	14	4.24

Economy: Jamaica					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	32	0	0.00	0	0.00
1994	35	0	0.00	0	0.00
1995	36	0	0.00	0	0.00
1996	36	0	0.00	1	2.78
1997	35	0	0.00	5	14.29
1998	30	0	0.00	0	0.00
1999	31	0	0.00	0	0.00
2000	33	0	0.00	0	0.00
2001	33	0	0.00	1	3.03
2002	32	0	0.00	0	0.00
2003	33	0	0.00	0	0.00
2004	33	0	0.00	0	0.00
2005	34	0	0.00	0	0.00
2006	36	0	0.00	1	2.78
2007	36	0	0.00	2	5.56
2008	38	0	0.00	2	5.26
2009	37	0	0.00	0	0.00
2010	45	0	0.00	0	0.00
2011	49	0	0.00	4	8.16
2012	46	0	0.00	4	8.70
2013	49	0	0.00	2	4.08
2014	50	0	0.00	1	2.00
2015	54	0	0.00	1	1.85
2016	63	0	0.00	2	3.17

Economy: Japan

		Defaults		Others	
Year	Active	#	%	#	%
1990	2405	0	0.00	5	0.21
1991	2529	0	0.00	2	0.08
1992	2557	3	0.12	3	0.12
1993	2646	4	0.15	6	0.23
1994	2786	0	0.00	5	0.18
1995	2971	2	0.07	5	0.17
1996	3133	5	0.16	7	0.22
1997	3267	7	0.21	16	0.49
1998	3338	15	0.45	22	0.66
1999	3411	8	0.23	40	1.17
2000	3581	12	0.34	54	1.51
2001	3709	16	0.43	59	1.59
2002	3808	30	0.79	96	2.52
2003	3846	19	0.49	96	2.50
2004	3939	13	0.33	87	2.21
2005	4029	9	0.22	88	2.18
2006	4149	2	0.05	83	2.00
2007	4208	6	0.14	99	2.35
2008	4201	36	0.86	108	2.57
2009	4118	28	0.68	135	3.28
2010	4017	9	0.22	129	3.21
2011	3932	4	0.10	100	2.54
2012	3896	6	0.15	98	2.52
2013	3868	3	0.08	74	1.91
2014	3882	0	0.00	44	1.13
2015	3951	4	0.10	68	1.72
2016	3983	0	0.00	66	1.66

Economy: Jordan

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	71	0	0.00	1	1.41
1997	105	0	0.00	0	0.00
1998	119	0	0.00	1	0.84
1999	122	0	0.00	0	0.00
2000	128	0	0.00	2	1.56
2001	133	0	0.00	7	5.26
2002	130	0	0.00	4	3.08
2003	139	0	0.00	3	2.16
2004	148	0	0.00	2	1.35
2005	164	0	0.00	2	1.22
2006	195	0	0.00	4	2.05
2007	210	0	0.00	3	1.43
2008	228	0	0.00	3	1.32
2009	233	0	0.00	8	3.43
2010	231	0	0.00	6	2.60
2011	230	0	0.00	4	1.74
2012	228	0	0.00	7	3.07
2013	222	0	0.00	2	0.90
2014	225	0	0.00	11	4.89
2015	216	0	0.00	6	2.78
2016	211	0	0.00	0	0.00

Economy: Kazakhstan

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	1	0	0.00	0	0.00
2002	7	0	0.00	0	0.00
2003	7	0	0.00	0	0.00
2004	8	0	0.00	2	25.00
2005	6	0	0.00	0	0.00
2006	6	0	0.00	4	66.67
2007	24	0	0.00	0	0.00
2008	26	0	0.00	0	0.00
2009	28	4	14.29	5	17.86
2010	22	1	4.55	4	18.18
2011	18	0	0.00	1	5.56
2012	22	2	9.09	0	0.00
2013	20	0	0.00	3	15.00
2014	19	0	0.00	5	26.32
2015	17	0	0.00	1	5.88
2016	29	0	0.00	0	0.00

Economy: Kuwait

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	51	0	0.00	0	0.00
1997	65	0	0.00	0	0.00
1998	67	0	0.00	0	0.00
1999	75	0	0.00	4	5.33
2000	72	0	0.00	2	2.78
2001	72	0	0.00	0	0.00
2002	80	0	0.00	2	2.50
2003	92	0	0.00	0	0.00
2004	103	0	0.00	0	0.00
2005	140	0	0.00	1	0.71
2006	158	0	0.00	0	0.00
2007	178	0	0.00	2	1.12
2008	187	0	0.00	5	2.67
2009	196	1	0.51	6	3.06
2010	200	0	0.00	8	4.00
2011	196	0	0.00	8	4.08
2012	199	0	0.00	6	3.02
2013	194	0	0.00	5	2.58
2014	195	0	0.00	6	3.08
2015	194	0	0.00	7	3.61
2016	195	0	0.00	14	7.18

Economy: Latvia					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	18	0	0.00	0	0.00
2001	34	0	0.00	3	8.82
2002	33	0	0.00	1	3.03
2003	32	0	0.00	7	21.88
2004	30	0	0.00	0	0.00
2005	33	0	0.00	0	0.00
2006	34	0	0.00	2	5.88
2007	36	0	0.00	0	0.00
2008	36	0	0.00	1	2.78
2009	35	0	0.00	2	5.71
2010	33	0	0.00	0	0.00
2011	33	0	0.00	1	3.03
2012	33	0	0.00	1	3.03
2013	33	0	0.00	2	6.06
2014	31	0	0.00	1	3.23
2015	32	1	3.13	3	9.38
2016	29	0	0.00	1	3.45

Economy: Lithuania					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	35	0	0.00	1	2.86
2001	36	0	0.00	0	0.00
2002	42	0	0.00	1	2.38
2003	44	0	0.00	4	9.09
2004	42	0	0.00	0	0.00
2005	42	0	0.00	0	0.00
2006	43	0	0.00	2	4.65
2007	42	0	0.00	3	7.14
2008	40	0	0.00	0	0.00
2009	40	0	0.00	2	5.00
2010	41	0	0.00	2	4.88
2011	40	1	2.50	5	12.50
2012	34	0	0.00	0	0.00
2013	35	1	2.86	1	2.86
2014	37	1	2.70	2	5.41
2015	36	0	0.00	5	13.89
2016	32	0	0.00	0	0.00

Economy: Luxembourg					
		Defaults		Others	
Year	Active	#	%	#	%
1990	1	0	0.00	0	0.00
1991	1	0	0.00	0	0.00
1992	1	0	0.00	0	0.00
1993	1	0	0.00	0	0.00
1994	1	0	0.00	0	0.00
1995	24	0	0.00	0	0.00
1996	25	0	0.00	0	0.00
1997	30	0	0.00	2	6.67
1998	30	0	0.00	1	3.33
1999	32	0	0.00	4	12.50
2000	32	0	0.00	3	9.38
2001	29	0	0.00	2	6.90
2002	27	0	0.00	2	7.41
2003	26	0	0.00	0	0.00
2004	26	0	0.00	0	0.00
2005	27	0	0.00	1	3.70
2006	27	0	0.00	3	11.11
2007	25	0	0.00	3	12.00
2008	23	0	0.00	2	8.70
2009	21	0	0.00	3	14.29
2010	19	0	0.00	1	5.26
2011	19	0	0.00	2	10.53
2012	18	0	0.00	2	11.11
2013	16	0	0.00	1	6.25
2014	18	0	0.00	2	11.11
2015	18	0	0.00	2	11.11
2016	18	0	0.00	1	5.56

Economy: Macedonia					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	11	0	0.00	0	0.00
2005	68	0	0.00	0	0.00
2006	88	0	0.00	0	0.00
2007	101	0	0.00	7	6.93
2008	98	0	0.00	7	7.14
2009	91	1	1.10	6	6.59
2010	85	0	0.00	14	16.47
2011	72	0	0.00	4	5.56
2012	72	0	0.00	10	13.89
2013	67	0	0.00	6	8.96
2014	72	0	0.00	4	5.56
2015	88	0	0.00	3	3.41
2016	128	2	1.56	0	0.00

Economy: Malaysia

		Defaults		Others	
Year	Active	#	%	#	%
1990	271	0	0.00	0	0.00
1991	314	0	0.00	0	0.00
1992	361	0	0.00	1	0.28
1993	405	0	0.00	0	0.00
1994	472	0	0.00	0	0.00
1995	524	0	0.00	0	0.00
1996	615	0	0.00	0	0.00
1997	703	0	0.00	1	0.14
1998	738	14	1.90	19	2.57
1999	739	8	1.08	11	1.49
2000	775	13	1.68	8	1.03
2001	791	15	1.90	15	1.90
2002	828	13	1.57	24	2.90
2003	881	7	0.79	15	1.70
2004	951	6	0.63	8	0.84
2005	1027	5	0.49	26	2.53
2006	1053	14	1.33	26	2.47
2007	1055	13	1.23	60	5.69
2008	1027	23	2.24	40	3.89
2009	996	19	1.91	30	3.01
2010	999	22	2.20	28	2.80
2011	990	11	1.11	33	3.33
2012	976	9	0.92	35	3.59
2013	953	5	0.52	27	2.83
2014	939	2	0.21	16	1.70
2015	935	1	0.11	14	1.50
2016	936	1	0.11	14	1.50

Economy: Malta

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	5	0	0.00	0	0.00
1997	6	0	0.00	0	0.00
1998	7	0	0.00	0	0.00
1999	7	0	0.00	0	0.00
2000	9	0	0.00	0	0.00
2001	11	0	0.00	0	0.00
2002	12	0	0.00	1	8.33
2003	11	0	0.00	0	0.00
2004	11	0	0.00	0	0.00
2005	11	0	0.00	0	0.00
2006	12	0	0.00	0	0.00
2007	13	0	0.00	0	0.00
2008	16	0	0.00	2	12.50
2009	14	0	0.00	2	14.29
2010	12	0	0.00	0	0.00
2011	15	0	0.00	0	0.00
2012	20	0	0.00	0	0.00
2013	21	0	0.00	0	0.00
2014	21	0	0.00	0	0.00
2015	22	0	0.00	2	9.09
2016	22	0	0.00	0	0.00

Economy: Mexico

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	96	0	0.00	3	3.13
1995	100	0	0.00	1	1.00
1996	115	0	0.00	3	2.61
1997	132	1	0.76	8	6.06
1998	126	0	0.00	15	11.90
1999	119	1	0.84	11	9.24
2000	113	1	0.88	6	5.31
2001	110	1	0.91	4	3.64
2002	110	1	0.91	8	7.27
2003	108	2	1.85	4	3.70
2004	109	0	0.00	4	3.67
2005	114	0	0.00	6	5.26
2006	113	0	0.00	2	1.77
2007	117	0	0.00	9	7.69
2008	116	2	1.72	8	6.90
2009	108	2	1.85	2	1.85
2010	116	3	2.59	2	1.72
2011	116	0	0.00	8	6.90
2012	114	0	0.00	3	2.63
2013	126	5	3.97	2	1.59
2014	124	3	2.42	2	1.61
2015	132	1	0.76	3	2.27
2016	139	0	0.00	4	2.88

Economy: Montenegro

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	40	0	0.00	1	2.50
2004	69	0	0.00	3	4.35
2005	101	0	0.00	2	1.98
2006	132	0	0.00	3	2.27
2007	150	0	0.00	5	3.33
2008	147	0	0.00	29	19.73
2009	126	0	0.00	27	21.43
2010	101	0	0.00	3	2.97
2011	100	0	0.00	26	26.00
2012	75	0	0.00	18	24.00
2013	61	0	0.00	13	21.31
2014	52	0	0.00	7	13.46
2015	57	0	0.00	0	0.00
2016	106	0	0.00	0	0.00

Economy: Morocco

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	16	0	0.00	0	0.00
1997	43	0	0.00	0	0.00
1998	49	0	0.00	0	0.00
1999	52	0	0.00	1	1.92
2000	53	0	0.00	0	0.00
2001	55	0	0.00	1	1.82
2002	54	0	0.00	0	0.00
2003	54	0	0.00	2	3.70
2004	54	0	0.00	1	1.85
2005	55	0	0.00	2	3.64
2006	63	0	0.00	1	1.59
2007	72	0	0.00	0	0.00
2008	78	0	0.00	1	1.28
2009	77	0	0.00	1	1.30
2010	78	0	0.00	4	5.13
2011	77	0	0.00	1	1.30
2012	77	0	0.00	0	0.00
2013	78	0	0.00	3	3.85
2014	76	0	0.00	2	2.63
2015	76	0	0.00	3	3.95
2016	74	0	0.00	1	1.35

Economy: Netherlands

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	137	0	0.00	3	2.19
1991	154	0	0.00	1	0.65
1992	157	0	0.00	0	0.00
1993	165	0	0.00	0	0.00
1994	168	0	0.00	1	0.60
1995	178	0	0.00	0	0.00
1996	187	1	0.53	0	0.00
1997	201	0	0.00	11	5.47
1998	210	1	0.48	8	3.81
1999	221	0	0.00	16	7.24
2000	213	0	0.00	18	8.45
2001	203	8	3.94	19	9.36
2002	186	8	4.30	9	4.84
2003	171	5	2.92	12	7.02
2004	156	0	0.00	6	3.85
2005	156	0	0.00	8	5.13
2006	153	1	0.65	7	4.58
2007	150	0	0.00	9	6.00
2008	143	1	0.70	8	5.59
2009	140	4	2.86	2	1.43
2010	135	0	0.00	5	3.70
2011	132	0	0.00	7	5.30
2012	127	0	0.00	5	3.94
2013	124	1	0.81	8	6.45
2014	122	2	1.64	6	4.92
2015	127	2	1.57	7	5.51
2016	124	0	0.00	5	4.03

Economy: New Zealand					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	30	0	0.00	0	0.00
1993	33	0	0.00	0	0.00
1994	41	0	0.00	0	0.00
1995	43	0	0.00	1	2.33
1996	47	0	0.00	1	2.13
1997	49	0	0.00	0	0.00
1998	51	0	0.00	0	0.00
1999	56	0	0.00	0	0.00
2000	64	0	0.00	0	0.00
2001	72	0	0.00	0	0.00
2002	77	0	0.00	0	0.00
2003	89	0	0.00	0	0.00
2004	104	0	0.00	0	0.00
2005	108	0	0.00	0	0.00
2006	114	0	0.00	0	0.00
2007	122	0	0.00	0	0.00
2008	123	0	0.00	1	0.81
2009	123	0	0.00	0	0.00
2010	128	0	0.00	3	2.34
2011	130	0	0.00	2	1.54
2012	131	0	0.00	5	3.82
2013	135	2	1.48	7	5.19
2014	143	0	0.00	6	4.20
2015	142	0	0.00	5	3.52
2016	148	1	0.68	7	4.73

Economy: Nigeria					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	102	0	0.00	0	0.00
2003	107	0	0.00	5	4.67
2004	130	0	0.00	4	3.08
2005	140	0	0.00	2	1.43
2006	157	0	0.00	3	1.91
2007	170	0	0.00	1	0.59
2008	197	0	0.00	12	6.09
2009	198	0	0.00	9	4.55
2010	193	0	0.00	7	3.63
2011	189	0	0.00	12	6.35
2012	180	0	0.00	2	1.11
2013	186	0	0.00	6	3.23
2014	183	0	0.00	4	2.19
2015	180	0	0.00	1	0.56
2016	184	1	0.54	10	5.43

Economy: Norway

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	38	0	0.00	3	7.89
1991	61	0	0.00	0	0.00
1992	82	0	0.00	0	0.00
1993	98	0	0.00	0	0.00
1994	112	0	0.00	0	0.00
1995	134	0	0.00	0	0.00
1996	157	0	0.00	0	0.00
1997	209	0	0.00	8	3.83
1998	228	0	0.00	11	4.82
1999	226	0	0.00	22	9.73
2000	228	1	0.44	29	12.72
2001	238	3	1.26	18	7.56
2002	224	4	1.79	9	4.02
2003	218	4	1.83	26	11.93
2004	211	0	0.00	13	6.16
2005	253	0	0.00	17	6.72
2006	288	0	0.00	30	10.42
2007	298	0	0.00	33	11.07
2008	278	2	0.72	28	10.07
2009	251	5	1.99	21	8.37
2010	242	1	0.41	18	7.44
2011	237	1	0.42	11	4.64
2012	230	1	0.43	13	5.65
2013	227	3	1.32	22	9.69
2014	220	0	0.00	14	6.36
2015	221	4	1.81	14	6.33
2016	223	6	2.69	5	2.24

Economy: Oman

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	52	0	0.00	0	0.00
1997	71	0	0.00	0	0.00
1998	84	0	0.00	5	5.95
1999	80	0	0.00	6	7.50
2000	77	0	0.00	2	2.60
2001	76	0	0.00	13	17.11
2002	86	0	0.00	0	0.00
2003	95	0	0.00	2	2.11
2004	99	0	0.00	2	2.02
2005	103	0	0.00	5	4.85
2006	105	0	0.00	2	1.90
2007	105	0	0.00	4	3.81
2008	103	0	0.00	11	10.68
2009	93	0	0.00	1	1.08
2010	94	0	0.00	6	6.38
2011	89	0	0.00	4	4.49
2012	89	0	0.00	3	3.37
2013	92	0	0.00	0	0.00
2014	96	0	0.00	5	5.21
2015	95	0	0.00	6	6.32
2016	97	0	0.00	1	1.03

Economy: Pakistan					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	347	0	0.00	0	0.00
1999	420	0	0.00	2	0.48
2000	446	0	0.00	0	0.00
2001	461	0	0.00	7	1.52
2002	491	0	0.00	3	0.61
2003	508	0	0.00	0	0.00
2004	523	0	0.00	2	0.38
2005	538	0	0.00	7	1.30
2006	543	0	0.00	10	1.84
2007	557	0	0.00	6	1.08
2008	563	0	0.00	9	1.60
2009	572	0	0.00	30	5.24
2010	551	0	0.00	26	4.72
2011	531	0	0.00	48	9.04
2012	491	0	0.00	26	5.30
2013	474	0	0.00	10	2.11
2014	475	1	0.21	10	2.11
2015	474	0	0.00	12	2.53
2016	472	0	0.00	12	2.54

Economy: Peru					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	1	0	0.00	0	0.00
1992	1	0	0.00	0	0.00
1993	1	0	0.00	0	0.00
1994	59	0	0.00	0	0.00
1995	90	0	0.00	0	0.00
1996	102	0	0.00	2	1.96
1997	126	0	0.00	8	6.35
1998	127	0	0.00	17	13.39
1999	117	0	0.00	19	16.24
2000	106	2	1.89	18	16.98
2001	92	0	0.00	10	10.87
2002	91	2	2.20	8	8.79
2003	88	2	2.27	9	10.23
2004	88	1	1.14	5	5.68
2005	89	0	0.00	3	3.37
2006	94	0	0.00	4	4.26
2007	99	1	1.01	1	1.01
2008	98	0	0.00	4	4.08
2009	97	0	0.00	3	3.09
2010	96	0	0.00	4	4.17
2011	93	0	0.00	5	5.38
2012	91	0	0.00	7	7.69
2013	86	0	0.00	6	6.98
2014	83	0	0.00	3	3.61
2015	88	0	0.00	5	5.68
2016	104	0	0.00	3	2.88

Economy: Philippines					
		Defaults		Others	
Year	Active	#	%	#	%
1990	66	0	0.00	0	0.00
1991	71	0	0.00	0	0.00
1992	94	0	0.00	1	1.06
1993	115	1	0.87	0	0.00
1994	139	0	0.00	4	2.88
1995	161	0	0.00	1	0.62
1996	183	0	0.00	0	0.00
1997	194	0	0.00	2	1.03
1998	197	1	0.51	5	2.54
1999	200	4	2.00	3	1.50
2000	200	2	1.00	6	3.00
2001	198	2	1.01	5	2.53
2002	204	6	2.94	9	4.41
2003	202	5	2.48	2	0.99
2004	206	6	2.91	5	2.43
2005	204	3	1.47	3	1.47
2006	208	2	0.96	4	1.92
2007	221	1	0.45	8	3.62
2008	219	3	1.37	0	0.00
2009	224	2	0.89	1	0.45
2010	229	0	0.00	1	0.44
2011	240	0	0.00	1	0.42
2012	247	1	0.40	9	3.64
2013	247	0	0.00	3	1.21
2014	253	0	0.00	2	0.79
2015	256	0	0.00	13	5.08
2016	247	0	0.00	2	0.81

Economy: Poland					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	31	0	0.00	0	0.00
1995	58	0	0.00	0	0.00
1996	76	0	0.00	0	0.00
1997	138	0	0.00	1	0.72
1998	193	0	0.00	3	1.55
1999	214	0	0.00	3	1.40
2000	224	1	0.45	6	2.68
2001	226	1	0.44	5	2.21
2002	226	1	0.44	20	8.85
2003	210	3	1.43	14	6.67
2004	222	0	0.00	8	3.60
2005	244	1	0.41	9	3.69
2006	263	0	0.00	9	3.42
2007	339	0	0.00	9	2.65
2008	433	0	0.00	2	0.46
2009	467	1	0.21	9	1.93
2010	559	0	0.00	9	1.61
2011	748	0	0.00	13	1.74
2012	855	9	1.05	18	2.11
2013	882	5	0.57	32	3.63
2014	887	6	0.68	28	3.16
2015	902	12	1.33	38	4.21
2016	883	5	0.57	28	3.17

Economy: Portugal					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	1	0	0.00	0	0.00
1992	1	0	0.00	0	0.00
1993	78	0	0.00	1	1.28
1994	89	0	0.00	3	3.37
1995	97	0	0.00	1	1.03
1996	98	0	0.00	1	1.02
1997	105	0	0.00	7	6.67
1998	104	0	0.00	11	10.58
1999	105	0	0.00	14	13.33
2000	98	0	0.00	13	13.27
2001	86	0	0.00	11	12.79
2002	75	0	0.00	7	9.33
2003	70	0	0.00	3	4.29
2004	72	0	0.00	2	2.78
2005	72	0	0.00	3	4.17
2006	71	0	0.00	4	5.63
2007	70	0	0.00	6	8.57
2008	67	0	0.00	2	2.99
2009	65	0	0.00	3	4.62
2010	63	0	0.00	2	3.17
2011	61	0	0.00	3	4.92
2012	60	0	0.00	3	5.00
2013	59	0	0.00	1	1.69
2014	59	1	1.69	1	1.69
2015	59	2	3.39	1	1.69
2016	57	0	0.00	0	0.00

Economy: Romania					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	50	0	0.00	0	0.00
1998	75	0	0.00	0	0.00
1999	140	0	0.00	1	0.71
2000	152	0	0.00	15	9.87
2001	147	0	0.00	26	17.69
2002	123	0	0.00	4	3.25
2003	120	0	0.00	12	10.00
2004	119	0	0.00	7	5.88
2005	149	1	0.67	12	8.05
2006	163	0	0.00	21	12.88
2007	157	0	0.00	9	5.73
2008	155	0	0.00	17	10.97
2009	139	0	0.00	21	15.11
2010	120	0	0.00	5	4.17
2011	121	0	0.00	7	5.79
2012	122	0	0.00	5	4.10
2013	121	2	1.65	7	5.79
2014	117	1	0.85	4	3.42
2015	287	2	0.70	27	9.41
2016	304	0	0.00	0	0.00

Economy: Russian Federation					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	58	0	0.00	0	0.00
1998	62	2	3.23	4	6.45
1999	64	0	0.00	10	15.63
2000	68	0	0.00	5	7.35
2001	76	0	0.00	4	5.26
2002	92	0	0.00	26	28.26
2003	94	0	0.00	2	2.13
2004	131	2	1.53	3	2.29
2005	175	0	0.00	6	3.43
2006	249	2	0.80	20	8.03
2007	287	0	0.00	14	4.88
2008	327	1	0.31	26	7.95
2009	327	7	2.14	15	4.59
2010	329	1	0.30	13	3.95
2011	331	0	0.00	41	12.39
2012	298	2	0.67	60	20.13
2013	254	0	0.00	52	20.47
2014	205	2	0.98	33	16.10
2015	238	2	0.84	21	8.82
2016	231	2	0.87	4	1.73

Economy: Saudi Arabia					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	62	0	0.00	0	0.00
2001	65	0	0.00	0	0.00
2002	68	0	0.00	1	1.47
2003	69	0	0.00	0	0.00
2004	72	0	0.00	0	0.00
2005	76	0	0.00	0	0.00
2006	86	0	0.00	0	0.00
2007	111	0	0.00	2	1.80
2008	126	0	0.00	0	0.00
2009	135	0	0.00	1	0.74
2010	145	0	0.00	0	0.00
2011	149	0	0.00	0	0.00
2012	157	0	0.00	1	0.64
2013	162	1	0.62	0	0.00
2014	167	0	0.00	4	2.40
2015	167	1	0.60	0	0.00
2016	171	0	0.00	0	0.00

Economy: Serbia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	1	0	0.00	0	0.00
2005	183	0	0.00	0	0.00
2006	317	0	0.00	11	3.47
2007	449	0	0.00	29	6.46
2008	467	0	0.00	104	22.27
2009	386	0	0.00	101	26.17
2010	305	0	0.00	62	20.33
2011	273	0	0.00	68	24.91
2012	228	0	0.00	46	20.18
2013	205	0	0.00	36	17.56
2014	183	1	0.55	35	19.13
2015	173	0	0.00	29	16.76
2016	203	0	0.00	18	8.87

Economy: Singapore

		Defaults		Others	
Year	Active	#	%	#	%
1990	162	0	0.00	8	4.94
1991	168	0	0.00	3	1.79
1992	181	0	0.00	4	2.21
1993	201	0	0.00	0	0.00
1994	231	0	0.00	0	0.00
1995	252	1	0.40	0	0.00
1996	276	2	0.72	1	0.36
1997	309	1	0.32	6	1.94
1998	329	3	0.91	3	0.91
1999	376	4	1.06	11	2.93
2000	444	0	0.00	10	2.25
2001	471	2	0.42	22	4.67
2002	481	2	0.42	21	4.37
2003	519	1	0.19	11	2.12
2004	589	2	0.34	7	1.19
2005	643	4	0.62	8	1.24
2006	693	1	0.14	19	2.74
2007	731	0	0.00	15	2.05
2008	748	4	0.53	23	3.07
2009	755	13	1.72	16	2.12
2010	762	2	0.26	31	4.07
2011	751	1	0.13	34	4.53
2012	739	0	0.00	28	3.79
2013	738	1	0.14	25	3.39
2014	740	0	0.00	27	3.65
2015	734	6	0.82	26	3.54
2016	724	7	0.97	24	3.31

Economy: Slovakia					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	10	0	0.00	0	0.00
1999	12	0	0.00	0	0.00
2000	13	0	0.00	0	0.00
2001	18	0	0.00	1	5.56
2002	27	0	0.00	0	0.00
2003	41	0	0.00	0	0.00
2004	42	0	0.00	0	0.00
2005	44	0	0.00	6	13.64
2006	39	0	0.00	2	5.13
2007	39	0	0.00	6	15.38
2008	38	0	0.00	2	5.26
2009	49	0	0.00	7	14.29
2010	47	0	0.00	1	2.13
2011	51	0	0.00	2	3.92
2012	50	0	0.00	5	10.00
2013	46	0	0.00	3	6.52
2014	43	0	0.00	6	13.95
2015	38	0	0.00	9	23.68
2016	37	0	0.00	0	0.00

Economy: Slovenia					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	74	0	0.00	1	1.35
1999	98	0	0.00	3	3.06
2000	118	0	0.00	4	3.39
2001	131	0	0.00	17	12.98
2002	124	0	0.00	19	15.32
2003	116	0	0.00	8	6.90
2004	126	0	0.00	12	9.52
2005	119	0	0.00	25	21.01
2006	96	0	0.00	16	16.67
2007	83	0	0.00	9	10.84
2008	81	0	0.00	2	2.47
2009	80	3	3.75	8	10.00
2010	70	0	0.00	5	7.14
2011	65	1	1.54	6	9.23
2012	59	1	1.69	3	5.08
2013	57	2	3.51	7	12.28
2014	52	2	3.85	4	7.69
2015	46	0	0.00	5	10.87
2016	42	0	0.00	6	14.29

Economy: South Africa					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	388	0	0.00	0	0.00
1993	400	0	0.00	0	0.00
1994	429	0	0.00	2	0.47
1995	474	0	0.00	3	0.63
1996	501	0	0.00	7	1.40
1997	548	0	0.00	12	2.19
1998	631	2	0.32	58	9.19
1999	637	3	0.47	53	8.32
2000	591	6	1.02	85	14.38
2001	509	9	1.77	79	15.52
2002	428	7	1.64	65	15.19
2003	363	1	0.28	41	11.29
2004	329	3	0.91	36	10.94
2005	309	2	0.65	21	6.80
2006	319	0	0.00	17	5.33
2007	360	0	0.00	15	4.17
2008	356	0	0.00	18	5.06
2009	344	1	0.29	16	4.65
2010	339	2	0.59	18	5.31
2011	326	1	0.31	17	5.21
2012	318	5	1.57	17	5.35
2013	324	3	0.93	21	6.48
2014	323	0	0.00	19	5.88
2015	324	2	0.62	24	7.41
2016	309	0	0.00	10	3.24

Economy: South Korea					
		Defaults		Others	
Year	Active	#	%	#	%
1990	617	0	0.00	0	0.00
1991	634	0	0.00	0	0.00
1992	638	1	0.16	0	0.00
1993	645	0	0.00	0	0.00
1994	675	0	0.00	0	0.00
1995	704	1	0.14	0	0.00
1996	760	6	0.79	1	0.13
1997	1112	52	4.68	2	0.18
1998	1125	81	7.20	12	1.07
1999	1161	32	2.76	39	3.36
2000	1294	17	1.31	44	3.40
2001	1430	17	1.19	27	1.89
2002	1574	14	0.89	37	2.35
2003	1612	11	0.68	30	1.86
2004	1646	8	0.49	53	3.22
2005	1694	8	0.47	53	3.13
2006	1720	2	0.12	14	0.81
2007	1793	1	0.06	15	0.84
2008	1846	10	0.54	27	1.46
2009	1895	7	0.37	81	4.27
2010	1924	10	0.52	91	4.73
2011	1912	4	0.21	69	3.61
2012	1881	5	0.27	74	3.93
2013	1903	11	0.58	46	2.42
2014	1960	5	0.26	38	1.94
2015	2087	2	0.10	42	2.01
2016	2178	4	0.18	26	1.19

Economy: Spain

		Defaults		Others	
Year	Active	#	%	#	%
1990	104	0	0.00	0	0.00
1991	156	0	0.00	0	0.00
1992	164	0	0.00	1	0.61
1993	191	0	0.00	5	2.62
1994	257	0	0.00	1	0.39
1995	273	0	0.00	4	1.47
1996	283	0	0.00	5	1.77
1997	290	0	0.00	7	2.41
1998	299	0	0.00	47	15.72
1999	265	0	0.00	33	12.45
2000	245	0	0.00	14	5.71
2001	246	0	0.00	20	8.13
2002	240	2	0.83	18	7.50
2003	226	0	0.00	40	17.70
2004	194	0	0.00	15	7.73
2005	186	0	0.00	8	4.30
2006	194	0	0.00	26	13.40
2007	186	1	0.54	13	6.99
2008	178	2	1.12	8	4.49
2009	173	0	0.00	12	6.94
2010	174	1	0.57	11	6.32
2011	170	0	0.00	12	7.06
2012	165	2	1.21	5	3.03
2013	171	6	3.51	7	4.09
2014	174	0	0.00	9	5.17
2015	195	1	0.51	9	4.62
2016	217	1	0.46	2	0.92

Economy: Sri Lanka

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	1	0	0.00	0	0.00
1994	1	0	0.00	0	0.00
1995	132	0	0.00	0	0.00
1996	145	0	0.00	0	0.00
1997	152	0	0.00	0	0.00
1998	164	0	0.00	1	0.61
1999	167	0	0.00	1	0.60
2000	174	0	0.00	1	0.57
2001	178	0	0.00	1	0.56
2002	186	0	0.00	1	0.54
2003	193	0	0.00	3	1.55
2004	197	0	0.00	0	0.00
2005	211	0	0.00	0	0.00
2006	219	0	0.00	0	0.00
2007	220	0	0.00	1	0.45
2008	222	0	0.00	3	1.35
2009	223	0	0.00	0	0.00
2010	234	0	0.00	0	0.00
2011	261	0	0.00	2	0.77
2012	277	0	0.00	1	0.36
2013	277	0	0.00	1	0.36
2014	282	0	0.00	5	1.77
2015	279	0	0.00	3	1.08
2016	282	0	0.00	5	1.77

Economy: Sweden					
		Defaults		**Others**	
Year	Active	#	%	#	%
1990	41	0	0.00	0	0.00
1991	62	0	0.00	0	0.00
1992	121	0	0.00	0	0.00
1993	145	0	0.00	1	0.69
1994	173	0	0.00	2	1.16
1995	184	0	0.00	0	0.00
1996	238	0	0.00	0	0.00
1997	307	0	0.00	36	11.73
1998	320	1	0.31	20	6.25
1999	365	1	0.27	26	7.12
2000	402	1	0.25	34	8.46
2001	392	4	1.02	26	6.63
2002	382	6	1.57	21	5.50
2003	365	2	0.55	21	5.75
2004	379	1	0.26	21	5.54
2005	406	2	0.49	13	3.20
2006	457	0	0.00	21	4.60
2007	519	1	0.19	13	2.50
2008	542	2	0.37	28	5.17
2009	530	4	0.75	24	4.53
2010	535	2	0.37	28	5.23
2011	536	3	0.56	32	5.97
2012	524	0	0.00	41	7.82
2013	515	3	0.58	21	4.08
2014	572	3	0.52	26	4.55
2015	639	2	0.31	21	3.29
2016	703	1	0.14	22	3.13

Economy: Switzerland					
		Defaults		**Others**	
Year	Active	#	%	#	%
1990	140	0	0.00	0	0.00
1991	158	0	0.00	6	3.80
1992	157	0	0.00	1	0.64
1993	174	0	0.00	0	0.00
1994	184	0	0.00	1	0.54
1995	194	0	0.00	2	1.03
1996	209	0	0.00	1	0.48
1997	221	2	0.90	3	1.36
1998	231	0	0.00	5	2.16
1999	247	0	0.00	8	3.24
2000	262	0	0.00	6	2.29
2001	268	2	0.75	9	3.36
2002	260	1	0.38	9	3.46
2003	253	2	0.79	10	3.95
2004	245	1	0.41	7	2.86
2005	250	1	0.40	6	2.40
2006	260	0	0.00	13	5.00
2007	259	0	0.00	6	2.32
2008	260	0	0.00	8	3.08
2009	260	0	0.00	6	2.31
2010	260	0	0.00	8	3.08
2011	258	2	0.78	10	3.88
2012	251	1	0.40	8	3.19
2013	247	0	0.00	5	2.02
2014	249	1	0.40	7	2.81
2015	245	1	0.41	13	5.31
2016	239	0	0.00	8	3.35

Economy: Taiwan					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	193	0	0.00	0	0.00
1992	234	0	0.00	2	0.85
1993	255	0	0.00	0	0.00
1994	287	0	0.00	0	0.00
1995	332	0	0.00	0	0.00
1996	367	0	0.00	0	0.00
1997	395	0	0.00	1	0.25
1998	428	3	0.70	3	0.70
1999	465	7	1.51	6	1.29
2000	540	7	1.30	9	1.67
2001	602	8	1.33	12	1.99
2002	674	7	1.04	28	4.15
2003	686	1	0.15	10	1.46
2004	753	5	0.66	8	1.06
2005	763	3	0.39	21	2.75
2006	760	2	0.26	14	1.84
2007	784	2	0.26	18	2.30
2008	794	3	0.38	10	1.26
2009	806	1	0.12	4	0.50
2010	831	1	0.12	9	1.08
2011	847	0	0.00	5	0.59
2012	866	0	0.00	4	0.46
2013	878	0	0.00	4	0.46
2014	893	2	0.22	6	0.67
2015	901	0	0.00	3	0.33
2016	909	1	0.11	7	0.77

Economy: Thailand					
		Defaults		Others	
Year	Active	#	%	#	%
1990	147	0	0.00	0	0.00
1991	190	0	0.00	1	0.53
1992	279	0	0.00	0	0.00
1993	330	0	0.00	0	0.00
1994	377	0	0.00	0	0.00
1995	408	1	0.25	4	0.98
1996	445	6	1.35	1	0.22
1997	449	21	4.68	29	6.46
1998	407	12	2.95	31	7.62
1999	379	15	3.96	19	5.01
2000	371	20	5.39	9	2.43
2001	362	8	2.21	8	2.21
2002	379	4	1.06	9	2.37
2003	404	4	0.99	6	1.49
2004	446	0	0.00	10	2.24
2005	494	3	0.61	16	3.24
2006	500	0	0.00	5	1.00
2007	510	2	0.39	11	2.16
2008	513	2	0.39	11	2.14
2009	527	10	1.90	8	1.52
2010	525	4	0.76	10	1.90
2011	528	2	0.38	11	2.08
2012	535	1	0.19	6	1.12
2013	560	1	0.18	4	0.71
2014	594	0	0.00	5	0.84
2015	633	1	0.16	10	1.58
2016	650	0	0.00	3	0.46

Economy: Tunisia					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	33	0	0.00	0	0.00
2000	37	0	0.00	0	0.00
2001	41	0	0.00	0	0.00
2002	43	0	0.00	0	0.00
2003	43	0	0.00	0	0.00
2004	43	0	0.00	1	2.33
2005	45	0	0.00	0	0.00
2006	48	0	0.00	0	0.00
2007	51	0	0.00	0	0.00
2008	53	0	0.00	4	7.55
2009	51	0	0.00	0	0.00
2010	55	0	0.00	1	1.82
2011	55	0	0.00	0	0.00
2012	56	0	0.00	0	0.00
2013	65	0	0.00	0	0.00
2014	75	0	0.00	1	1.33
2015	77	0	0.00	0	0.00
2016	78	0	0.00	0	0.00

Economy: Turkey					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	9	0	0.00	0	0.00
1993	15	0	0.00	0	0.00
1994	34	0	0.00	0	0.00
1995	201	0	0.00	0	0.00
1996	223	1	0.45	2	0.90
1997	257	0	0.00	1	0.39
1998	277	0	0.00	2	0.72
1999	284	0	0.00	9	3.17
2000	313	0	0.00	17	5.43
2001	298	0	0.00	13	4.36
2002	293	0	0.00	7	2.39
2003	290	0	0.00	6	2.07
2004	296	0	0.00	0	0.00
2005	305	0	0.00	2	0.66
2006	320	0	0.00	6	1.88
2007	323	0	0.00	5	1.55
2008	320	0	0.00	4	1.25
2009	319	0	0.00	4	1.25
2010	337	0	0.00	0	0.00
2011	364	0	0.00	2	0.55
2012	401	0	0.00	5	1.25
2013	422	0	0.00	6	1.42
2014	431	0	0.00	13	3.02
2015	426	0	0.00	13	3.05
2016	418	0	0.00	11	2.63

Economy: Ukraine					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	30	0	0.00	1	3.33
1999	38	0	0.00	0	0.00
2000	39	0	0.00	5	12.82
2001	34	0	0.00	12	35.29
2002	27	0	0.00	5	18.52
2003	29	0	0.00	7	24.14
2004	44	0	0.00	0	0.00
2005	75	0	0.00	1	1.33
2006	118	0	0.00	2	1.69
2007	133	0	0.00	2	1.50
2008	138	0	0.00	9	6.52
2009	135	1	0.74	39	28.89
2010	98	0	0.00	44	44.90
2011	67	0	0.00	13	19.40
2012	65	0	0.00	8	12.31
2013	79	0	0.00	11	13.92
2014	72	0	0.00	14	19.44
2015	62	0	0.00	27	43.55
2016	41	0	0.00	6	14.63

Economy: United Arab Emirates					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	0	0	NaN	0	NaN
2005	0	0	NaN	0	NaN
2006	76	0	0.00	0	0.00
2007	87	0	0.00	2	2.30
2008	92	0	0.00	5	5.43
2009	89	0	0.00	1	1.12
2010	92	0	0.00	2	2.17
2011	94	0	0.00	2	2.13
2012	95	1	1.05	2	2.11
2013	95	0	0.00	2	2.11
2014	105	0	0.00	1	0.95
2015	108	0	0.00	5	4.63
2016	110	0	0.00	1	0.91

Economy: United Kingdom					
		Defaults		Others	
Year	Active	#	%	#	%
1990	260	0	0.00	2	0.77
1991	1056	1	0.09	5	0.47
1992	1112	0	0.00	6	0.54
1993	1201	0	0.00	5	0.42
1994	1308	0	0.00	2	0.15
1995	1460	0	0.00	2	0.14
1996	1656	0	0.00	10	0.60
1997	1799	0	0.00	36	2.00
1998	1859	0	0.00	147	7.91
1999	1809	3	0.17	200	11.06
2000	1881	2	0.11	171	9.09
2001	1839	12	0.65	114	6.20
2002	1800	14	0.78	109	6.06
2003	1763	5	0.28	126	7.15
2004	1916	2	0.10	96	5.01
2005	2186	2	0.09	120	5.49
2006	2364	0	0.00	175	7.40
2007	2429	3	0.12	169	6.96
2008	2332	24	1.03	231	9.91
2009	2106	32	1.52	216	10.26
2010	1940	2	0.10	172	8.87
2011	1833	9	0.49	131	7.15
2012	1755	18	1.03	127	7.24
2013	1700	10	0.59	107	6.29
2014	1715	7	0.41	97	5.66
2015	1746	7	0.40	128	7.33
2016	1710	3	0.18	106	6.20

Economy: United States					
		Defaults		Others	
Year	Active	#	%	#	%
1990	3829	5	0.13	83	2.17
1991	4130	18	0.44	102	2.47
1992	5394	18	0.33	88	1.63
1993	6159	25	0.41	143	2.32
1994	6904	17	0.25	222	3.22
1995	7387	17	0.23	361	4.89
1996	7937	16	0.20	401	5.05
1997	8307	51	0.61	558	6.72
1998	8283	80	0.97	879	10.61
1999	7993	77	0.96	918	11.49
2000	7629	117	1.53	778	10.20
2001	6967	167	2.40	756	10.85
2002	6257	114	1.82	532	8.50
2003	5836	82	1.41	472	8.09
2004	5668	31	0.55	370	6.53
2005	5653	38	0.67	384	6.79
2006	5589	16	0.29	380	6.80
2007	5612	28	0.50	462	8.23
2008	5285	65	1.23	382	7.23
2009	5000	93	1.86	320	6.40
2010	4860	29	0.60	313	6.44
2011	4713	35	0.74	303	6.43
2012	4601	38	0.83	264	5.74
2013	4626	25	0.54	238	5.14
2014	4777	27	0.57	211	4.42
2015	4863	42	0.86	274	5.63
2016	4787	62	1.30	360	7.52

Economy: Venezuela					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	7	0	0.00	0	0.00
1994	12	0	0.00	0	0.00
1995	16	0	0.00	1	6.25
1996	15	0	0.00	0	0.00
1997	49	0	0.00	2	4.08
1998	47	0	0.00	4	8.51
1999	46	0	0.00	9	19.57
2000	38	0	0.00	4	10.53
2001	37	1	2.70	4	10.81
2002	34	0	0.00	5	14.71
2003	32	0	0.00	3	9.38
2004	32	0	0.00	2	6.25
2005	31	0	0.00	0	0.00
2006	32	0	0.00	3	9.38
2007	29	0	0.00	0	0.00
2008	32	0	0.00	1	3.13
2009	31	0	0.00	1	3.23
2010	30	0	0.00	2	6.67
2011	29	0	0.00	7	24.14
2012	23	0	0.00	4	17.39
2013	19	0	0.00	1	5.26
2014	21	0	0.00	0	0.00
2015	23	0	0.00	0	0.00
2016	24	0	0.00	0	0.00

Economy: Vietnam					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	5	0	0.00	0	0.00
2001	10	0	0.00	0	0.00
2002	18	0	0.00	0	0.00
2003	20	0	0.00	0	0.00
2004	23	0	0.00	0	0.00
2005	29	0	0.00	0	0.00
2006	87	0	0.00	0	0.00
2007	209	0	0.00	3	1.44
2008	272	0	0.00	2	0.74
2009	400	0	0.00	25	6.25
2010	596	0	0.00	10	1.68
2011	643	1	0.16	13	2.02
2012	652	0	0.00	10	1.53
2013	656	0	0.00	24	3.66
2014	656	0	0.00	17	2.59
2015	689	0	0.00	17	2.47
2016	701	0	0.00	5	0.71

B APPENDIX: PERFORMANCE ANALYSIS

Table B.1: Accuracy ratios (AR) and Area Under Receiver Operating Characteristic (AUROC) for three calibration groups and different economies.

	AR				AUROC			
Economy	1mth	1yr	2yr	5yr	1mth	1yr	2yr	5yr
Australia	0.83246	0.67209	0.56095	0.39794	0.91624	0.83644	0.78156	0.70273
Brazil	0.87197	0.80106	0.71095	0.49877	0.93600	0.90087	0.85644	0.75299
Canada	0.95304	0.82627	0.70260	0.49930	0.97653	0.91340	0.85218	0.75294
China	0.70164	0.69218	0.65805	0.53890	0.85095	0.84756	0.83214	0.77971
Germany	0.86694	0.69298	0.57753	0.46766	0.93350	0.84729	0.79090	0.73943
Denmark	0.82046	0.76551	0.61542	0.53745	0.91025	0.88313	0.80902	0.77238
France	0.85554	0.72841	0.63541	0.55865	0.92777	0.86437	0.81818	0.78071
Hong Kong	0.77080	0.53696	0.42181	0.23816	0.88541	0.7688	0.71172	0.62184
India	0.72501	0.65636	0.60090	0.47297	0.86254	0.82876	0.80183	0.74053
Indonesia	0.73299	0.69022	0.60649	0.41965	0.86655	0.84599	0.80578	0.71957
Italy	0.87879	0.82573	0.66153	0.46295	0.93940	0.91300	0.83130	0.73359
Japan	0.91234	0.85442	0.79959	0.66773	0.95617	0.92731	0.90009	0.83519
Malaysia	0.84062	0.78735	0.71994	0.53608	0.92034	0.89419	0.86133	0.77391
Mexico	0.82134	0.79538	0.73614	0.56559	0.91070	0.89822	0.86944	0.78851
Netherlands	0.88257	0.83564	0.68133	0.55146	0.94130	0.91814	0.84190	0.77934
Norway	0.95316	0.82900	0.60700	0.29491	0.97659	0.91482	0.80479	0.65201
Philippines	0.72890	0.65725	0.64384	0.57070	0.86449	0.82928	0.82343	0.79093
Poland	0.87899	0.75093	0.59734	0.34276	0.93951	0.87586	0.79996	0.67558
Russian Federation	0.79778	0.42557	0.19024	0.083178	0.89892	0.71382	0.59783	0.54766
Singapore	0.81505	0.71364	0.54761	0.32252	0.90754	0.85714	0.77481	0.66464
South Africa	0.92794	0.85689	0.74132	0.46368	0.96398	0.92866	0.87148	0.73559
South Korea	0.87184	0.73760	0.66442	0.55799	0.93593	0.86914	0.83311	0.78194
Sweden	0.90945	0.79508	0.68702	0.41611	0.95473	0.89776	0.84413	0.71050
Taiwan	0.87882	0.77457	0.70024	0.61224	0.93942	0.88747	0.85065	0.80799
Thailand	0.81878	0.78254	0.73483	0.61134	0.90942	0.89188	0.86903	0.8118
United Kingdom	0.88910	0.77209	0.62690	0.43333	0.94456	0.88628	0.81424	0.71930
United States	0.94433	0.83615	0.72316	0.53831	0.97217	0.91844	0.86279	0.77353
Developed Asia-Pacific	0.86693	0.74847	0.66370	0.53063	0.93347	0.87446	0.83248	0.76757
Emerging MKT	0.82510	0.77456	0.70990	0.55807	0.91257	0.88765	0.85595	0.78320
Europe	0.87762	0.75037	0.61715	0.45191	0.93882	0.87546	0.80943	0.72860
North America	0.94531	0.83533	0.72152	0.53539	0.97266	0.91802	0.86193	0.77194

Note: *This table only shows the economies with more than 20 defaults in the testing period.

Figure B.1: Plots of US default parameters across all horizons for the Stock index one-year return, Short-term interest rate, DTD Level, DTD Trend, CASH/TA Level and CASH/TA Trend. Solid lines are the parameter estimates and dashed lines are the 90% confidence level. Horizontal axis is the horizon in months.

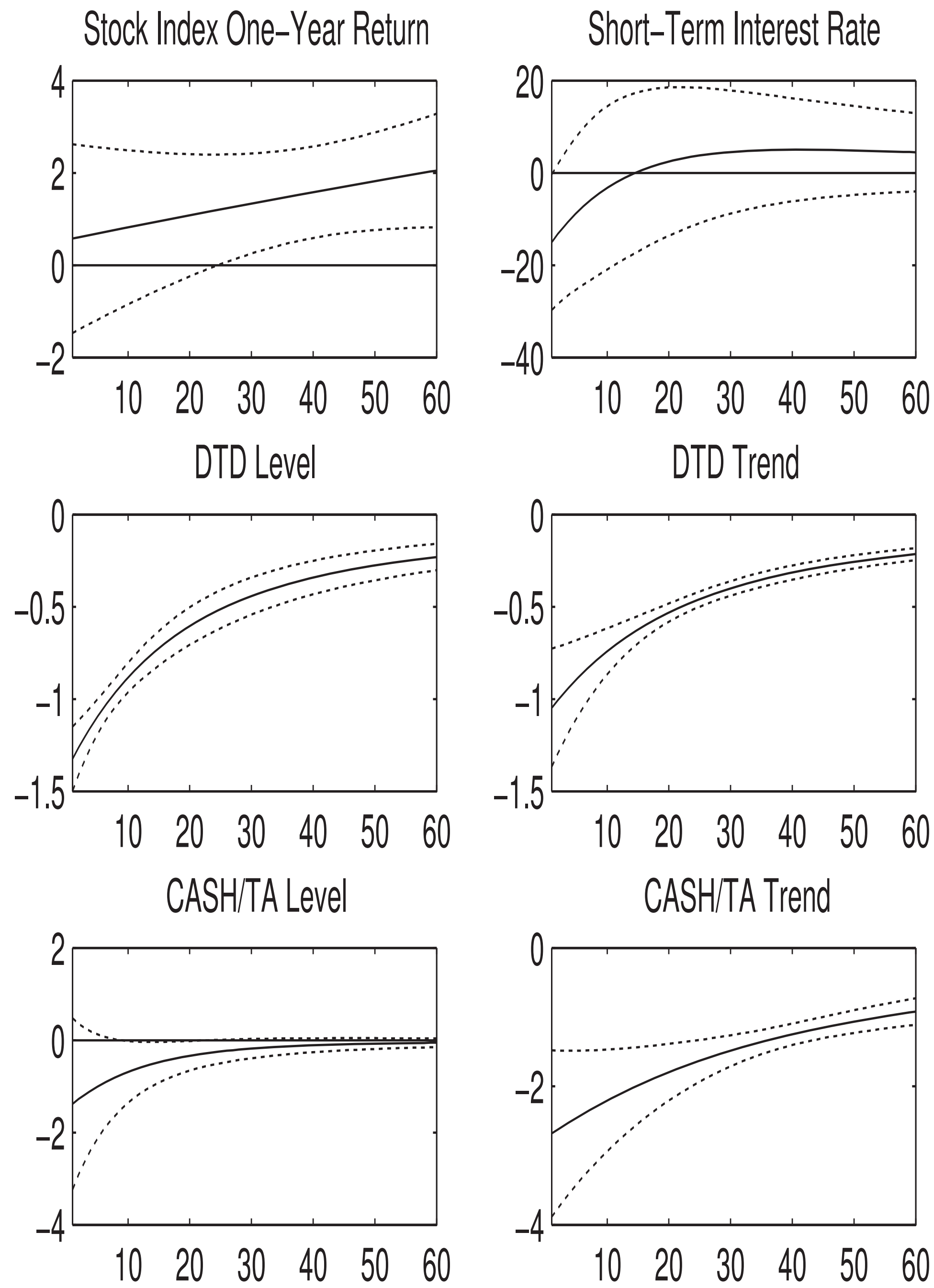


Figure B.2: Plots of US default parameters across all horizons for the NI/TA Level, NI/TA Trend, SIZE Level, SIZE Trend, M/B and SIGMA. Solid lines are the parameter estimates and dashed lines are the 90% confidence level. Horizontal axis is the horizon in months.

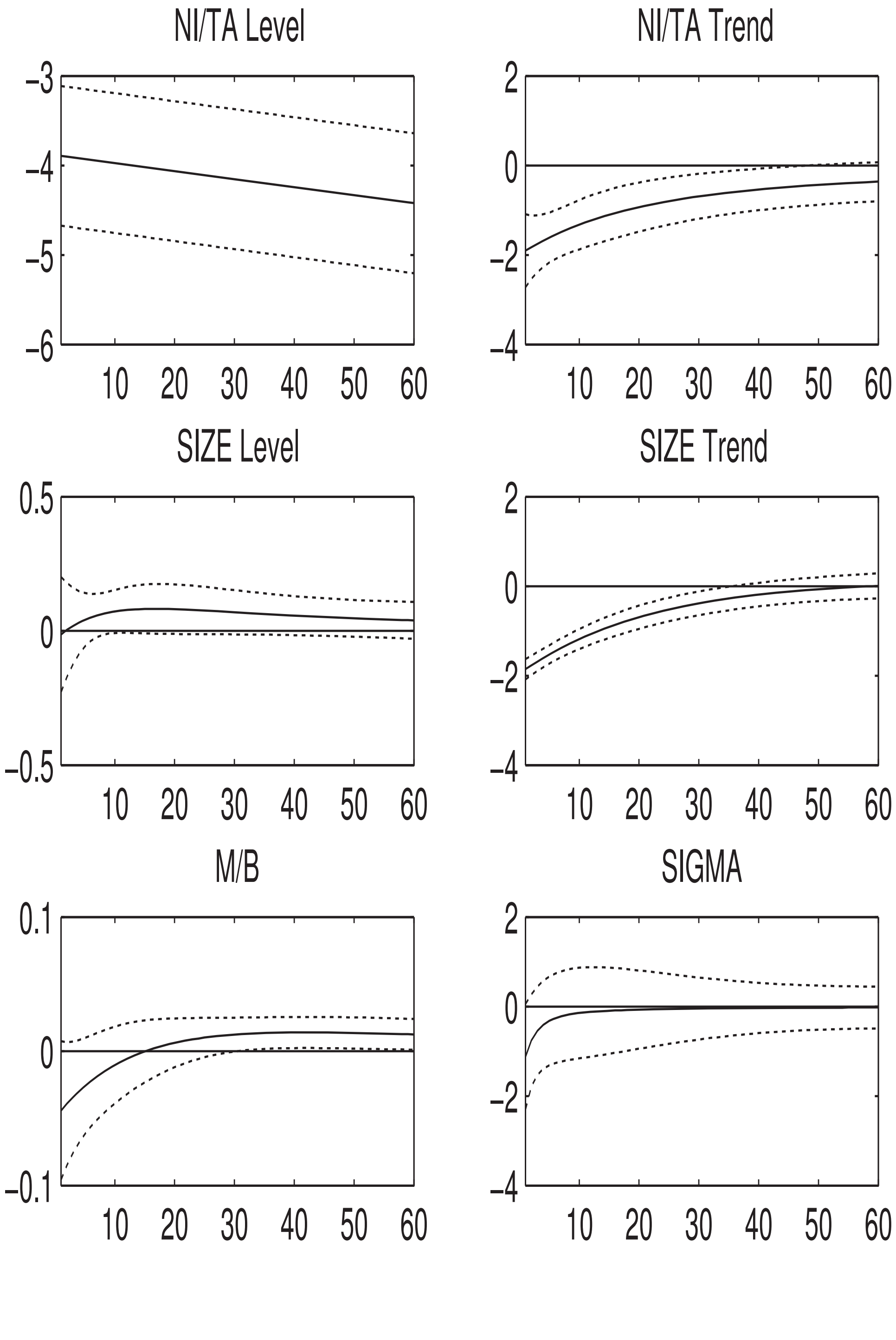
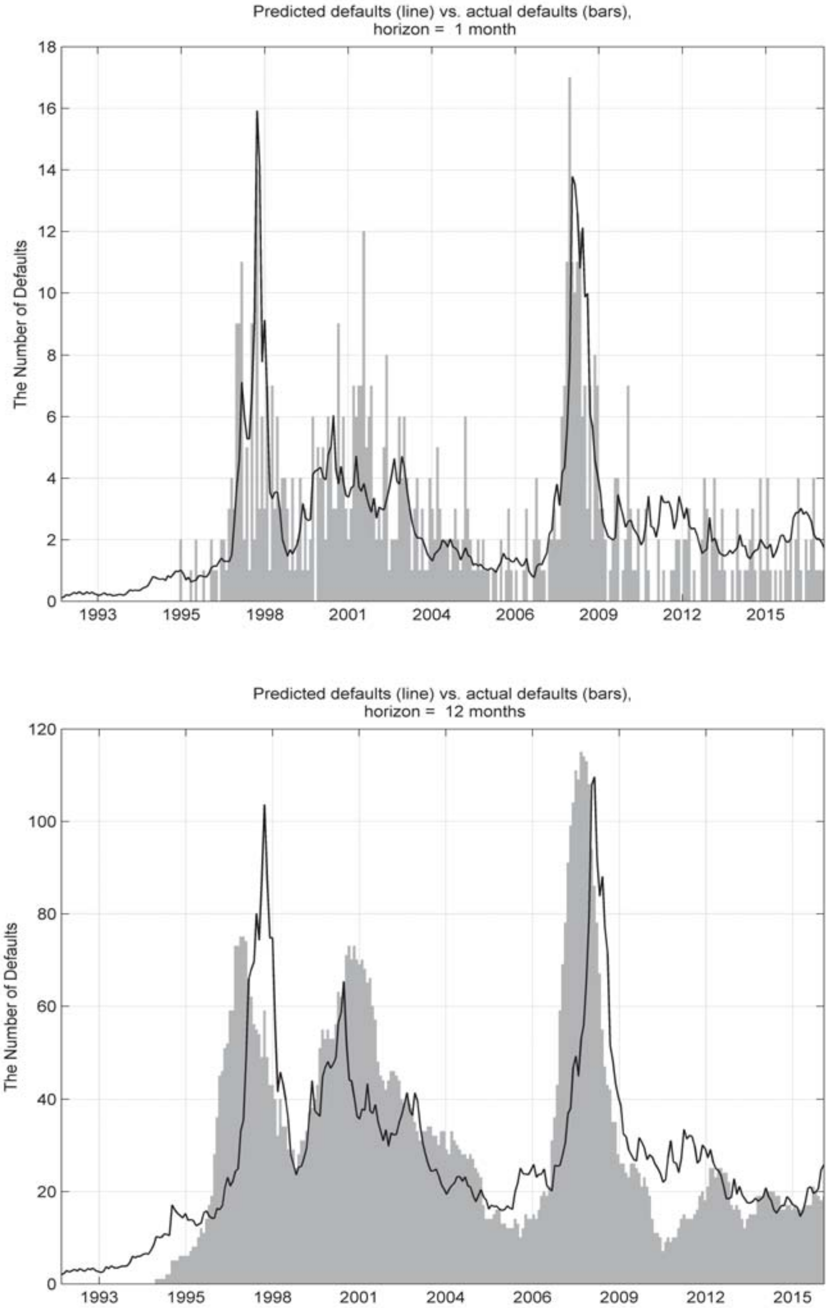
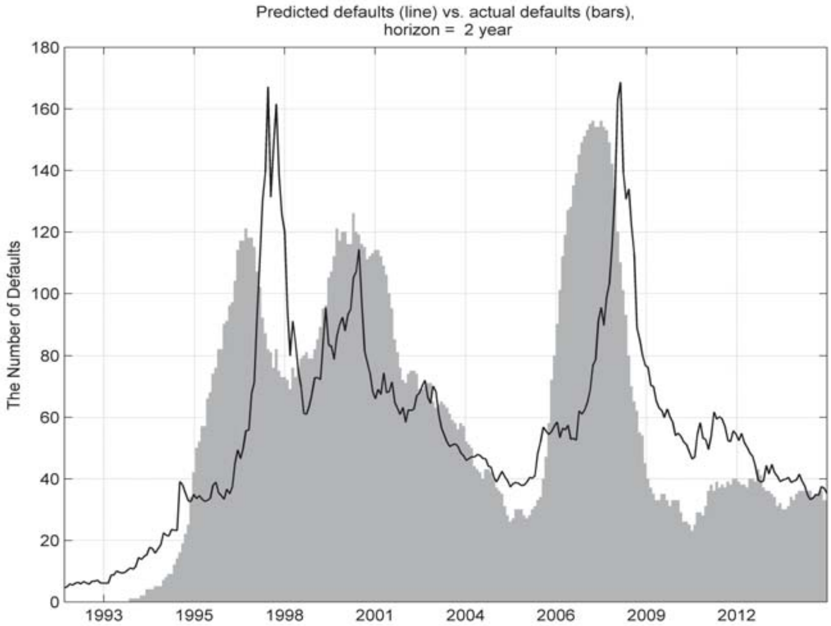


Figure B.3: Performance test for the Developed Asia, in sample.




Predicted defaults (line) vs. actual defaults (bars),
horizon = 2 year
The Number of Defaults
0
20
40
60
80
100
120
140
160
180
1993
1995
1998
2001
2004
2006
2009
2012

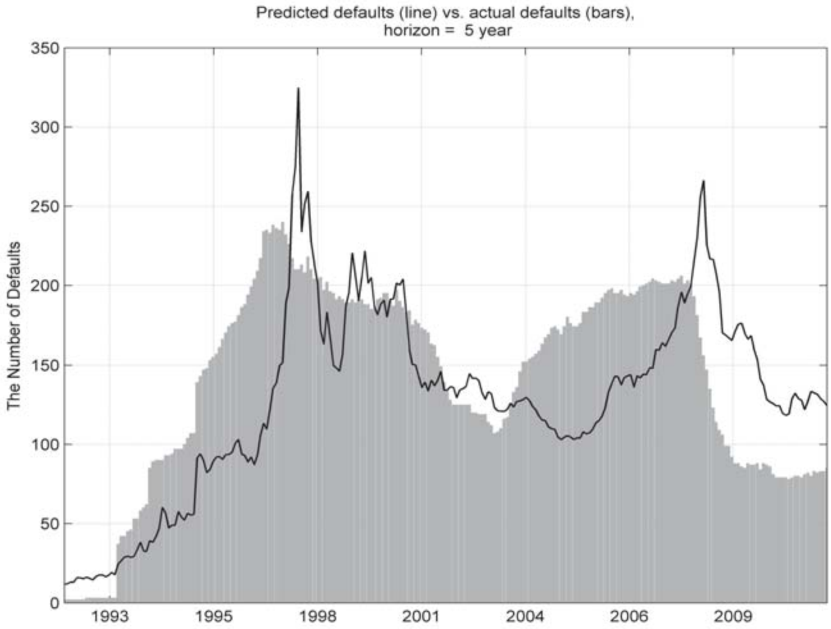
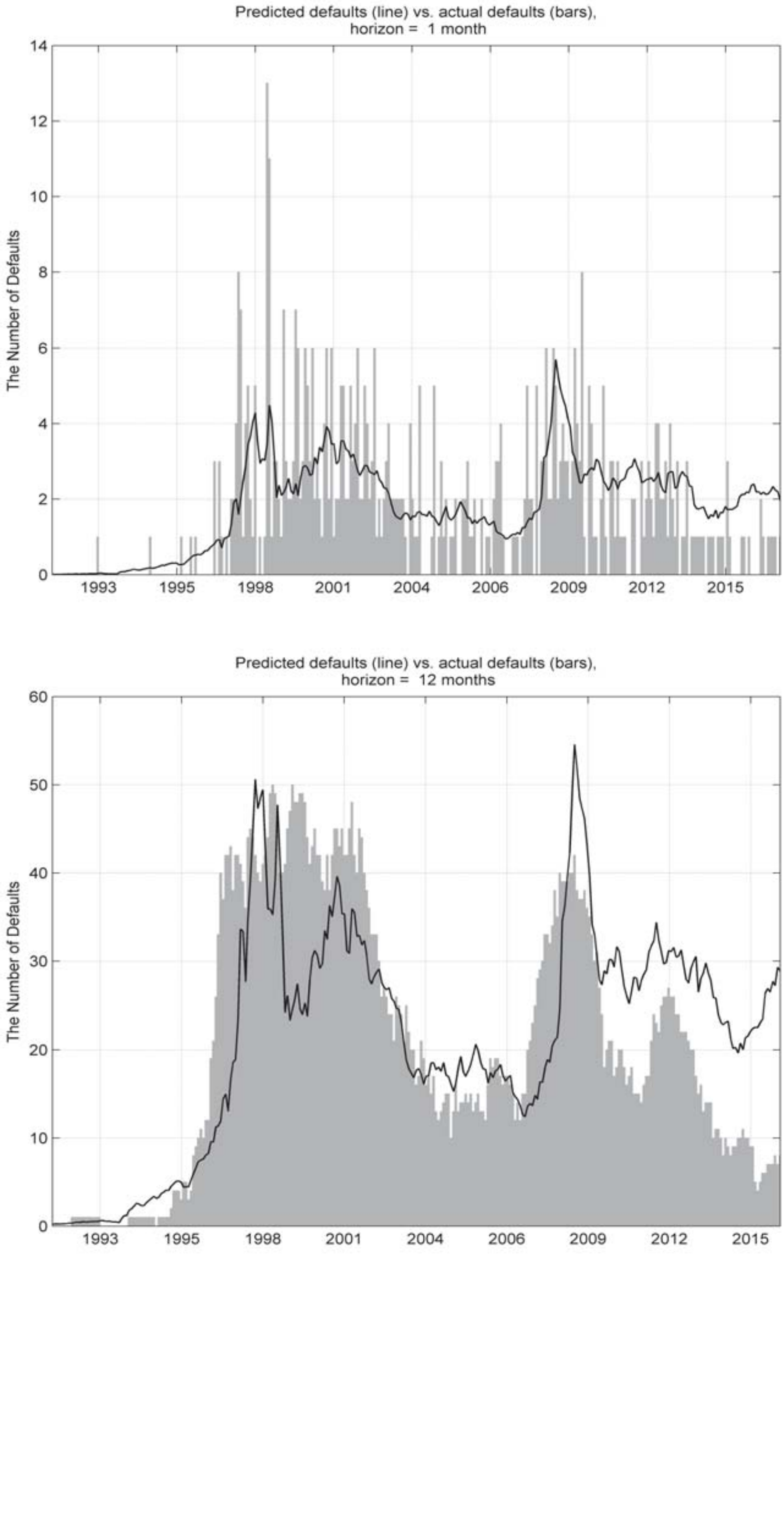

Predicted defaults (line) vs. actual defaults (bars),
horizon = 5 year
The Number of Defaults
0
50
100
150
200
250
300
350
1993
1995
1998
2001
2004
2006
2009

Figure B.4: Performance test for the Emerging Market, in sample.




Predicted defaults (line) vs. actual defaults (bars),
horizon = 2 year
The Number of Defaults
120
100
80
60
40
20
0
1993
1995
1998
2001
2004
2006
2009
2012

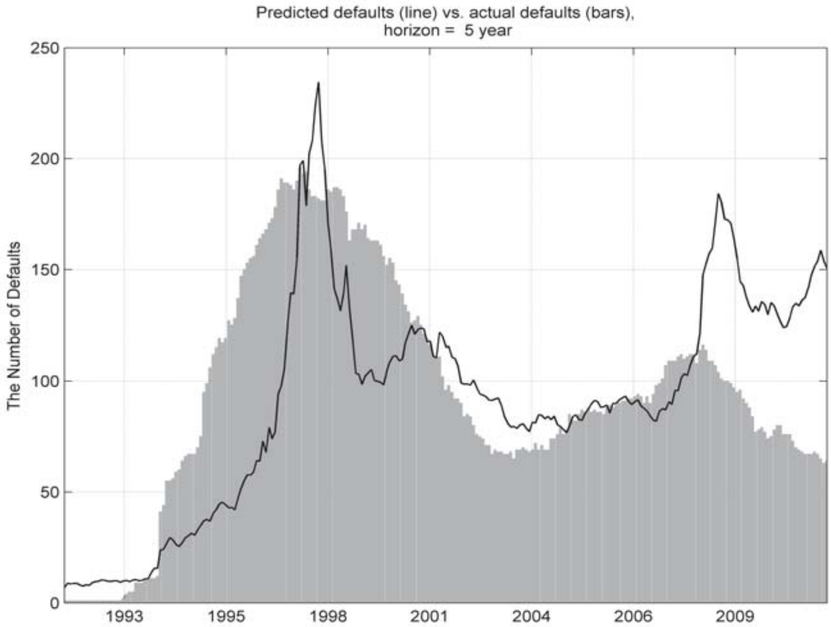
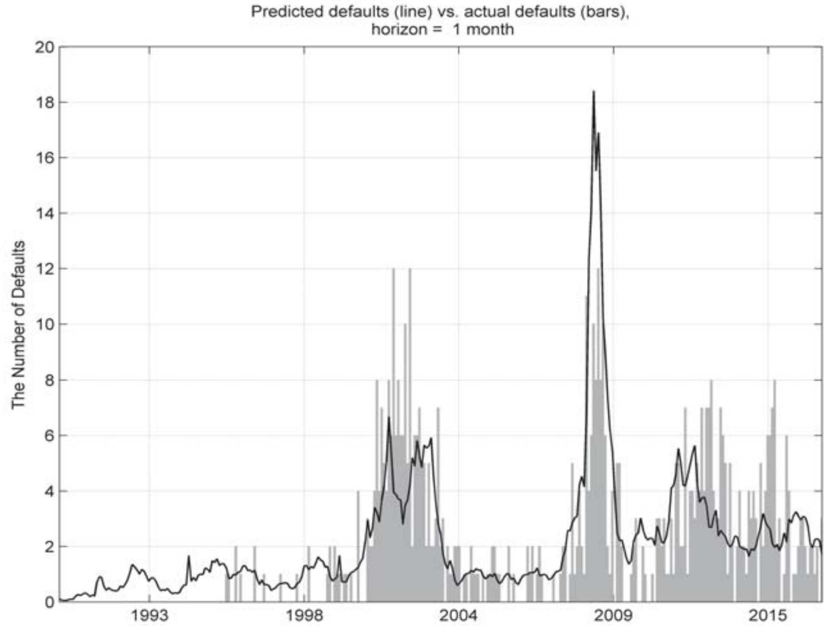
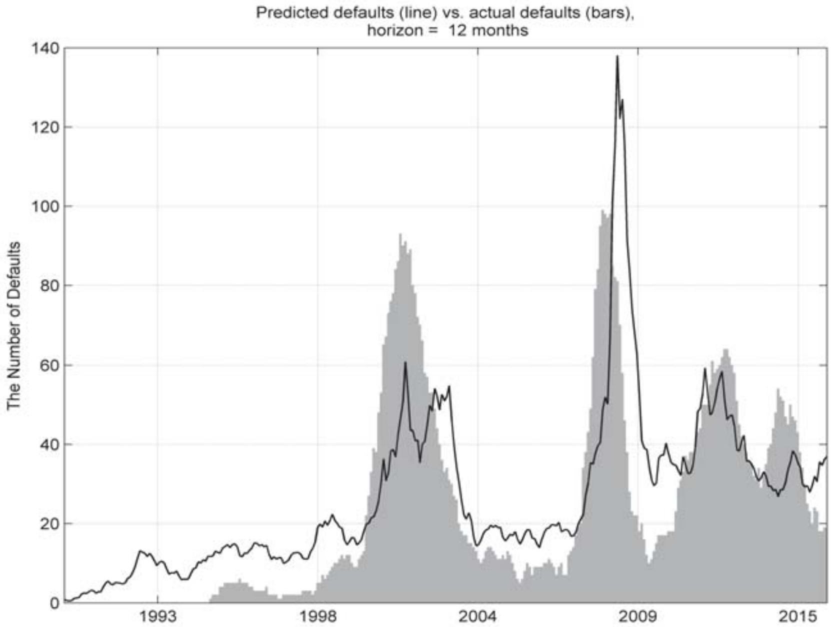
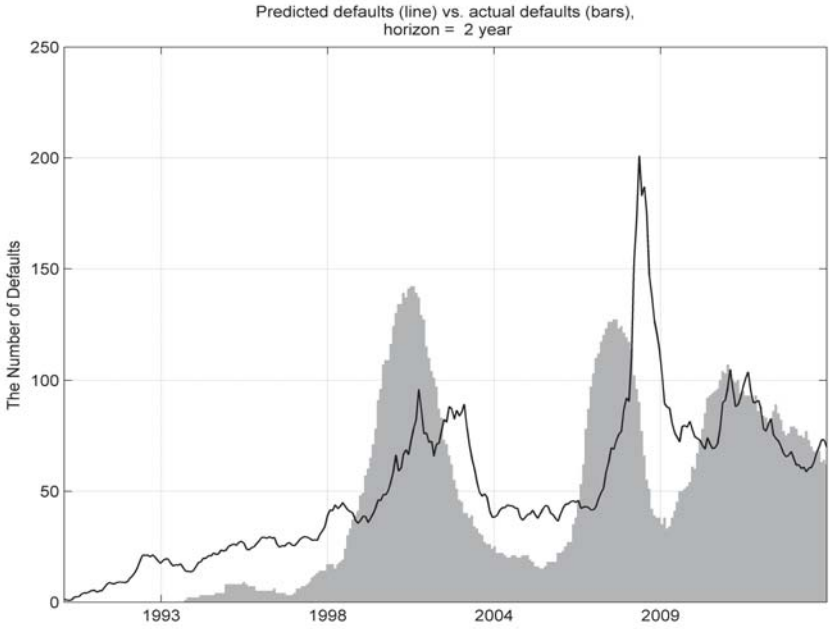

Predicted defaults (line) vs. actual defaults (bars),
horizon = 5 year
The Number of Defaults
250
200
150
100
50
0
1993
1995
1998
2001
2004
2006
2009

Figure B.5: Performance test for the Europe group, in sample.






Predicted defaults (line) vs. actual defaults (bars),
horizon = 2 year
The Number of Defaults
250
200
150
100
50
0
1993
1998
2004
2009

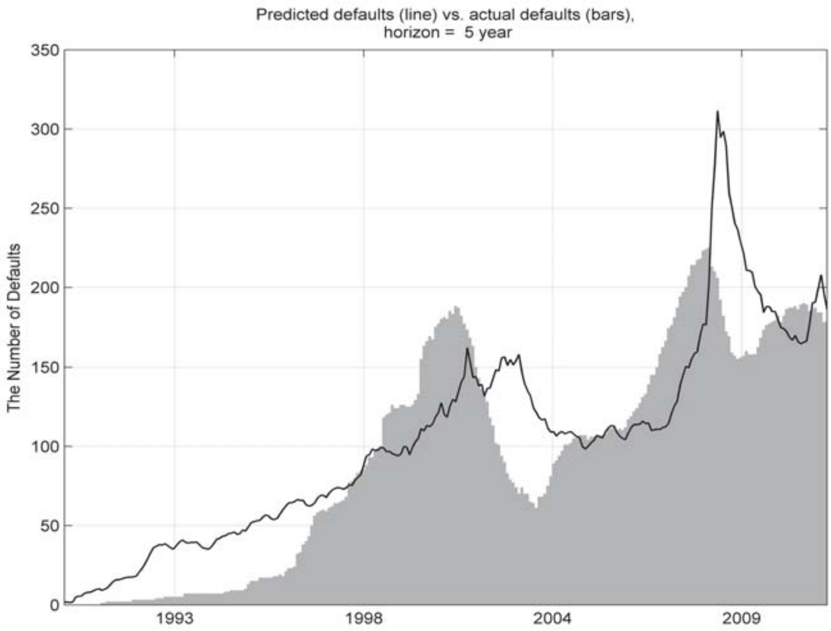
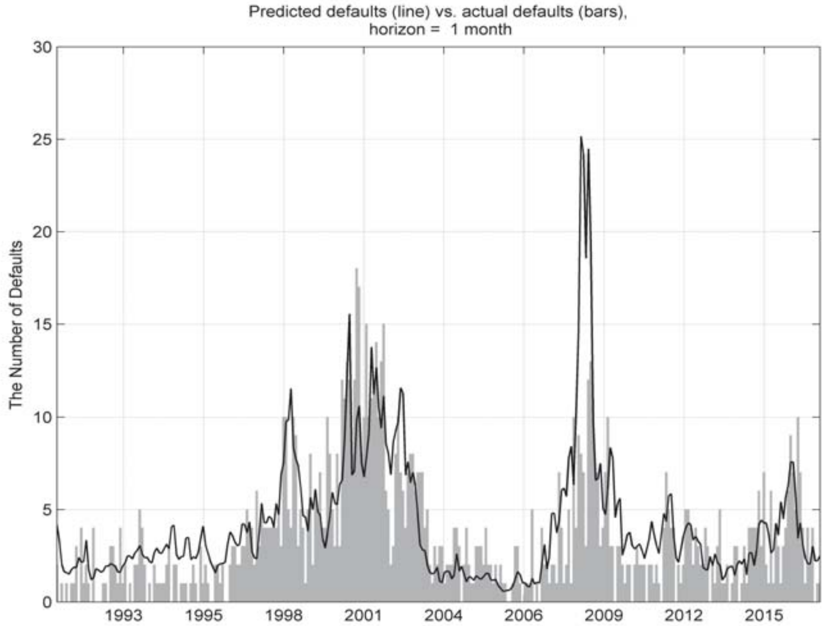
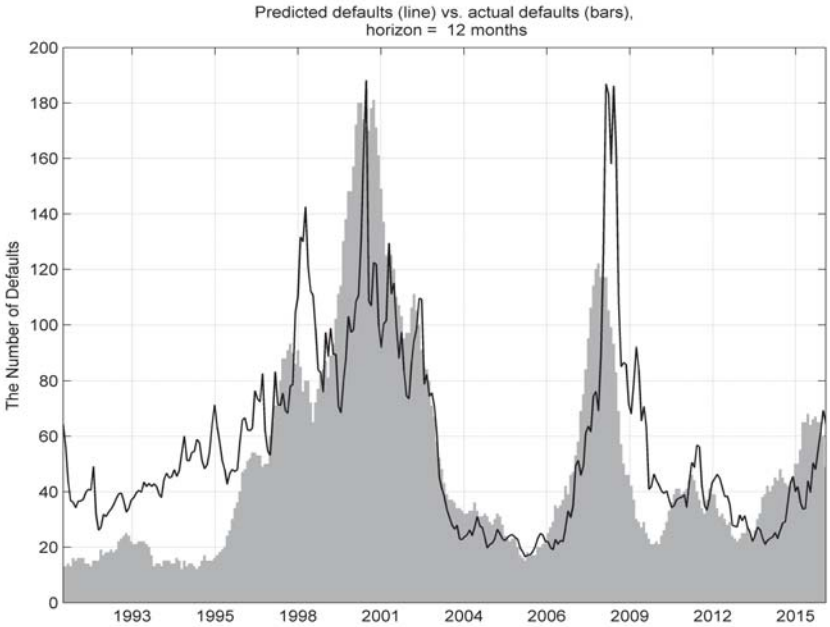
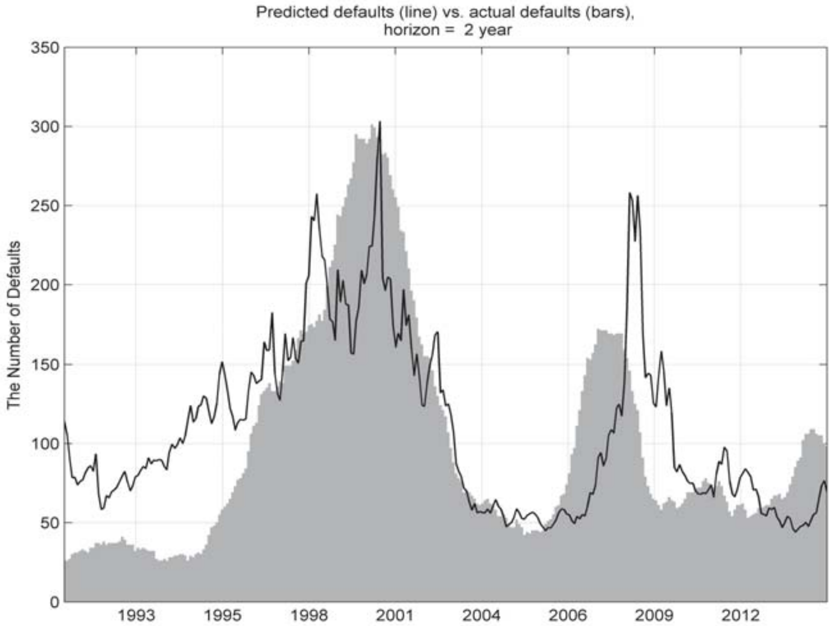

Predicted defaults (line) vs. actual defaults (bars),
horizon = 5 year
The Number of Defaults
350
300
250
200
150
100
50
0
1993
1998
2004
2009

Figure B.6: Performance test for North America group, in sample.






Predicted defaults (line) vs. actual defaults (bars),
horizon = 2 year
The Number of Defaults
0
50
100
150
200
250
300
350
1993
1995
1998
2001
2004
2006
2009
2012

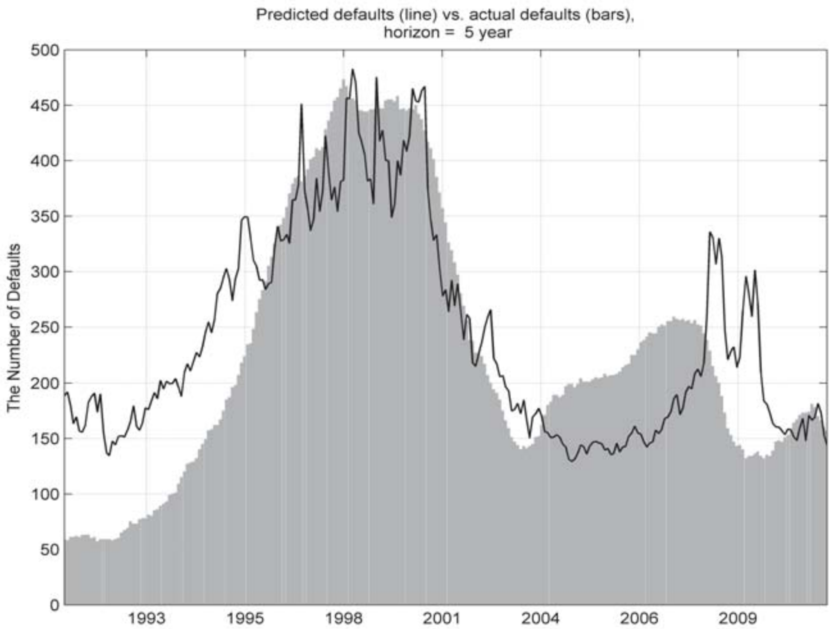
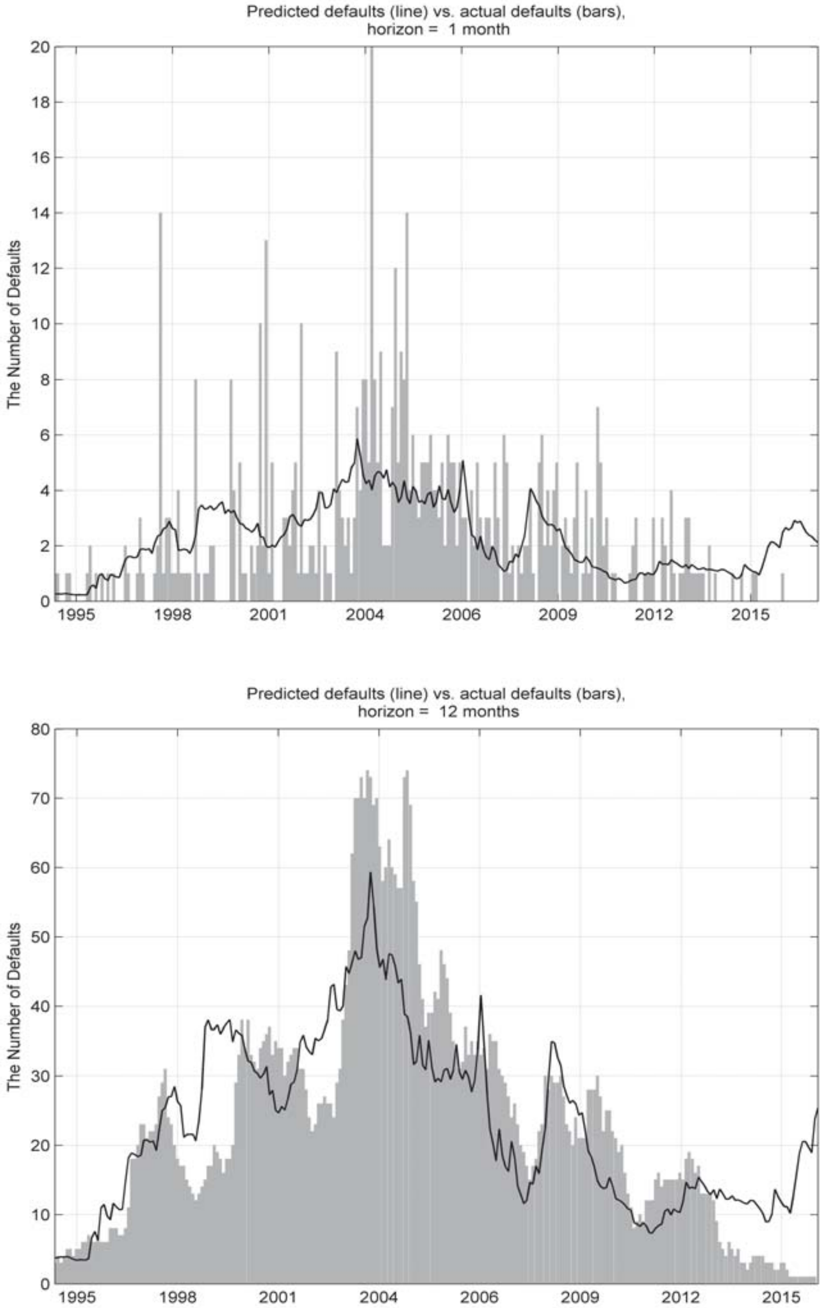
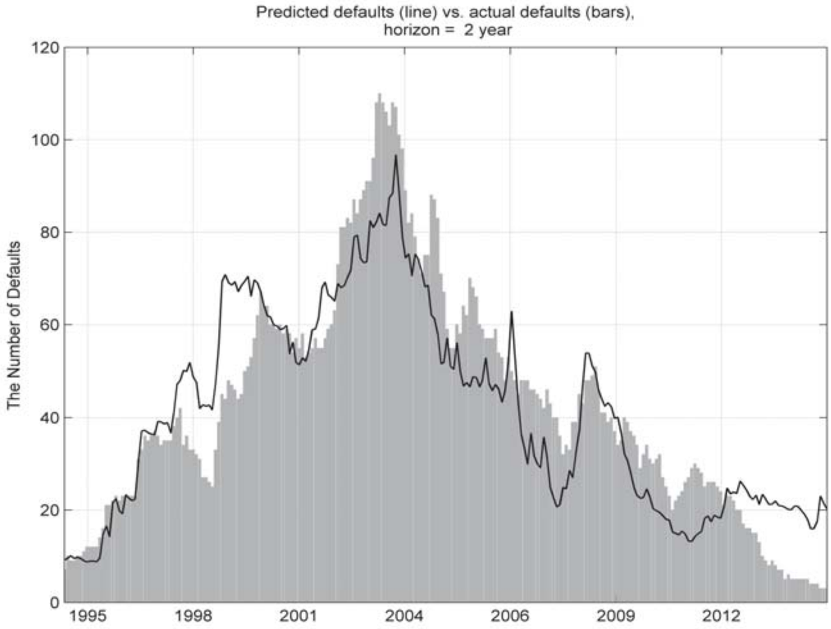

Predicted defaults (line) vs. actual defaults (bars),
horizon = 5 year
The Number of Defaults
0
50
100
150
200
250
300
350
400
450
500
1993
1995
1998
2001
2004
2006
2009

Figure B.7: Performance test for China, in sample.




Predicted defaults (line) vs. actual defaults (bars),
horizon = 2 year
The Number of Defaults
120
100
80
60
40
20
0
1995
1998
2001
2004
2006
2009
2012

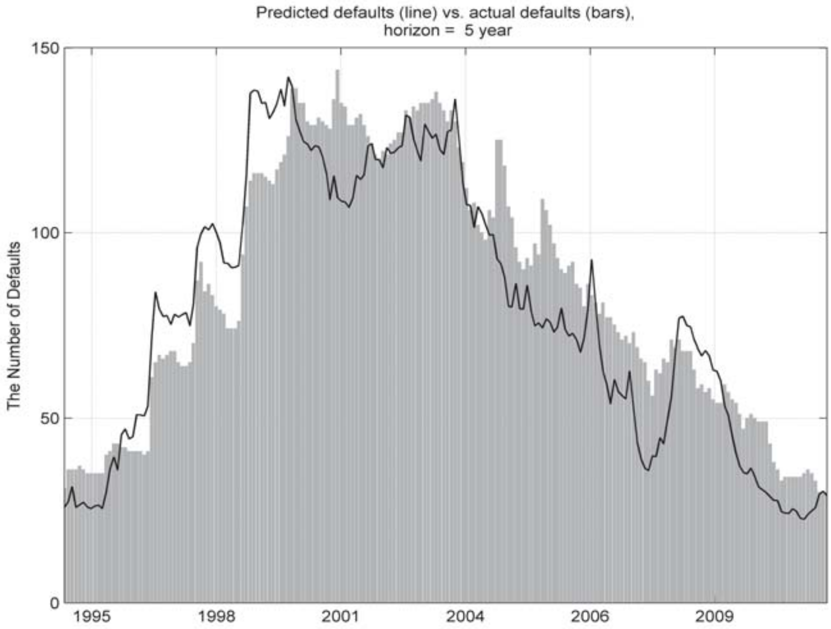
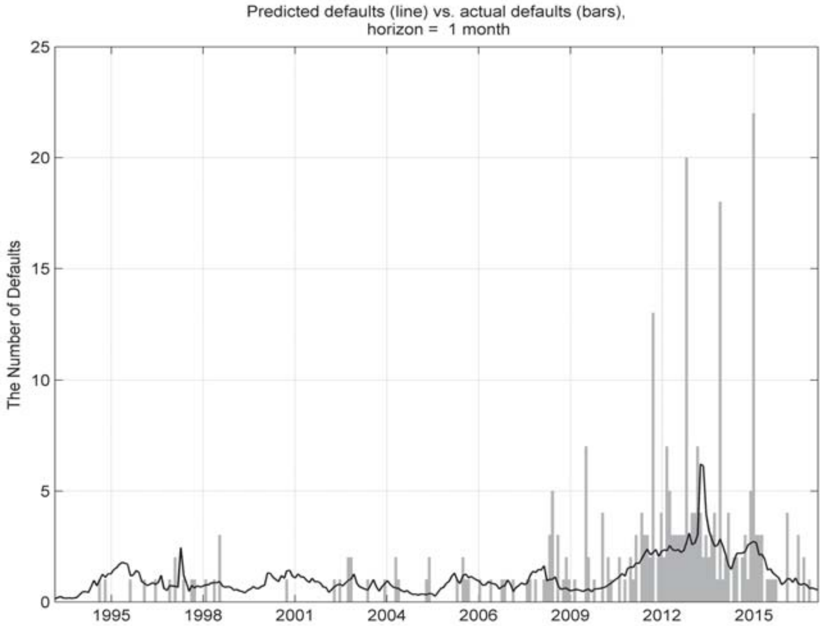
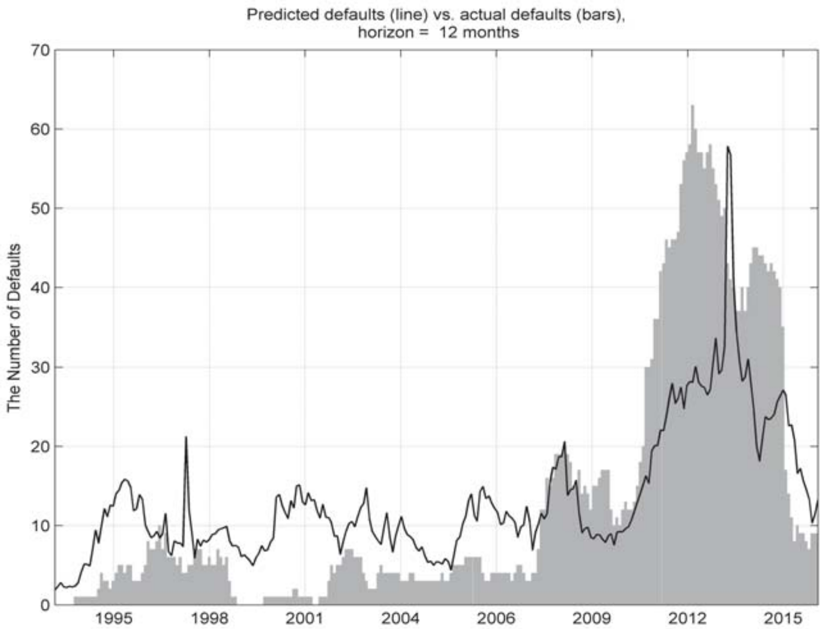
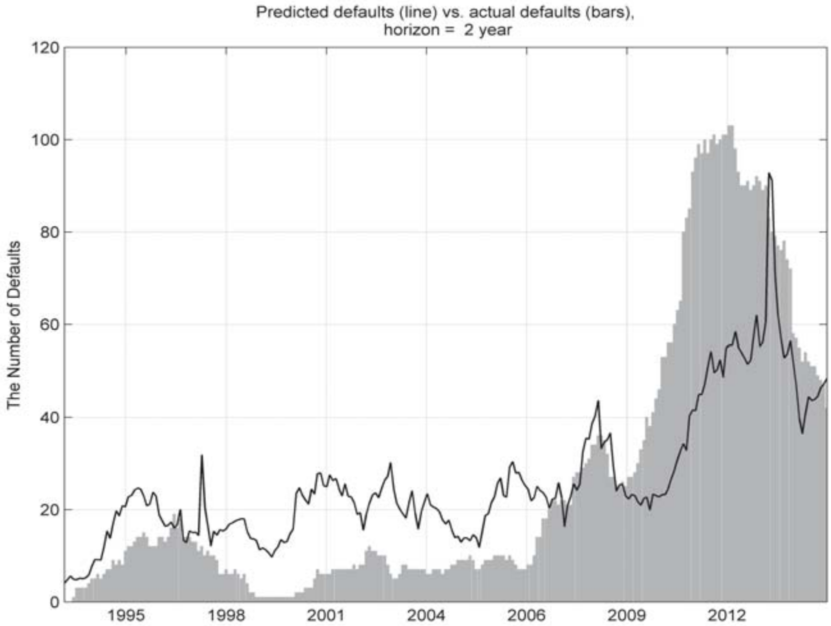
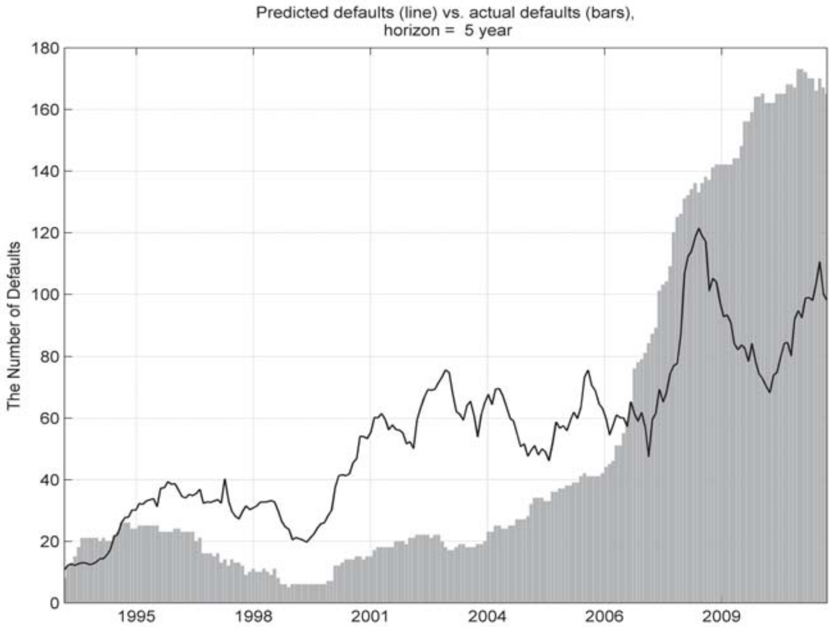

Predicted defaults (line) vs. actual defaults (bars),
horizon = 5 year
The Number of Defaults
150
100
50
0
1995
1998
2001
2004
2006
2009

Figure B.8: Performance test for India, in sample.









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