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NUS-RMI Credit Research Initiative Technical Report Version: 2015 Update 1

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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 over 60,000 exchange listed firms (including delisted ones) in 117 economies around the world (see Table A.1). Of them, over 30,000 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 2015 technical report and operational implementation of our model are: (1) Change in the financial statement (FS) priority rule; (2) exclusion of the OTC-listed companies in a number of economies; (3) replacement of the stock indices, 3-month interest rates and 1-year risk free rates

for a number of economies; (4) inclusion of economies Bangladesh, Oman, Jamaica, Tunisia, Bosnia and Herzegovina, Montenegro and Serbia in the calibration process; (5) new treatment rules for firms' financials after merges and acquisitions (M&A); (6) revised treatment rules for missing data handling; (7) a new section explaining the AS, a new credit risk measure now being calculated and released daily by the CRI. 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 January 2015. 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 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 I describes the quantitative model that is currently used to compute the PDs. The model was first described 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 II 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 I provides a broader description of the model, Sec. III 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 IV shows an empirical analysis for those economies that are currently covered. While the analysis shows excellent results in several economies, there is a 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. Section V explains how the AS is formulated. A detailed theoretical background can be found in Duan (2014). Section VI discusses future developments.

I. 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.

Section I.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. Section I.2 explains how the model can be calibrated. Section I.3 details the way parameters are estimated based on the Sequential Monte Carlo (SMC) technique.

I.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. FS 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 ith firm at the end of the nth 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 signalled 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. For example, in mergers and acquisitions involving two public companies, there will be one company that

delists from its stock exchange. This is important in predicting defaults because a default cannot happen if a firm has been previously delisted. An exception is if the exit is a distressed exit and is followed soon after by a credit event. See Sec. II.4 for details on how this case is handled in the CRI system.

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 $m < n$.

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:

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

where 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

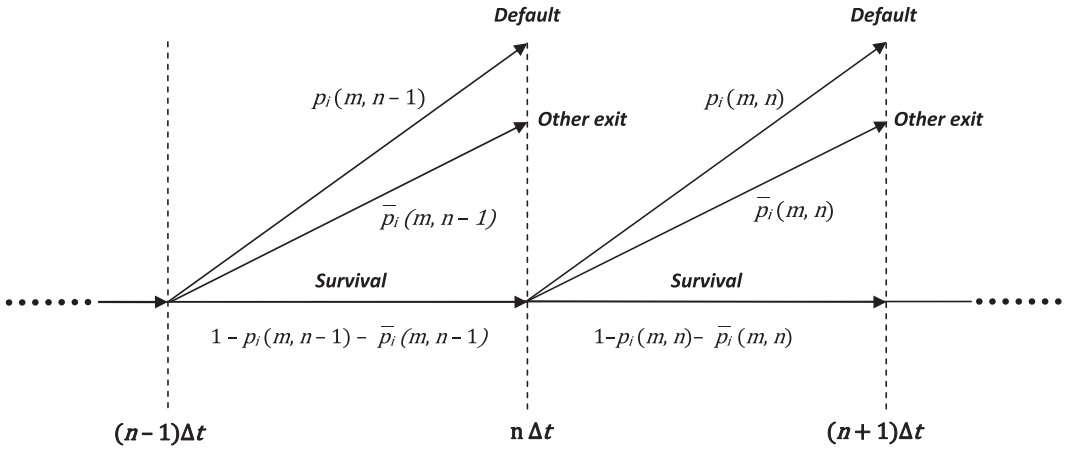


Figure 1. Default-other exit-survival tree for firm i, viewed from time $t = m\Delta t$.

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 $n\Delta t$:

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

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 $m \le n$. The corresponding forward intensity for a non-default exit is denoted by $\bar{h}_i(m,n)$. Because default is signalled 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 on 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:

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

where, 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 Secs. I.2 and I.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:

$$\text{Prob}_{t=m\Delta t}[\tau_i = n, \tau_i < \bar{\tau}_i] = \{1 - \exp[-\Delta t\; H(\beta(n-1-m), X_i(m))]\}$$

$$\times \prod_{j=m}^{n-2} \exp\{-\Delta t\ [H(\beta(j-m), X_i(m)) + H(\bar{\beta}(j-m), X_i(m))]\}$$
$$= \{1 - \exp[-\Delta t\ H(\beta(n-m-1), X_i(m))]\} \times \exp\left\{-\Delta t \sum_{j=m}^{n-2} [H(\beta(j-m), X_i(m)) + H(\bar{\beta}(j-m), X_i(m))]\right\}. \quad (8)$$

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:

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

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.

I.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 $n = 1, \ldots, N$. 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 $i = 1, \ldots, I$. As before, the input variables for the ith firm in the nth 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 ith 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 from 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:

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

Here, $P_{\min(N-m,\ell)}(\beta, \bar{\beta}; \tau_i, \bar{\tau}_i, X_i(m))$ is a probability for the ith 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:

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

In other words, if the ith 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:

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

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

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

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. Section I.3 will further explain how the optimum parameters can be estimated.

I.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, $\bar{\beta}$ 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. Section I.3.1 describes the parameterization of the parameters by NS functions, Sec. I.3.2 gives an overview of the SMC method that is used to estimate the NS functions, Sec. I.3.3 details the calculation of the confidence intervals for the parameter estimation, and Sec. I.3.4 describes how the parameters can be re-estimated given new data or updates of old data.

I.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 four 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:

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

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 Sec. II for descriptions of these covariates.

I.3.2. *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:

$$\mathcal{L}_{m,\min(N-m,\ell)}(\theta) = \prod_{i=1}^{I} P_{\min(N-m,\ell)}(\beta(\theta), \bar{\beta}(\theta); \tau_i, \bar{\tau}_i, X_i(m)), \tag{16}$$

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 Sec. I.1, consider the following pseudo-posterior distribution at time n after one makes the ℓ-period prediction:

$$\gamma_n(\theta) \propto \prod_{m=1}^{n-1} \mathcal{L}_{m,\min(N-m,\ell)}(\theta)\pi(\theta), \quad \text{for } n = 2, \ldots, N, \tag{17}$$

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:

$$\overline{\gamma}_{n+1,p}(\theta) \propto \gamma_n(\theta)\mathcal{L}^{\xi_p}_{n,\min(N-n,\ell)}(\theta), \quad \text{for } p = 1, \ldots, P_{n+1}. \tag{18}$$

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 decribed 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:

$$\overline{\theta}^{(k,n+1,p)} = \overline{\theta}^{(k,n+1,p-1)}, \tag{19}$$

$$\begin{aligned}\overline{w}^{(k,n+1,p)} &= \overline{w}^{(k,n+1,p-1)} \times \frac{\overline{\gamma}_{n+1,p}(\overline{\theta}^{(k,n+1,p)})}{\overline{\gamma}_{n+1,p-1}(\overline{\theta}^{(k,n+1,p)})} \\ &= \overline{w}^{(k,n+1,p-1)} \times \mathcal{L}^{\xi_p-\xi_{p-1}}_{n+1,\min(N\Delta t-(n+1)\Delta t,\ell)}(\overline{\theta}^{(k,n+1,p)}).\end{aligned} \tag{20}$$

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

$$\text{ESS} = \frac{\left(\sum_{k=1}^{N} \overline{w}^{(k,n+1,p)}\right)^2}{\sum_{k=1}^{N} \left(\overline{w}^{(k,n+1,p)}\right)^2}, \tag{21}$$

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%. Thus, if ESS $< 50\%$, 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

$$\overline{\theta}^{(k,n+1,p)} = \overline{\theta}^{(I^{(k,n+1,p)},n+1,p)}, \tag{22}$$

$$\overline{w}^{(k,n+1,p)} = \frac{1}{K}. \tag{23}$$

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

$$\alpha = \min\left(1, \frac{\overline{\gamma}_{n+1,p}\left(\theta^{*(k)}\right)\mathcal{Q}_{n+1,p}\left(\overline{\theta}^{(k,n+1,p)}\middle|\,\theta^{*(k)}\right)}{\overline{\gamma}_{n+1,p}\left(\overline{\theta}^{(k,n+1,p)}\right)\mathcal{Q}_{n+1,p}\left(\theta^{*(k)}\middle|\,\overline{\theta}^{(k,n+1,p)}\right)}\right). \tag{24}$$

(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:

$$(\theta^{(k,n+1)}, w^{(k,n+1)}) = (\overline{\theta}^{(k,n+1,P_{n+1})}, \overline{w}^{(k,n+1,P_{n+1})}). \tag{25}$$

Following Duan and Fulop (2013), the tempering sequence ξ_p is automatically set to ensure that the ESS stays close to 50%. 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 50% 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 $\geq B$ for $\xi_p = 1$.)

I.3.3. *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 $n = 2, \ldots, N$,

$$\hat{\theta}_n = \frac{1}{\sum_{k=1}^{K} w^{(k,n)}} \sum_{k=1}^{K} w^{(k,n)} \theta^{(k,n)}. \tag{26}$$

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. (17) 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:

$$t^* = \frac{\sqrt{N-1}\left(\hat{\theta}_N^{(k)} - a\right)}{\sqrt{\hat{\delta}_{k,N}}} \xrightarrow{d} \frac{W(1)}{[\int_0^1 (W(r) - rW(1))^2 dr]^{1/2}}, \quad (27)$$

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

$$\hat{C}_N = \frac{1}{(N-1)^2} \sum_{n=2}^{N} n^2 (\hat{\theta}_n - \hat{\theta}_N)(\hat{\theta}_n - \hat{\theta}_N)'. \quad (28)$$

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.

I.3.4. *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

$$\gamma_N^{(N)}(\theta) \propto \prod_{m=1}^{N-1} \mathcal{L}_{m,\min(N-m,\ell)}^{(N)}(\theta)\pi(\theta), \quad (29)$$

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

$$\gamma_{N+1}^{(N+1)}(\theta) \propto \prod_{m=1}^{N} \mathcal{L}_{m,\min((N+1)-m,\ell)}^{(N+1)}(\theta)\pi(\theta). \quad (30)$$

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

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

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, preform a reweighting by

$$\theta^{*(k,N)} = \theta^{(k,N)}, \quad (32)$$

$$w^{*(k,N)} = w^{(k,N)} \times \frac{\gamma_N^{(N+1,N)}\left(\theta^{(k,N)}\right)}{\gamma_N^{(N)}\left(\theta^{(k,N)}\right)}. \quad (33)$$

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 Sec. I.3.2, starting from Eq. (18), 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 1000 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 Sec. III.

II. INPUT VARIABLES AND DATA

Section II.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 Sec. IV.

Section II.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.

Section II.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.

Section II.4 discusses the definition and sources of defaults and of other exits used in the CRI.

II.1. Input Variables

Following the notation that was introduced in Sec. I, 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 two 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 six different firm characteristics.

The six firm characteristics are:

(1) volatility-adjusted leverage;
(2) liquidity;
(3) profitability;
(4) relative size;
(5) market misvaluation/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 Sec. III.

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 has 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.

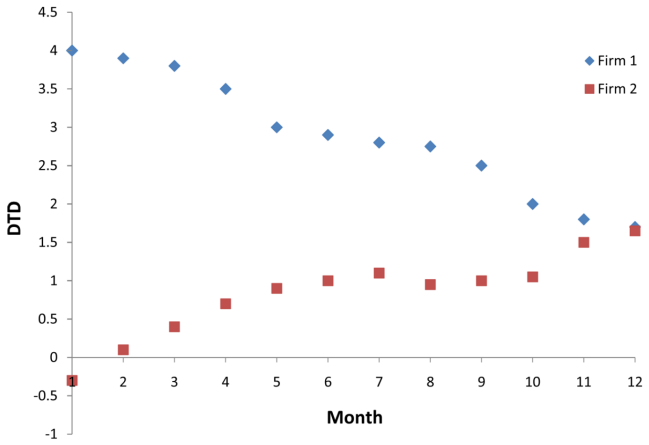


Figure 2. Two firms with all current values equal to each other, but DTD trending in the opposite direction.

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 Sec. IV.

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 Sec. II.3. The remaining data fields required are straightforward and standard. The computation for DTD is explained in Sec. III.

II.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 FSs as companies release them. Firms will often have multiple versions of FSs 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 FSs to decide which data should be used. The priority rules are described in Sec. III.

The firm coverage of the Back Office Product is of sufficient quality that over 30,000 firms can be updated on a daily basis in the 117 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; and data from Prowess for Indian firms.

With all of the databases merged together and for the 117 economies under CRI's coverage, over 60,000 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 117 economies, 78 economies have their own stock exchange (see Table A.2). For the other 39 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.

II.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' FSs 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 Sec. III. 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 for 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 FSs. 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.

II.4. Data for Defaults

The CRI database contains credit events of over 4000 firms from 1990 to the present. The default events come from numerous sources, including Bloomberg, Compustat, CRSP, Moodys reports, TEJ, exchange websites and news sources.

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. However, firms that are delisted from an exchange and then experience a default event within 365 calendar days of the delisting will have an exit event reclassified as credit default. 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 made.

Complete statistics of the total number of firms, number of defaults and number of other exits in each of the 78 economies from 1992 to 2014 are listed in Table A.11.

III. IMPLEMENTATION DETAILS

Section I 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.

Section III.1 describes implementation details related to data, mainly dealing with data cleaning and missing data. Section III.2 describes the specific computation of DTD used by the CRI system that leads to meaningful DTD for financial firms. Section III.3 explains how the calibration previously described in Sec. I.2 can be implemented. Section III.4 gives the implementation details relevant to the daily output. This includes an explanation of the various modifications needed to compute daily PD so that the daily PD is consistent with the usual month end PD, and a description of the computation of the aggregate PDs provided by the CRI.

III.1. Data Treatment

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 three 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 FSs quicker than three 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 three months. If there was no revision to an FS, the originally released FS is used. Whenever the latest revision is available more than three 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 FSs: As described in Sec. II.2, data provided in Bloomberg's Back Office Product can include numerous versions of FSs within the same period. If there are multiple FSs 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 FSs more frequently than consolidated ones. As a result, this prioritization rule can lead to cases where the FSs 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 FSs, 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 are not meaningful. Because of this, as of October 2013 calibration, we only use data from annual FSs 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, FSs 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, FSs 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, FSs 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 FSs available in the database from the highest priority to the lowest. If there are FSs 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 previous 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 in 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 FSs 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 FSs 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 FS that reflects the post-M&A situation becomes available, which varies across economies and can range from three 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 FS 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 FS 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 FS variables. By using this method, we assume that the financial manager of the acquirer consolidates the FSs of both entities. As a consequence, the FS 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 FS 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 be 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 PD, the PD 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 of a firm's history.

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% and 99.9% 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%, 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% and 99.9% 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 six 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 one and five 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 FSs 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 and Brazil's Soma. To identify the smaller markets outside of 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.

Firms that record an exit (other than due to no trading for 90 calendar days) will not enter back into the calibration even if the firm continues to trade and issues FSs, as that can happen after the firms declare bankruptcy. There are two exceptions to this exclusion. The first, determined on a case by case basis, is if the firm should be deemed to have re-emerged from bankruptcy. The second exception is for all firms in China, where two situations are prevalent. The first situation is that the firm experiences few repercussions from the default and continues operating normally. The other situation is for one firm to take over a defaulted firm's listing. This happens due to the limited supply of exchange listings. Both of these situations can be considered as emerging from default, so the CRI system enters all of these companies back into the calibration as new companies.

III.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:

$$\mathrm{d}V_t = \mu V_t \mathrm{d}t + \sigma V_t \mathrm{d}B_t, \tag{34}$$

where, 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. 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: $E_t = \max(V_t - L, 0)$. 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,

$$E_t = V_t N(d_+) - e^{-r(T-t)} L N(d_-), \tag{35}$$

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

$$d_\pm = \frac{\log\left(\frac{V_T}{L}\right) + \left(r \pm \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}. \tag{36}$$

Following the Merton (1974) model, the probability of the company's default at time T evaluated at time t is $N(-\mathrm{DTD}_t)$, where DTD at time t is defined as:

$$\mathrm{DTD}_t = \frac{\log\left(\frac{V_T}{L}\right) + \left(\mu - \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}. \tag{37}$$

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 firms current liabilities plus one half of its long-term debt. Here, the current liabilities and long-term debt are taken from the firm's FSs. If the firm is missing the current liabilities field, then various substitutes for this field can be used, as described in Sec. II.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 maximum likelihood estimation method developed in Duan (1994, 2000). 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 is:

$$\begin{aligned}\mathcal{L}(\mu, \sigma, \delta) = &-\frac{n-1}{2}\log(2\pi) - \frac{1}{2}\sum_{t=2}^{n}\log(\sigma^2 h_t) \\ &- \sum_{t=2}^{n}\log\left(\frac{\hat{V}_t(\sigma,\delta)}{A_t}\right) \\ &- \sum_{t=2}^{n}\log[N(\hat{d}_+(\hat{V}_t(\sigma,\delta),\sigma,\delta))] \\ &- \frac{1}{2\sigma^2}\sum_{t=2}^{n}\frac{1}{h_t}\left[\log\left(\frac{\hat{V}_t(\sigma,\delta)}{A_t} \right.\right. \\ &\left.\left. \times \frac{A_{t-1}}{\hat{V}_{t-1}(\sigma,\delta)}\right) - \left(\mu - \frac{\sigma^2}{2}\right)h_t\right]^2,\end{aligned} \tag{38}$$

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. (35), $\hat{d}_+$ is computed with Eq. (36) 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. (35). If there are fewer than 50 days of valid observations for the market capitalization

or FS variables, 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 (38) over $\sigma \geq 0$ and $0 \leq \delta \leq 1$, and then to calculate the DTD from Eq. (37). 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

$$\hat{\mu} = \frac{\hat{\sigma}^2}{2} + \frac{1}{\sum_{t=2}^{n} h_t} \log\left(\frac{\hat{V}_n(\hat{\sigma}, \hat{\delta})}{A_n} \times \frac{A_1}{\hat{V}_1(\hat{\sigma}, \hat{\delta})}\right). \tag{39}$$

In view of this, maximizing the 3D function $\mathcal{L}(\mu, \sigma, \delta)$ can be equivalently reduced to maximizing the 2D function $\tilde{\mathcal{L}}(\sigma, \delta)$ taking the form

$$\begin{aligned}\tilde{\mathcal{L}}(\sigma, \delta) = &-\frac{n-1}{2}\log(2\pi) - \frac{1}{2}\sum_{t=2}^{n}\log(\sigma^2 h_t) \\ &- \sum_{t=2}^{n}\log\left(\frac{\hat{V}_t(\sigma, \delta)}{A_t}\right) - \frac{1}{2\sigma^2}\left\{\sum_{t=2}^{n}\frac{1}{h_t}\right. \\ &\times\left[\log\left(\frac{\hat{V}_t(\sigma, \delta)}{A_t} \times \frac{A_{t-1}}{\hat{V}_{t-1}(\sigma, \delta)}\right)\right]^2 \\ &- \frac{1}{\sum_{t=2}^{n} h_t} \\ &\left.\times\left[\log\left(\frac{\hat{V}_n(\hat{\sigma}, \hat{\delta})}{A_n} \times \frac{A_1}{\hat{V}_1(\hat{\sigma}, \hat{\delta})}\right)\right]^2\right\}.\end{aligned} \tag{40}$$

However, with quarterly FSs, 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. All financial sector firms in the same economy are assumed to share the same estimate of δ, chosen to be the average of all its individual estimates. The same is done for non-financial firms. Accordingly, with δ being fixed to be the sector average, the original maximization of $\tilde{\mathcal{L}}(\sigma, \delta)$ is reduced to a 1D maximization in σ. Thus, this maximization is used to perform the estimates of 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 is used instead of one year, and a minimum of 250 days of valid observations of the market capitalization 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. (37) is eliminated.

In summary, the DTD for each firm is computed using the economy and sector (financial or non-financial) average 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 h 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.

III.3. Calibration

Implementation: As shown in Sec. I, 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.

III.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 PD: 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 8 July 2014, the display of the aggregate PD 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 Sec. III.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.

In order to implement the treatment, default events are classified into hard defaults and soft defaults (see Table 1).

Hard defaults are default events that are typically permanent. In other words, companies typically cannot emerge from hard defaults. An example of a hard default is a forced liquidation of a company. PDs will not be computed after the default event unless there is an exceptional circumstance that warrants a manual intervention. General Motors (GM) is an example of such an event. Although GM filed for Chapter 11 reorganization in June 2009, the company resumed operations in March 2011. As of March 2011, after the company resumed operations, we decided to treat GM as a new company.

Soft defaults are default events that companies can typically emerge from. An example of a soft default is a debt restructuring. More specifically, after a soft default, if there is sufficient data for the company, then the company is assumed to have been able to continue its operations and PDs are computed. The PDs are generated once sufficient history of both the market capitalization data and the new FS data (released after the event) becomes available. Take the Australian company Marion Energy Ltd as an example, which had a debt restructuring in April 2010. We stopped calculating PD after 31 March 2010. As debt restructuring is considered as a soft default, we started calculating PD again from 30 September 2010 onwards, when data requirements were met.

This treatment does not apply to Chinese companies, based on two reasons: (1) A firm typically experiences few repercussions from the default and

Table 1. Classification of default events.

Default-action type	Subcategory
Hard defaults (default events that are typically permanent)	Administration, Arrangement, Canadian CCAA, Chapter 7, Chapter 11, Chapter 15, Conservatorship, Insolvency, Japanese CRL, Judicial Management, Liquidation, Pre-Negotiated Chapter 11, Protection, Receivership, Rehabilitation, Reorganization, Restructuring, Section 304, Supreme court declaration, Winding Up, Work Out, Other, Unknown.
Soft defaults (default events that companies can emerge from)	Coupon & Principal Payment, Coupon Payment Only, Debt Restructuring, Interest Payment, Loan Payment, Principal Payment, ADR (Japan only), Declared Sick (India only), Rehabilitation (Thailand 1997), Unknown.

continues operating normally; and (2) it is common for another firm to take over a defaulted firm's listing, due to the limited supply of exchange listings. Both of these situations can be considered as emerging from default, so the CRI system enters all of these companies back into the calibration as new companies.

IV. 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 Sec. IV.1, an overview is given of the default parameter estimates. Section IV.2 explains and provides the accuracy ratios for the different countries under the CRI coverage.

IV.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 January 2015 using data up until the end of December 2014. 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.

IV.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: $\text{AR} = 2 \times \text{AUROC} - 1$.

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 PD are taken to be non-overlapping. For example, the one-year AR is based on PDs computed on 31 December 2000, 31 December 2001, . . . , 31 December 2009 and firms defaulting within one year of those dates, while the two-year AR is based on PDs computed on 31 December 2000, 31 December 2002, . . . , 31 December 2008 and firms defaulting within two years of those dates.

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 Figs. B.3–B.8. For China and India in particular, these figures show that there is room for improvement in the predictive power of the model.

V. ACTUARIAL SPREAD

In July 2014, CRI launched a new credit risk measure, the 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 PD 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 PD. Much like the par spread in a standard credit default swap (CDS) contract, the AS leverages the term structure of the physical PD 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 PD 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 $t_1, t_2, \ldots, t_k$ 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:

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

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 $q \geq s \geq 1$. 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

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

Furthermore, we let $r_t(q, q) = r_t(1, q) \cdot q - r_t(1, q - 1) \cdot (q - 1)$ for $q \geq 2$, 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

$$\begin{aligned} &S_t^{(a)}(T - t) \\ &\quad = \frac{(1 - \bar{R}_t) \cdot E_t^p \left[e^{-r_t(1,\tau-t)(\tau-t)/365} \cdot 1_{\{t<\tau\leq t'_k\}} \right]}{\sum_{i=1}^{k} \Big\{ A(t_{i-1} \vee (t + 1), t'_i) \\ &\qquad \times e^{-r_t(1,t_i-t)(t_i-t)/365} \cdot E_t^p \Big[1_{\{t'_i<\tau\}} \Big] \\ &\qquad + E_t^p \left[A(t_{i-1} \vee (t + 1), \tau) \right] \\ &\qquad \times e^{-r_t(1,\tau-t)(\tau-t)/365} \cdot 1_{\{t'_{i-1}<\tau\leq t'_i\}} \Big\}} \end{aligned} \tag{41}$$

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, two macroeconomic variables and 10 firm-specific variables, in the form of

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

and

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

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

$$\begin{aligned} &\alpha_i(u; \varrho_{i,0}, \varrho_{i,1}, \varrho_{i,2}, d_i) \\ &\quad = \varrho_{i,0} + \varrho_{i,1} \frac{1 - \exp(-u\Delta t/d_i)}{u\Delta t/d_i} \\ &\qquad + \varrho_{i,2} \left[\frac{1 - \exp(-u\Delta t/d_i)}{u\Delta t/d_i} - \exp(-u\Delta t/d_i) \right], \end{aligned} \tag{42}$$

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 are indeed 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

$$P_t(s, q; r_t(1, v), s \le v \le q) = \sum_{v=s}^{q} e^{-\sum_{u=s}^{v}[r_t(u,u)+f_t(u)]\Delta t} f_t(v)\Delta t. \quad (43)$$

By temporarily setting the forward interest rate to 0 in Eq. (43), the first term of denominator in Eq. (41) can be presented in the form of

$$E_t^P(1_{\{t_i'<\tau\}}) = 1 - P_t(1, t_i' - t; r_t(1, u) = 0 \text{ for } 1 \le u \le t_i' - t). \quad (44)$$

The solutions to the two remaining two terms of Eq. (41) can be expressed as

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

and

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

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.

VI. ONGOING DEVELOPMENTS

The CRI can be developed along 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.

As an example, the CRI plans to implement the partially-conditioned forward intensity approach proposed in Duan and Fulop (2013) to study its practicality and performance. In fact, the parameter constraints on the forward-intensity function essential to the implementation of that approach has already been incorporated into the current CRI system in making longer-term default predictions.

Within the current modeling framework, future developments involve, for example, variable selection where more experiments are needed to identify common risk factors and company-specific attributes that are more indicative of defaults in emerging markets. Another example is that we are designing a more comprehensive treatment scheme to handle missing data.

Finally, a series of new applications and tools using the RMI-CRI PD as an input are currently being developed. More specifically, CRI is active 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. CRI has developed a tool for stress testing the financial stability for economies around the world. CRI has also developed a model for predicting recovery rate and a methodology to address default correlations within a portfolio. CRI remains committed to making its vast resources available for academic research.

ACKNOWLEDGMENT

The RMI CRI 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@globalcreditreview.com.

APPENDIX A: DATA

Table A.1. All countries under the RMI 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 (19)	Azerbaijan, 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 (18)	Argentina, Bahamas, Belize, Brazil, British Virgin Islands, Cayman Islands, Chile, Colombia, Curacao, Dominican Republic, Falkland Islands, Jamaica, Mexico, Peru, Panama, Puerto Rico, U.S. Virgin Islands, Venezuela.
Middle East & Africa (26)	Angola, Bahrain, Egypt, Gabon, Ghana, Iraq, Israel, Jordan, Kuwait, Madagascar, Mauritius, Morocco, Mozambique, Namibia, Nigeria, 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 39 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.

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

Note: The gray boxes indicate that these economies also have their own local stock exchange.

Table A.4. ISO codes for economies currently covered by the CRI and the group that each economy is calibrated in.

ISO Code	Economy	Calibration group
ARE	United Arab Emirates	Emerging
ARG	Argentina	Emerging
AUT	Austria	Europe
AUS	Australia	Developed Asia-Pacific
BIH	Bosnia and Herzegovina	Europe
BGD	Bangladesh	Emerging
BEL	Belgium	Europe
BGR	Bulgaria	Europe
BHR	Bahrain	Emerging
BRA	Brazil	Emerging
CAN	Canada	North America
CHE	Switzerland	Europe
CHL	Chile	Emerging
CHN	China	China
COL	Colombia	Emerging
CYP	Cyprus	Europe
CZE	Czech Republic	Europe
DEU	Germany	Europe
DNK	Denmark	Europe
EST	Estonia	Europe
EGY	Egypt	Emerging
ESP	Spain	Europe
FIN	Finland	Europe
FRA	France	Europe
GBR	United Kingdom	Europe
GRC	Greece	Europe

(*Continued*)

Table A.4. (*Continued*)

ISO Code	Economy	Calibration group
HKG	Hong Kong	Developed Asia-Pacific
HRV	Croatia	Europe
HUN	Hungary	Europe
IDN	Indonesia	Emerging
IRL	Ireland	Europe
ISR	Israel	Europe
IND	India	India
ISL	Iceland	Europe
ITA	Italy	Europe
JAM	Jamaica	Emerging
JOR	Jordan	Emerging
JPN	Japan	Developed Asia-Pacific
KOR	South Korea	Developed Asia-Pacific
KWT	Kuwait	Emerging
KAZ	Kazakhstan	Emerging
LKA	Sri Lanka	Emerging
LTU	Lithuania	Europe
LUX	Luxembourg	Europe
LVA	Latvia	Europe
MAR	Morocco	Emerging
MNE	Montenegro	Europe
MKD	Macedonia	Europe
MLT	Malta	Europe
MEX	Mexico	Emerging
MYS	Malaysia	Emerging
NGA	Nigeria	Emerging
NLD	Netherlands	Europe
NOR	Norway	Europe
NZL	New Zealand	Developed Asia-Pacific
OMN	Oman	Emerging
PER	Peru	Emerging
PHL	Philippines	Emerging
PAK	Pakistan	Emerging
POL	Poland	Europe
PRT	Portugal	Europe
ROM	Romania	Europe
SRB	Serbia	Europe
RUS	Russian Federation	Europe
SAU	Saudi Arabia	Emerging
SWE	Sweden	Europe
SGP	Singapore	Developed Asia-Pacific
SVN	Slovenia	Europe
SVK	Slovakia	Europe
THA	Thailand	Emerging
TUN	Tunisia	Emerging
TUR	Turkey	Europe
TWN	Taiwan	Developed Asia-Pacific
UKR	Ukraine	Europe
USA	United States	North America
VEN	Venezuela	Emerging
VNM	Vietnam	Emerging
ZAF	South Africa	Emerging

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

Country	Stock exchange	Period used*
ARE	FTSE NASDAQ DUB UAE 20	06/28/2006–Present
ARG	Buenos Aires Stock Exchange Merval Index	
AUT	Austrian Traded ATX Index	
AUS	All Ordinaries Index	
BIH	SASX-10	02/06/2006–Present
BGD	Dhaka Stock Exchange Index	01/07/2008–Present
BEL	Brussels Stock Exchange Belgian All Shares Return Spot + Forward Index	
BGR	Bulgaria Stock Exchange Sofix Index	10/24/2000–Present
BHR	Bahrain Bourse All Share Index	07/08/2004–Present
BRA	Brazil Bovespa Stock Index	
CAN	S&P/TSX 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 Exch Index	04/05/1994–Present
DEU	CDAX Performance Index	
DNK	OMX Copenhagen 20 Index	
EST	OMX Tallinn OMXT	06/03/1996–Present
EGY	EGX 100 Index	05/01/2006–Present
ESP	IBEX 35 Index	
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 Exch Indx	01/02/1991–Present
IDN	Jakarta Composite Index	
IRL	IRISH Overall Index	
ISR	Tel Aviv 100 Index	12/31/1991–Present
IND	BSE Sensex 30 Index	
ISL	OMX Iceland All-Share PR	12/31/1992–Present
ITA	Italy Stock Market BCI Comit Globale	
JAM	Jamaica Stock Exchange Market Index	
JOR	MSCI Jordan Index	
JPN	NIKKEI 500	
KOR	KOSPI Index	
KWT	Kuwait SE Weighted Index	01/02/2012–Present
	Kuwait Global General Index	01/02/1984–01/01/2012
KAZ	Kazakhstan Stock Exchange Index KASE	07/12/2000–Present
LKA	Sri Lanka Colombo All-Share Index	
LTU	OMX Vilnius OMXV	01/04/2000–Present
LUX	Luxembourg Stock Exchange LuxX Index	01/04/1999–Present
	Luxembourg Stock Exchange 13 'Dead'	01/02/1998–01/03/1999
LVA	OMX Riga OMXR	01/03/2000–Present
MAR	CFG 25	12/31/1993–Present
MNE	Montenegro Stock Exchange 20	03/03/2003–Present
MKD	Macedonian Stock Exchange MBI 10	12/30/2004–Present
MLT	Malta Stock Exchange	12/27/1995–Present

(*Continued*)

Table A.5. (*Continued*)

Country	Stock exchange	Period used*
MEX	Mexico Bolsa Index	01/19/1994–Present
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	Muscat Securities Market 30 Index	03/31/1992–Present
PER	Bolsa de Valores de Lima General Sector Index	01/02/1990–Present
PHL	PSEi — Philippine SE Index	
PAK	Karachi All Share Index	03/11/1998–Present
POL	WSE WIG Index	04/16/1991–Present
PRT	PSI General Index	
ROM	BET Index	06/23/2014–Present
	Bucharest Stock Exchange Trading Composite Index	09/22/1997–06/22/2014
RUS	MICEX Index	09/22/1997–Present
SAU	Tadawul All Share Index	01/31/1994–Present
SGP	Straits Time Index	01/10/2008–Present
	Straits Time Old Index	01/04/1985–01/09/2008
SRB	BELEXline Index	10/01/2004–Present
SVN	HSBC Slovenia Dollar	12/29/1995–Present
SVK	Slovak Share Index	09/14/1993–Present
SWE	OMX Stockholm All-Share	
THA	Stock Exchange of Thai Index	
TUN	Tunis SE TUNINDEX	04/13/1999–Present
TUR	Istanbul Stock Exchange National 100 Index	
TWN	Taiwan TAIEX 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 interest rate that is used throughout the whole period.

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

Country	Short term interest rate	Period used
ARE	UAE Ibor 3 Month	05/15/2000–Present
ARG	Argentina Deposit 90-Day	04/01/1991–Present
AUT	Germany 3 Month Bubill	01/01/1999–Present
	—	–12/31/1998
AUS	Australia Dealer Bill 90-Day	
BIH	BP interest rate: Lending rate NADJ	09/15/1998–Present
BGD	Bangladesh 3 Month Bill Auction Cut Off Yield	01/31/2006–Present
BEL	Germany 3 Month Bubill	01/01/1999–Present
	—	–12/31/1998
BGR	Bulgaria Interbank 3 Month	02/17/2003–Present
BHR	Bahrain Ibor 3 Month	12/14/2006–Present
BRA	Andima Brazil Govt Bond Fixed Rate 3 Month	04/03/2000–Present
	Brazil CDB (Up to 30-Day)	10/10/1994–04/02/2000

(*Continued*)

Table A.6. (*Continued*)

Country	Short term interest rate	Period used
CAN	Canada Treasury Bill 3 Month	01/02/1990–Present
CHE	Swiss Interbank 3 Month	
CHL	Chile TAB UF Interbank Rate 90-Day	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	
EST	Germany 3 Month Bubill	01/01/2011–Present
	—	–12/31/2010
EGY	Egypt 91-Day T-Bill	07/06/2004–Present
ESP	Germany 3 Month Bubill	01/01/1999–Present
	—	–12/31/1998
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 SBI 90-Day	07/10/2003–Present
	Indoneia SBI/DISC 90-Day 'DEAD'	01/01/1985–07/09/2003
IRL	Germany 3 Month Bubill	01/01/1999–Present
	—	–12/31/1998
ISR	Israel T-Bill Seconday 3 Month	05/30/1995–Present
IND	India Treasury Bill 3 Month	05/20/2013–Present
	India T-Bill Secondary 91-Day	01/15/1993–05/19/2013
ISL	Iceland Interbank 3 Month	08/04/1998–Present
	Iceland 90-Day CB NOTES	05/12/1987–08/03/1998
ITA	Germany 3 Month Bubill	01/01/1999–Present
	—	–12/31/1998
JAM	Jamaica 3 Month repo rate	07/17/2008–Present
JOR	Interbank offered rate 3 Month	09/20/2006–Present
	Jordan Re-discount rate	–09/19/2006
JPN	Japan Treasury Discount Bills 3 Month	07/10/1992–Present
	Japanese Government Bond Interest Rate –1 Year maturity	09/24/1974–07/09/1992
KOR	Korea Commercial Paper 91-Day	06/14/1993–Present
KWT	Kuwait Interbank 3 Month	
KAZ	Kazakhstan KIBOR/KIBID 90-Day Interbank	09/29/2001–Present
LKA	Sri Lanka Treasury Bill 3 Month	01/01/2015–Present
LTU	Germany 3 Month Bubill	
	—	01/00/1900 –12/31/2014
LUX	Germany 3 Month Bubill	
	—	–12/31/1998
LVA	Germany 3 Month Bubill	
	—	–12/31/2013

(*Continued*)

Table A.6. (*Continued*)

Country	Short term interest rate	Period used
MAR	Morocco Deposit Rate 3 Month	06/06/2003–Present
MNE	Treasury Bill Rate 91-Day (EP)	06/25/2004–Present
MKD	Macedonia Skibor 3 Month	01/01/2008–Present
MLT	Germany 3 Month Bubill	12/31/2007–Present
	—	–12/31/2007
MEX	Mexico CETES 2nd MKT. 90-Day	06/26/1996–Present
	Mexico CETES 91-Day AVG.RET.AT AUC.	03/09/1989–06/25/1996
MYS	Malaysia Deposit 3 Month	
NGA	Nigeria Interbank Offered Rate 3 Month	01/01/1999–Present
NLD	Germany 3 Month Bubill	12/31/1998–Present
	—	–12/31/1998
NOR	Norway Govt Treasury Bills 3 Month	06/27/1995–Present
	Norway Interbank 3 Month (Effective)	01/02/1986–06/26/1995
NZL	—	
OMN	Omani Rial 3 Month Deposit	07/16/2002–Present
PER	Peru Savings Rate	07/01/1991–Present
PHL	Philippine Treasury Bill 91-Day	
PAK	PKR 3 Month Repo	10/29/1999–Present
POL	Poland Interbank 3 Month (EOD)	01/01/1999–Present
PRT	Germany 3 Month Bubill	12/31/1998–Present
	—	–12/31/1998
ROM	Romanian Interbank 3 Month	04/18/2005–Present
RUS	MosPime 3 Month Rate	08/14/2000–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	09/20/2013–Present
SGP	Monetary Authority of Singapore Benchmark Govt Bill Yield 3 Month	01/02/1998–Present
	Singapore T-bill 3 Month	01/08/1988–09/19/2013
SRB	National Bank of Serbia BELIBOR 3 Month Rate (Interbank rate)	01/01/2007–Present
SVN	Germany 3 Month Bubill	12/31/2006–Present
	—	–12/31/2006
SVK	Germany 3 Month Bubill	12/31/2008–Present
	—	–12/31/2008
SWE	Sweden T Bill 3 Month	05/25/1993–Present
	Sweden Treasury Bill 90-Day	04/25/1989–05/24/1993
THA	Bloomberg 3 Month Thailand BIBOR	05/30/2002–Present
	Thailand 3 Month repo rate	03/11/1994–05/29/2002
TUN	TU Policy Rates: TMM (AVG.)	
TUR	Turkish Interbank 3 Month	08/01/2002–Present
TWN	Taiwan Money Market 90-Day	
UKR	Ukraine Interbank 3 Month	03/01/2001–Present
USA	US Generic Govt 3 Month Yield	01/10/1997–Present
VEN	Venezuela 90-Day Deposit Rate	01/09/1997–Present
	Venezuela Overnight	11/28/1994–01/09/1997
VNM	—	
ZAF	SA T-Bill 91-Day (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.

Country	Interest rate name	Period used*
ARE	UAE Ibor 1 Year	05/15/2000–Present
ARG	Argentina Deposit 90-Day (PA.)	04/01/1991–Present
AUT	German Government Bonds 1 Year BKO	01/01/1999–Present
	Austria VIBOR 12 Month	06/10/1991–12/31/1998
AUS	Australia Govt Bonds Generic Mid Yield 1 Year	
BIH	BP Real Interest Rate NADJ	01/01/1998–Present
BGD	Bangladesh 12 Month Bill Auction Cut Off Yield	09/30/2008–Present
BEL	German Government Bonds 1 Year BKO	01/01/1999–Present
	Belgium Treasury Bill 1 Year	04/02/1991–12/31/1998
BGR	Bulgaria Interbank 3 Month	02/17/2003–Present
BHR	Bahrain Ibor 1 Year	12/14/2006–Present
BRA	Andima Brazil Govt Bond Fixed Rate 1 Year	04/03/2000–Present
	Brazil CDB (Up to 30-Day)	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-Day	08/01/1996–Present
	Chile TAB UF Interbank Rate 90-Day	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	03/01/2001–Present
	Colombia CD Rate 360-Day	07/12/1993–02/28/2001
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
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
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
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 12 Month	01/03/1989–12/31/1998
GBR	UK Govt Bonds 1 Year Note Gene	09/12/2001–Present
	UK Govt. Liab. Nom. Spot Curve 12 Month	01/02/1979–09/11/2001
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
IRL	German Government Bonds 1 Year BKO	01/01/1999–Present
	Dublin Interbank Offered Rates	04/10/1991–12/31/1998
ISR	Israel T-Bill Secondary 1 Year	11/15/1994–Present
IND	India Treasury Bond 1 Year	05/20/2013–Present
	India T-Bill Secondary 1 Year	01/01/1993–05/19/2013

(*Continued*)

Table A.7. (*Continued*)

Country	Interest rate name	Period used*
ISL	Iceland Interbank 12 Month	02/01/2000–Present
	Iceland Interbank 3 Month	08/04/1998–01/31/2000
	Iceland 90–Day CB Notes	05/12/1987–08/03/1998
ITA	German Government Bonds 1 Year BKO	01/01/1999–Present
	Italy Bots Treasury Bill 12 Month Gross Yields	12/29/1995–12/31/1998
	Italy T-Bill AUCT. Gross 12 Month	03/31/1987–09/04/1994
JAM	Jamaica 12 Month repo rate	07/17/2008–Present
JOR	Interbank offered rate 3 Month	09/20/2006–Present
	Jordan Re-discount rate	03/09/2001–09/19/2006
JPN	Japan Treasury Bills 12 Month	12/14/1999–Present
	Japanese Government Bond Interest Rate 1 Year maturity	09/24/1974–12/13/1999
KOR	Korea Monetary Stab. Bonds 1 Year	01/03/1992–Present
KWT	Kuwait Interbank 1 Year	
KAZ	Kazakhstan KIBOR/KIBID 90-Day Interbank	09/29/2001–Present
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.)	01/15/1985–12/31/1998
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
MNE	Treasury Bill Rate 182-Day (EP)	07/16/2004–Present
MKD	Macedonia Skibor 3 Month	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
MEX	Mexico CETES 2nd MKT. 360-Day	06/26/1996–Present
	Mexico CETES 91-Day AVG.RET.AT AUC.	03/09/1989–06/25/1996
MYS	Bank Negara Malaysia 1 Year Govt Securities Indicative YTM	06/21/2005–Present
	Malayisa Deposit 1 Year	01/01/1985–06/20/2005
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
	Amsterdam Interbank Offered Rate 12 Month	01/02/1979–12/31/1998
NOR	Norway Govt Treasury Bills 12 Month	07/01/1997–Present
	Norway Interbank 1 Year	01/02/1986–06/30/1997
NZL	New Zealand Dollar Deposit 1 Year	
OMN	Omani Rial 12 Month Deposit	07/16/2002–Present
PER	Peru Savings Rate	07/01/1991–Present
PHL	Philippine Treasury Bill 364D	
PAK	PKR 12 Month Repo	10/29/2004–Present
POL	Poland Interbank 1 Year (EOD)	10/11/1995–Present
PRT	German Government Bonds 1 Year BKO	01/01/1999–Present
	Portugal 1 Year - LISBOR	08/16/1993–12/31/1998
ROM	Romanian Interbank 12 Month	08/01/1995–Present
RUS	MosPime 3 Month 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	
SGP	Monetary Authority of Singapore Benchmark Govt Bill Yield 3 Month	09/20/2013–Present
	Singapore T-Bill 3 Month	01/08/1988–09/19/2013
SRB	Serbia Treasury Bill Auction Results 12 Month Average Accepted Yield	08/26/2009–Present

(*Continued*)

Table A.7. (*Continued*)

Country	Interest Rate Name	Period Used*
SVN	German Government Bonds 1 Year BKO	01/01/2007–Present
	Slovenia Treasury Bill 3 Month 'DEAD'	10/29/1998–12/31/2006
SVK	German Government Bonds 1 Year BKO	01/01/2009–Present
	Slovak Rep. Interbank 1 Year	08/09/1994–12/31/2008
SWE	Sweden T Bill 3 Month	05/25/1993–Present
	Sweden Treasury Bill 90-Day	04/25/1989–05/24/1993
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	01/15/2000–Present
TUR	Turkish Interbank 12 Month	08/01/2002–Present
TWN	Taiwan Deposit 12 Month	
UKR	Ukraine Interbank 3 Month	03/01/2001–Present
USA	US Treasury Constant Matuities 1 Year	
VEN	Venezuela Savings Deposit Rate	01/03/2000–Present
	Venezuela Overnight Rate	11/28/1994–01/02/2000
VNM	Vietnam Interbank 3 Month	12/11/1998–Present
ZAF	South African Prime Overdraft 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 1991 to December 2014).

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				DTD Level				
ARE	−0.80	1.83	2.78	4.06	13.33	3.17	1.99	5598
ARG	−1.75	1.28	2.60	3.95	25.02	2.88	2.37	12369
AUT	−2.64	1.88	3.16	5.18	25.65	3.99	3.90	20010
AUS	−1.39	1.74	2.92	4.34	19.45	3.30	2.27	281837
BIH	−1.50	1.39	2.50	4.59	25.65	3.52	3.54	3415
BGD	−1.49	1.88	2.95	4.66	15.62	3.37	2.01	6299
BEL	−2.64	2.45	4.41	6.97	25.65	5.12	3.92	28909
BGR	−1.77	0.97	1.98	3.40	25.65	2.56	2.61	9273
BHR	−0.27	1.66	2.53	4.56	18.23	3.57	3.06	1332
BRA	−1.86	0.62	1.97	3.84	23.09	2.57	2.85	47510
CAN	−1.13	1.84	3.23	5.06	24.99	3.73	2.70	219416
CHE	−2.64	2.61	4.18	6.17	25.65	4.67	3.03	49954
CHL	−1.86	3.33	5.19	7.13	25.02	5.71	3.74	25147
CHN	−0.02	3.13	4.24	5.83	16.51	4.71	2.30	290782
COL	−1.35	2.18	3.98	6.31	19.98	4.55	3.30	5111
CYP	−1.19	0.84	1.54	2.58	23.81	2.11	2.35	14849
CZE	−2.64	1.18	2.38	3.81	20.20	2.74	2.33	5415
DEU	−2.64	1.57	2.90	4.57	25.65	3.37	2.77	177728
DNK	−1.92	1.82	3.18	4.87	25.65	3.74	3.15	40147
EST	−0.30	2.29	3.71	6.08	13.73	4.40	2.89	875
EGY	−1.86	1.84	2.93	4.35	25.02	3.31	2.23	15878
ESP	−2.64	1.97	3.49	5.22	25.65	3.94	3.19	32772
FIN	−2.64	2.31	3.53	5.11	22.02	3.88	2.46	28393
FRA	−2.64	1.81	3.08	4.79	25.65	3.58	2.80	159574
GBR	−2.64	2.07	3.53	5.50	25.65	4.08	2.90	348773
GRC	−2.64	1.29	2.32	3.70	23.60	2.65	2.16	55956

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				DTD Level				
HKG	−1.39	1.55	2.61	4.11	19.45	3.13	2.36	221639
HRV	−2.64	1.05	2.25	3.86	22.33	2.76	2.51	10040
HUN	−1.27	1.52	2.74	4.34	25.65	3.13	2.37	7010
IDN	−1.86	0.71	1.77	3.10	25.02	2.17	2.23	57695
IRL	−1.73	1.82	3.23	4.93	25.65	3.53	2.47	9091
ISR	−2.64	1.25	2.41	3.84	25.65	2.82	2.52	74817
IND	−1.91	0.78	1.75	2.99	21.53	2.20	2.32	463124
ISL	−1.48	1.70	2.94	4.46	20.01	3.42	2.57	3810
ITA	−2.64	1.56	2.84	4.47	25.65	3.24	2.57	60410
JAM	−1.07	1.02	2.55	3.65	15.39	2.71	2.30	1946
JOR	−1.86	2.35	3.57	5.38	23.79	4.14	2.61	21339
JPN	−1.39	2.09	3.16	4.59	19.45	3.59	2.26	829137
KOR	−1.39	1.30	2.27	3.51	19.45	2.65	2.21	300613
KWT	−0.44	2.26	3.29	4.65	25.02	3.78	2.37	21880
KAZ	−1.60	0.53	1.55	3.71	25.02	2.99	4.61	689
LKA	−1.86	1.53	2.52	3.93	17.81	2.93	2.09	18803
LTU	−1.30	1.46	3.16	5.46	20.95	3.82	3.38	4469
LUX	−0.56	2.95	4.67	7.48	25.65	6.13	4.72	2662
LVA	−1.45	1.17	2.28	3.93	25.65	2.92	2.61	2635
MAR	−0.69	2.60	3.81	5.33	21.53	4.14	2.42	7755
MNE	−0.28	1.38	2.22	2.91	7.96	2.43	1.56	908
MKD	−1.09	1.25	1.92	2.84	17.47	2.80	3.01	1943
MLT	−0.65	2.33	3.72	5.30	14.99	4.35	3.21	946
MEX	−1.86	1.99	3.81	5.99	25.02	4.34	3.33	17484
MYS	−1.86	1.58	2.86	4.70	25.02	3.57	3.00	193732
NGA	−1.78	1.07	2.30	3.58	25.02	3.02	3.79	13837
NLD	−2.64	2.38	3.96	5.86	25.65	4.40	3.02	36017
NOR	−2.64	1.24	2.42	3.94	20.49	2.74	2.15	40938
NZL	−1.27	2.75	4.91	7.24	19.45	5.32	3.41	17222
OMN	−0.10	3.49	5.00	7.47	21.16	6.02	3.95	2013
PER	−1.86	1.74	3.20	4.83	24.27	3.69	2.86	9624
PHL	−1.86	1.13	2.37	4.02	25.02	2.86	2.52	36818
PAK	−1.86	0.42	1.82	3.51	14.58	2.18	2.36	25199
POL	−2.64	1.34	2.39	3.60	25.65	2.69	2.13	61740
PRT	−2.64	1.00	2.26	4.02	20.16	2.75	2.47	12731
ROM	−2.64	0.77	1.70	2.94	25.65	2.06	1.96	12591
SRB	−2.64	0.48	1.80	3.23	22.90	2.21	2.80	2450
RUS	−2.51	0.96	2.19	3.78	25.65	2.58	2.28	18231
SAU	−1.52	3.88	5.77	8.34	25.02	6.59	3.87	15956
SWE	−2.64	1.66	3.06	4.73	25.65	3.46	2.62	79835
SGP	−1.25	1.51	2.68	4.38	19.45	3.24	2.48	120299
SVN	−2.47	1.67	3.34	5.46	16.87	3.80	3.15	5438
SVK	−0.60	0.85	2.23	3.57	25.65	4.23	6.65	710
THA	−1.71	1.70	2.94	4.57	25.02	3.39	2.58	98786
TUN	−1.69	2.00	3.42	5.59	17.78	4.07	2.91	6558
TUR	−1.66	1.67	2.93	4.70	25.65	3.67	3.25	43456
TWN	−1.24	2.83	4.02	5.56	19.45	4.46	2.55	146050
UKR	−1.70	0.63	1.55	2.80	21.76	1.90	2.21	3652
USA	−1.13	1.82	3.12	4.86	24.99	3.64	2.70	1485264
VEN	−1.86	0.58	1.60	3.27	16.99	2.24	2.88	2932
VNM	−1.35	1.02	1.83	2.98	25.02	2.20	1.82	37405
ZAF	−1.86	1.14	2.66	4.71	25.02	3.32	3.20	74458

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				DTD Trend				
ARE	−4.95	−0.45	−0.01	0.36	6.00	−0.07	0.86	5598
ARG	−7.52	−0.52	−0.02	0.42	7.59	−0.04	1.03	12369
AUT	−8.06	−0.56	−0.02	0.46	7.73	−0.12	1.52	20010
AUS	−5.80	−0.50	−0.03	0.41	5.67	−0.05	1.01	281837
BIH	−8.06	−0.51	−0.08	0.22	7.73	−0.12	1.23	3415
BGD	−2.76	−0.10	0.11	0.46	5.33	0.23	0.67	6299
BEL	−8.06	−0.62	−0.00	0.63	7.73	−0.01	1.55	28909
BGR	−8.06	−0.45	0.00	0.40	7.73	−0.05	1.09	9273
BHR	−7.52	−0.36	0.01	0.33	4.36	−0.06	0.95	1332
BRA	−7.52	−0.41	0.00	0.41	7.59	0.00	1.06	47510
CAN	−6.39	−0.55	−0.02	0.48	5.55	−0.04	1.13	219416
CHE	−8.06	−0.61	0.02	0.68	7.73	0.03	1.32	49954
CHL	−7.52	−0.71	0.01	0.65	7.59	−0.02	1.60	25147
CHN	−5.79	−0.55	−0.01	0.50	5.36	−0.05	1.03	290782
COL	−7.52	−0.47	0.03	0.70	7.59	0.10	1.45	5111
CYP	−8.06	−0.36	−0.07	0.19	7.73	−0.12	0.79	14849
CZE	−7.78	−0.37	0.00	0.40	5.78	−0.00	0.92	5415
DEU	−8.06	−0.51	−0.02	0.45	7.73	−0.03	1.12	177728
DNK	−8.06	−0.52	0.00	0.48	7.73	−0.02	1.26	40147
EST	−3.42	−0.10	0.17	0.70	7.73	0.29	0.94	875
EGY	−7.52	−0.43	0.02	0.54	7.59	0.04	1.01	15878
ESP	−8.06	−0.52	0.01	0.56	7.73	0.01	1.31	32772
FIN	−8.06	−0.46	0.04	0.57	7.73	0.05	1.06	28393
FRA	−8.06	−0.49	0.00	0.48	7.73	−0.01	1.11	159574
GBR	−8.06	−0.61	−0.01	0.50	7.73	−0.07	1.32	348773
GRC	−8.06	−0.51	−0.07	0.33	7.73	−0.09	0.94	55956
HKG	−5.80	−0.47	0.00	0.47	5.67	−0.01	0.99	221639
HRV	−6.30	−0.54	−0.05	0.30	7.73	−0.09	1.00	10040
HUN	−8.06	−0.44	0.00	0.42	7.73	−0.06	0.95	7010
IDN	−7.52	−0.34	0.01	0.36	7.59	0.00	0.83	57695
IRL	−8.06	−0.50	0.02	0.54	7.36	−0.02	1.07	9091
ISR	−8.06	−0.45	0.00	0.47	7.73	−0.00	1.09	74817
IND	−7.50	−0.37	−0.01	0.37	5.79	−0.01	0.89	463124
ISL	−8.06	−0.74	−0.07	0.44	6.70	−0.18	1.41	3810
ITA	−8.06	−0.56	−0.01	0.50	7.73	−0.04	1.14	60410
JAM	−6.45	−0.41	0.00	0.39	5.28	0.01	0.91	1946
JOR	−7.52	−0.49	−0.02	0.42	7.59	−0.06	1.10	21339
JPN	−5.80	−0.46	0.00	0.46	5.67	0.00	0.90	829137
KOR	−5.80	−0.42	0.00	0.45	5.67	0.01	0.94	300613
KWT	−7.52	−0.45	0.00	0.44	7.59	−0.03	1.08	21880
KAZ	−7.52	−0.52	0.00	0.42	7.59	−0.06	1.38	689
LKA	−7.52	−0.32	0.06	0.51	7.59	0.11	0.93	18803
LTU	−8.06	−0.63	−0.01	0.63	7.73	−0.00	1.39	4469
LUX	−8.06	−0.68	0.04	0.61	7.73	−0.06	1.51	2662
LVA	−8.06	−0.43	0.00	0.40	6.75	−0.06	1.11	2635
MAR	−7.52	−0.53	−0.03	0.43	7.59	−0.05	1.06	7755
MNE	−3.61	−0.32	0.01	0.28	4.94	0.03	0.76	908
MKD	−6.14	−0.36	−0.03	0.37	6.55	0.03	0.94	1943
MLT	−6.66	−0.45	0.01	0.83	7.38	0.17	1.28	946
MEX	−7.52	−0.48	0.05	0.64	7.59	0.07	1.21	17484
MYS	−7.52	−0.46	0.00	0.45	7.59	−0.02	1.09	193732
NGA	−7.52	−0.43	0.00	0.50	7.59	0.08	1.63	13837
NLD	−8.06	−0.63	−0.01	0.58	7.73	−0.04	1.23	36017

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				DTD Trend				
NOR	−8.06	−0.45	0.00	0.43	7.73	−0.03	0.95	40938
NZL	−5.80	−0.63	0.00	0.66	5.67	0.00	1.48	17222
OMN	−7.52	−0.44	0.08	0.74	7.59	0.19	1.55	2013
PER	−7.52	−0.49	0.00	0.57	7.59	0.05	1.34	9624
PHL	−7.52	−0.39	0.00	0.40	7.59	0.01	1.01	36818
PAK	−6.29	−0.26	0.03	0.38	6.17	0.05	0.76	25199
POL	−8.06	−0.49	−0.03	0.38	7.73	−0.07	0.93	61740
PRT	−8.06	−0.48	−0.03	0.39	7.73	−0.03	1.00	12731
ROM	−8.06	−0.31	0.00	0.30	7.73	0.01	0.82	12591
SRB	−8.06	−0.40	−0.01	0.22	4.75	−0.12	0.89	2450
RUS	−8.06	−0.58	−0.03	0.44	7.73	−0.12	1.15	18231
SAU	−7.52	−0.77	0.14	1.05	7.59	0.11	1.85	15956
SWE	−8.06	−0.48	0.00	0.49	7.73	0.01	1.07	79835
SGP	−5.80	−0.44	0.00	0.43	5.67	−0.02	1.00	120299
SVN	−5.13	−0.57	−0.06	0.33	7.73	−0.12	1.09	5438
SVK	−8.06	−0.21	0.03	0.33	7.73	−0.12	2.13	710
THA	−7.52	−0.52	0.00	0.50	7.59	−0.01	1.08	98786
TUN	−7.52	−0.55	−0.04	0.52	7.59	−0.02	1.25	6558
TUR	−8.06	−0.58	0.05	0.63	7.73	0.04	1.37	43456
TWN	−5.80	−0.57	0.01	0.60	5.67	0.01	1.10	146050
UKR	−5.71	−0.60	−0.04	0.34	7.73	−0.16	1.03	3652
USA	−6.39	−0.48	0.00	0.49	5.55	−0.01	1.01	1485264
VEN	−6.72	−0.41	−0.03	0.34	7.59	−0.05	1.01	2932
VNM	−7.52	−0.35	0.00	0.33	7.59	−0.01	0.70	37405
ZAF	−7.52	−0.47	−0.01	0.41	7.59	−0.06	1.20	74458
				CASH/TA Level				
ARE	0.00	0.07	0.14	0.22	0.94	0.17	0.13	7458
ARG	0.00	0.02	0.05	0.11	0.69	0.08	0.08	13968
AUT	0.00	0.03	0.07	0.15	0.99	0.11	0.13	22908
AUS	0.00	0.04	0.13	0.35	0.98	0.23	0.25	314592
BIH	0.00	0.01	0.02	0.07	0.78	0.07	0.12	5937
BGD	0.00	0.01	0.08	0.22	0.82	0.15	0.17	12753
BEL	0.00	0.03	0.07	0.18	0.99	0.14	0.17	33098
BGR	0.00	0.01	0.03	0.08	0.58	0.07	0.09	10621
BHR	0.00	0.09	0.18	0.26	0.91	0.20	0.14	3179
BRA	0.00	0.02	0.08	0.17	0.94	0.12	0.13	56630
CAN	0.00	0.01	0.07	0.21	0.99	0.16	0.21	234721
CHE	0.00	0.05	0.10	0.20	0.99	0.16	0.16	58085
CHL	0.00	0.01	0.03	0.08	0.94	0.06	0.09	32212
CHN	0.00	0.08	0.15	0.25	0.89	0.19	0.16	303903
COL	0.00	0.03	0.06	0.09	0.76	0.07	0.07	6631
CYP	0.00	0.01	0.05	0.15	0.93	0.10	0.14	16885
CZE	0.00	0.02	0.05	0.11	0.99	0.09	0.12	6811
DEU	0.00	0.03	0.08	0.20	0.99	0.15	0.18	192799
DNK	0.00	0.03	0.08	0.18	0.99	0.14	0.17	47317
EST	0.00	0.03	0.05	0.12	0.53	0.09	0.09	2723
EGY	0.00	0.04	0.11	0.22	0.94	0.15	0.14	18069
ESP	0.00	0.02	0.05	0.11	0.99	0.09	0.10	40542
FIN	0.00	0.03	0.08	0.16	0.99	0.12	0.14	31095
FRA	0.00	0.04	0.08	0.17	0.99	0.13	0.15	172844
GBR	0.00	0.03	0.09	0.22	0.99	0.17	0.21	399841
GRC	0.00	0.02	0.05	0.13	0.83	0.10	0.11	58800

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				CASH/TA Level				
HKG	0.00	0.07	0.14	0.26	0.98	0.19	0.17	233633
HRV	0.00	0.01	0.02	0.05	0.52	0.05	0.08	13528
HUN	0.00	0.02	0.06	0.12	0.74	0.09	0.10	8069
IDN	0.00	0.03	0.08	0.17	0.90	0.12	0.12	67899
IRL	0.00	0.05	0.09	0.22	0.97	0.16	0.17	10816
ISR	0.00	0.03	0.10	0.22	0.99	0.18	0.21	79976
IND	0.00	0.01	0.03	0.07	0.84	0.06	0.10	653392
ISL	0.00	0.02	0.04	0.08	0.53	0.06	0.06	4868
ITA	0.00	0.03	0.06	0.14	0.99	0.10	0.11	65157
JAM	0.00	0.05	0.12	0.27	0.94	0.20	0.21	5316
JOR	0.00	0.01	0.05	0.18	0.94	0.12	0.16	27112
JPN	0.00	0.08	0.13	0.23	0.98	0.17	0.14	852432
KOR	0.00	0.04	0.09	0.18	0.98	0.13	0.13	308291
KWT	0.00	0.03	0.07	0.20	0.94	0.15	0.18	24689
KAZ	0.00	0.07	0.13	0.17	0.36	0.13	0.07	1100
LKA	0.00	0.02	0.05	0.10	0.94	0.09	0.13	20714
LTU	0.00	0.01	0.03	0.07	0.51	0.06	0.08	4760
LUX	0.00	0.05	0.11	0.17	0.97	0.14	0.14	3349
LVA	0.00	0.01	0.04	0.12	0.44	0.08	0.09	3477
MAR	0.00	0.01	0.05	0.12	0.78	0.08	0.11	11560
MNE	0.00	0.00	0.01	0.08	0.45	0.06	0.09	2044
MKD	0.00	0.02	0.05	0.18	0.59	0.12	0.13	2651
MLT	0.00	0.03	0.08	0.19	0.50	0.13	0.14	1539
MEX	0.00	0.03	0.06	0.11	0.77	0.08	0.08	21681
MYS	0.00	0.03	0.07	0.16	0.94	0.12	0.13	200371
NGA	0.00	0.02	0.07	0.19	0.73	0.13	0.14	16217
NLD	0.00	0.02	0.05	0.12	0.99	0.10	0.13	39155
NOR	0.00	0.04	0.09	0.19	0.99	0.15	0.18	46768
NZL	0.00	0.01	0.03	0.10	0.98	0.10	0.17	19531
OMN	0.00	0.03	0.07	0.16	0.94	0.12	0.14	13757
PER	0.00	0.01	0.04	0.13	0.71	0.09	0.11	12774
PHL	0.00	0.02	0.09	0.18	0.94	0.13	0.15	42541
PAK	0.00	0.01	0.05	0.14	0.90	0.10	0.12	33138
POL	0.00	0.02	0.06	0.14	0.99	0.11	0.13	65218
PRT	0.00	0.01	0.03	0.08	0.54	0.06	0.08	15195
ROM	0.00	0.01	0.03	0.10	0.73	0.08	0.11	15295
SRB	0.00	0.04	0.13	0.27	0.91	0.18	0.17	9580
RUS	0.00	0.02	0.06	0.15	0.99	0.11	0.12	25014
SAU	0.00	0.04	0.09	0.19	0.94	0.16	0.19	16594
SWE	0.00	0.04	0.09	0.21	0.99	0.16	0.19	85767
SGP	0.00	0.06	0.13	0.24	0.98	0.17	0.15	126566
SVN	0.00	0.01	0.03	0.08	0.41	0.06	0.07	7543
SVK	0.00	0.02	0.05	0.10	0.59	0.08	0.09	1573
THA	0.00	0.02	0.06	0.14	0.94	0.10	0.12	104087
TUN	0.00	0.03	0.07	0.13	0.70	0.10	0.11	7390
TUR	0.00	0.02	0.06	0.15	0.99	0.11	0.14	66280
TWN	0.00	0.05	0.11	0.20	0.89	0.15	0.13	149260
UKR	0.00	0.01	0.02	0.07	0.88	0.07	0.12	6062
USA	0.00	0.03	0.08	0.25	0.99	0.18	0.22	1562083
VEN	0.00	0.04	0.07	0.18	0.94	0.12	0.11	4123
VNM	0.00	0.03	0.08	0.18	0.93	0.13	0.15	40214
ZAF	0.00	0.03	0.08	0.16	0.94	0.12	0.14	84532

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				CASH/TA Trend				
ARE	−0.36	−0.02	−0.00	0.01	0.40	−0.01	0.05	7458
ARG	−0.36	−0.01	0.00	0.01	0.40	0.00	0.04	13968
AUT	−0.46	−0.01	0.00	0.00	0.47	−0.00	0.04	22908
AUS	−0.42	−0.03	−0.00	0.01	0.45	−0.01	0.09	314592
BIH	−0.46	−0.00	0.00	0.00	0.37	−0.00	0.04	5937
BGD	−0.36	−0.01	0.00	0.00	0.40	−0.00	0.05	12753
BEL	−0.46	−0.01	0.00	0.01	0.47	−0.00	0.04	33098
BGR	−0.25	−0.00	0.00	0.00	0.47	−0.00	0.03	10621
BHR	−0.36	−0.02	−0.00	0.01	0.40	−0.00	0.06	3179
BRA	−0.36	−0.01	0.00	0.01	0.40	−0.00	0.05	56630
CAN	−0.44	−0.02	0.00	0.01	0.43	−0.00	0.07	234721
CHE	−0.46	−0.01	0.00	0.01	0.47	−0.00	0.04	58085
CHL	−0.36	−0.01	−0.00	0.01	0.40	−0.00	0.04	32212
CHN	−0.30	−0.03	−0.00	0.01	0.30	−0.01	0.05	303903
COL	−0.36	−0.01	0.00	0.01	0.40	0.00	0.04	6631
CYP	−0.46	−0.01	0.00	0.00	0.47	−0.00	0.04	16885
CZE	−0.33	−0.00	0.00	0.00	0.47	0.00	0.04	6811
DEU	−0.46	−0.01	0.00	0.01	0.47	−0.00	0.06	192799
DNK	−0.46	−0.01	−0.00	0.01	0.47	−0.00	0.06	47317
EST	−0.25	−0.01	0.00	0.01	0.17	−0.00	0.03	2723
EGY	−0.36	−0.02	0.00	0.01	0.40	−0.00	0.05	18069
ESP	−0.46	−0.01	0.00	0.01	0.47	−0.00	0.04	40542
FIN	−0.46	−0.01	−0.00	0.01	0.47	−0.00	0.05	31095
FRA	−0.46	−0.01	0.00	0.01	0.47	−0.00	0.04	172844
GBR	−0.46	−0.02	0.00	0.01	0.47	−0.00	0.07	399841
GRC	−0.46	−0.01	−0.00	0.01	0.47	−0.00	0.04	58800
HKG	−0.42	−0.02	0.00	0.01	0.45	−0.00	0.07	233633
HRV	−0.19	−0.01	−0.00	0.00	0.44	0.00	0.03	13528
HUN	−0.46	−0.01	−0.00	0.01	0.47	−0.00	0.04	8069
IDN	−0.36	−0.01	0.00	0.01	0.40	−0.00	0.04	67899
IRL	−0.46	−0.01	0.00	0.01	0.47	−0.00	0.05	10816
ISR	−0.46	−0.02	−0.00	0.01	0.47	−0.00	0.08	79976
IND	−0.35	−0.00	0.00	0.00	0.37	−0.00	0.04	653392
ISL	−0.36	−0.01	0.00	0.00	0.40	−0.00	0.03	4868
ITA	−0.46	−0.01	−0.00	0.01	0.47	−0.00	0.04	65157
JAM	−0.36	−0.01	0.00	0.01	0.40	0.00	0.07	5316
JOR	−0.36	−0.01	0.00	0.00	0.40	−0.00	0.05	27112
JPN	−0.42	−0.01	0.00	0.01	0.45	−0.00	0.04	852432
KOR	−0.42	−0.02	−0.00	0.01	0.45	−0.00	0.06	308291
KWT	−0.36	−0.01	−0.00	0.01	0.40	−0.00	0.06	24689
KAZ	−0.17	−0.02	0.00	0.01	0.30	−0.00	0.04	1100
LKA	−0.36	−0.01	−0.00	0.01	0.40	−0.00	0.05	20714
LTU	−0.20	−0.01	−0.00	0.00	0.31	0.00	0.03	4760
LUX	−0.36	−0.01	0.00	0.00	0.26	−0.00	0.04	3349
LVA	−0.21	−0.01	0.00	0.01	0.32	0.00	0.04	3477
MAR	−0.36	−0.01	0.00	0.01	0.40	−0.00	0.04	11560
MNE	−0.23	−0.00	0.00	0.00	0.24	0.00	0.03	2044
MKD	−0.18	−0.00	0.00	0.00	0.31	0.00	0.04	2651
MLT	−0.32	−0.01	0.00	0.00	0.18	−0.00	0.03	1539
MEX	−0.31	−0.01	−0.00	0.01	0.40	−0.00	0.03	21681
MYS	−0.36	−0.01	0.00	0.01	0.40	−0.00	0.05	200371
NGA	−0.36	−0.01	0.00	0.00	0.40	−0.00	0.06	16217
NLD	−0.46	−0.01	0.00	0.00	0.47	−0.00	0.04	39155

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				CASH/TA Trend				
NOR	−0.46	−0.02	−0.00	0.01	0.47	−0.00	0.06	46768
NZL	−0.42	−0.01	0.00	0.00	0.45	−0.00	0.06	19531
OMN	−0.36	−0.01	0.00	0.01	0.40	−0.00	0.05	13757
PER	−0.32	−0.01	0.00	0.01	0.39	−0.00	0.04	12774
PHL	−0.36	−0.01	0.00	0.01	0.40	−0.00	0.06	42541
PAK	−0.36	−0.01	0.00	0.00	0.40	−0.00	0.04	33138
POL	−0.46	−0.01	0.00	0.00	0.47	−0.00	0.05	65218
PRT	−0.40	−0.01	0.00	0.00	0.47	−0.00	0.03	15195
ROM	−0.46	−0.00	0.00	0.00	0.47	−0.00	0.04	15295
SRB	−0.46	−0.00	0.00	0.00	0.47	−0.00	0.06	9580
RUS	−0.46	−0.01	0.00	0.01	0.47	0.00	0.06	25014
SAU	−0.36	−0.02	0.00	0.01	0.40	−0.00	0.06	16594
SWE	−0.46	−0.01	−0.00	0.01	0.47	−0.00	0.06	85767
SGP	−0.42	−0.02	0.00	0.01	0.45	−0.00	0.06	126566
SVN	−0.30	−0.00	0.00	0.00	0.28	−0.00	0.03	7543
SVK	−0.13	−0.01	0.00	0.00	0.15	−0.00	0.02	1573
THA	−0.36	−0.01	−0.00	0.01	0.40	−0.00	0.05	104087
TUN	−0.22	−0.01	0.00	0.01	0.19	−0.00	0.03	7390
TUR	−0.46	−0.01	−0.00	0.01	0.47	−0.00	0.06	66280
TWN	−0.42	−0.02	0.00	0.02	0.45	0.00	0.04	149260
UKR	−0.23	−0.00	0.00	0.00	0.32	0.00	0.03	6062
USA	−0.44	−0.02	−0.00	0.01	0.43	−0.00	0.06	1562083
VEN	−0.18	−0.01	0.00	0.00	0.31	−0.00	0.03	4123
VNM	−0.36	−0.02	−0.00	0.01	0.40	−0.00	0.05	40214
ZAF	−0.36	−0.01	0.00	0.01	0.40	−0.00	0.05	84532
				NI/TA Level				
ARE	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	7542
ARG	−0.04	−0.00	0.00	0.01	0.03	0.00	0.01	14028
AUT	−0.62	0.00	0.00	0.00	0.08	−0.00	0.02	23317
AUS	−0.49	−0.02	−0.00	0.00	0.10	−0.02	0.06	315606
BIH	−0.07	−0.00	0.00	0.00	0.08	0.00	0.01	6393
BGD	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	13239
BEL	−0.35	0.00	0.00	0.01	0.08	0.00	0.01	33300
BGR	−0.19	−0.00	0.00	0.01	0.08	0.00	0.01	12137
BHR	−0.03	0.00	0.00	0.01	0.03	0.01	0.01	3237
BRA	−0.04	−0.00	0.00	0.01	0.03	0.00	0.01	56700
CAN	−0.52	−0.01	0.00	0.00	0.21	−0.01	0.05	235708
CHE	−0.62	0.00	0.00	0.01	0.08	0.00	0.02	58422
CHL	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	32334
CHN	−0.14	0.00	0.00	0.01	0.18	0.00	0.01	304239
COL	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	6744
CYP	−0.62	−0.00	0.00	0.00	0.08	−0.00	0.03	17495
CZE	−0.29	0.00	0.00	0.00	0.04	0.00	0.01	6884
DEU	−0.62	−0.00	0.00	0.00	0.08	−0.00	0.02	195238
DNK	−0.62	0.00	0.00	0.00	0.08	−0.00	0.03	47843
EST	−0.09	−0.00	0.00	0.01	0.05	0.00	0.01	2747
EGY	−0.04	0.00	0.00	0.01	0.03	0.01	0.01	18259
ESP	−0.62	0.00	0.00	0.00	0.08	0.00	0.03	40631
FIN	−0.22	0.00	0.00	0.01	0.08	0.00	0.01	31188
FRA	−0.62	0.00	0.00	0.00	0.08	0.00	0.02	173977
GBR	−0.62	−0.01	0.00	0.01	0.08	−0.01	0.05	402939
GRC	−0.62	−0.00	0.00	0.01	0.08	0.00	0.02	59147

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				NI/TA Level				
HKG	−0.49	−0.00	0.00	0.01	0.10	−0.00	0.03	233727
HRV	−0.11	−0.00	0.00	0.00	0.08	0.00	0.01	14028
HUN	−0.13	−0.00	0.00	0.01	0.03	0.00	0.01	8117
IDN	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	68086
IRL	−0.62	−0.00	0.00	0.01	0.08	0.00	0.02	10901
ISR	−0.62	−0.00	0.00	0.00	0.08	−0.01	0.06	80044
IND	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	659644
ISL	−0.13	0.00	0.00	0.01	0.02	0.00	0.01	4945
ITA	−0.60	−0.00	0.00	0.00	0.08	0.00	0.01	65433
JAM	−0.04	0.00	0.00	0.01	0.03	0.01	0.01	5794
JOR	−0.04	−0.00	0.00	0.00	0.03	0.00	0.01	27713
JPN	−0.49	0.00	0.00	0.00	0.10	0.00	0.01	852635
KOR	−0.49	−0.00	0.00	0.01	0.10	−0.00	0.02	312934
KWT	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	24947
KAZ	−0.04	0.00	0.00	0.00	0.03	0.00	0.01	1113
LKA	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	20864
LTU	−0.05	−0.00	0.00	0.01	0.05	0.00	0.01	4791
LUX	−0.20	0.00	0.00	0.01	0.08	0.00	0.02	3548
LVA	−0.12	−0.00	0.00	0.01	0.08	0.00	0.01	3634
MAR	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	11684
MNE	−0.06	−0.00	0.00	0.00	0.03	−0.00	0.01	2099
MKD	−0.50	0.00	0.00	0.00	0.03	−0.00	0.03	2849
MLT	−0.14	0.00	0.00	0.00	0.04	0.00	0.01	1563
MEX	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	21878
MYS	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	200539
NGA	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	17353
NLD	−0.62	0.00	0.00	0.01	0.08	0.00	0.03	39197
NOR	−0.62	−0.00	0.00	0.00	0.08	−0.00	0.03	47341
NZL	−0.49	−0.00	0.00	0.01	0.10	−0.01	0.05	19568
OMN	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	13952
PER	−0.04	0.00	0.00	0.01	0.03	0.01	0.01	12876
PHL	−0.04	−0.00	0.00	0.01	0.03	0.00	0.01	42570
PAK	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	33259
POL	−0.54	−0.00	0.00	0.01	0.08	0.00	0.02	67137
PRT	−0.22	−0.00	0.00	0.00	0.07	0.00	0.01	15323
ROM	−0.62	−0.00	0.00	0.01	0.08	0.00	0.02	19102
SRB	−0.12	0.00	0.00	0.01	0.08	0.00	0.01	10796
RUS	−0.62	0.00	0.00	0.01	0.08	0.00	0.02	25623
SAU	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	17191
SWE	−0.62	−0.01	0.00	0.01	0.08	−0.01	0.03	87681
SGP	−0.49	0.00	0.00	0.01	0.10	0.00	0.02	126721
SVN	−0.11	−0.00	0.00	0.00	0.03	0.00	0.01	7866
SVK	−0.03	−0.00	0.00	0.00	0.03	0.00	0.01	1764
THA	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	104148
TUN	−0.04	0.00	0.00	0.00	0.02	0.00	0.01	7538
TUR	−0.62	−0.00	0.00	0.01	0.08	0.00	0.03	66579
TWN	−0.49	0.00	0.00	0.01	0.09	0.00	0.01	149305
UKR	−0.10	−0.00	0.00	0.01	0.06	0.00	0.01	6301
USA	−0.52	−0.00	0.00	0.01	0.21	−0.00	0.03	1571287
VEN	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	4177
VNM	−0.04	0.00	0.00	0.01	0.03	0.01	0.01	41348
ZAF	−0.04	0.00	0.00	0.01	0.03	0.00	0.01	85104

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				NI/TA Trend				
ARE	−0.03	−0.00	0.00	0.00	0.03	0.00	0.01	7542
ARG	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	14028
AUT	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.01	23317
AUS	−0.40	−0.00	0.00	0.00	0.30	−0.00	0.05	315606
BIH	−0.19	−0.00	0.00	0.00	0.18	−0.00	0.01	6393
BGD	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.00	13239
BEL	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.01	33300
BGR	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.02	12137
BHR	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.00	3237
BRA	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	56700
CAN	−0.35	−0.00	0.00	0.00	0.29	0.00	0.04	235708
CHE	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.01	58422
CHL	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	32334
CHN	−0.20	−0.00	−0.00	0.00	0.14	−0.00	0.01	304239
COL	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.00	6744
CYP	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.02	17495
CZE	−0.27	−0.00	0.00	0.00	0.26	−0.00	0.01	6884
DEU	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.02	195238
DNK	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.02	47843
EST	−0.32	−0.00	0.00	0.00	0.11	−0.00	0.02	2747
EGY	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	18259
ESP	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.02	40631
FIN	−0.20	−0.00	0.00	0.00	0.32	−0.00	0.01	31188
FRA	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.01	173977
GBR	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.03	402939
GRC	−0.34	−0.00	−0.00	0.00	0.32	−0.00	0.01	59147
HKG	−0.40	−0.00	0.00	0.00	0.30	−0.00	0.03	233727
HRV	−0.22	−0.00	0.00	0.00	0.11	−0.00	0.01	14028
HUN	−0.14	−0.00	0.00	0.00	0.11	−0.00	0.01	8117
IDN	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	68086
IRL	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.02	10901
ISR	−0.34	−0.00	−0.00	0.00	0.32	0.00	0.04	80044
IND	−0.14	−0.00	0.00	0.00	0.13	−0.00	0.01	659644
ISL	−0.12	−0.00	0.00	0.00	0.13	−0.00	0.01	4945
ITA	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.01	65433
JAM	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	5794
JOR	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	27713
JPN	−0.40	−0.00	0.00	0.00	0.30	−0.00	0.01	852635
KOR	−0.40	−0.00	0.00	0.00	0.30	−0.00	0.03	312934
KWT	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	24947
KAZ	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	1113
LKA	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	20864
LTU	−0.12	−0.00	0.00	0.00	0.11	−0.00	0.01	4791
LUX	−0.09	−0.00	0.00	0.00	0.15	0.00	0.01	3548
LVA	−0.26	−0.00	0.00	0.00	0.08	−0.00	0.01	3634
MAR	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.00	11684
MNE	−0.05	−0.00	0.00	0.00	0.06	0.00	0.00	2099
MKD	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.02	2849
MLT	−0.04	−0.00	0.00	0.00	0.03	−0.00	0.00	1563
MEX	−0.03	−0.00	0.00	0.00	0.03	0.00	0.01	21878
MYS	−0.03	−0.00	−0.00	0.00	0.03	−0.00	0.01	200539
NGA	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	17353
NLD	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.02	39197

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				NI/TA Trend				
NOR	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.02	47341
NZL	−0.40	−0.00	0.00	0.00	0.30	−0.00	0.03	19568
OMN	−0.03	−0.00	0.00	0.00	0.03	0.00	0.01	13952
PER	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	12876
PHL	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	42570
PAK	−0.03	−0.00	0.00	0.00	0.03	0.00	0.00	33259
POL	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.02	67137
PRT	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.01	15323
ROM	−0.34	−0.00	0.00	0.00	0.32	−0.00	0.02	19102
SRB	−0.13	−0.00	0.00	0.00	0.06	−0.00	0.00	10796
RUS	−0.34	−0.00	0.00	0.00	0.32	0.00	0.02	25623
SAU	−0.03	−0.00	0.00	0.00	0.03	0.00	0.01	17191
SWE	−0.34	−0.00	0.00	0.00	0.32	0.00	0.03	87681
SGP	−0.40	−0.00	−0.00	0.00	0.30	−0.00	0.02	126721
SVN	−0.17	−0.00	0.00	0.00	0.06	−0.00	0.01	7866
SVK	−0.05	−0.00	0.00	0.00	0.06	−0.00	0.01	1764
THA	−0.03	−0.00	−0.00	0.00	0.03	−0.00	0.01	104148
TUN	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.00	7538
TUR	−0.34	−0.00	−0.00	0.00	0.32	−0.00	0.02	66579
TWN	−0.40	−0.00	−0.00	0.00	0.30	−0.00	0.01	149305
UKR	−0.11	−0.00	0.00	0.00	0.13	−0.00	0.01	6301
USA	−0.35	−0.00	0.00	0.00	0.29	−0.00	0.02	1571287
VEN	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.00	4177
VNM	−0.03	−0.00	−0.00	0.00	0.03	−0.00	0.01	41348
ZAF	−0.03	−0.00	0.00	0.00	0.03	−0.00	0.01	85104
				SIZE Level				
ARE	−4.25	−0.96	0.05	1.11	4.25	0.08	1.54	8455
ARG	−6.42	−1.42	0.24	1.57	7.06	0.12	2.04	15338
AUT	−6.74	−1.39	−0.13	1.34	4.50	−0.07	2.02	24512
AUS	−6.46	−1.27	−0.14	1.51	7.00	0.27	2.08	337212
BIH	−6.04	−0.64	0.76	2.45	7.65	0.94	2.17	24306
BGD	−5.27	−1.29	−0.23	1.15	4.84	−0.13	1.72	14586
BEL	−6.74	−1.41	0.10	1.55	6.91	0.10	2.27	40176
BGR	−6.74	−1.68	−0.31	0.91	7.92	−0.36	1.84	19050
BHR	−3.60	−1.10	−0.22	1.13	3.29	−0.04	1.49	3885
BRA	−6.42	−1.73	−0.09	1.30	7.11	−0.17	2.51	63084
CAN	−6.33	−1.56	−0.23	1.27	6.01	−0.12	2.16	258600
CHE	−6.74	−1.31	−0.09	1.20	6.22	0.02	1.94	56729
CHL	−6.42	−1.12	0.07	1.27	4.30	−0.00	1.83	35238
CHN	−2.50	−0.70	−0.22	0.35	3.90	−0.11	0.89	327242
COL	−5.42	−1.43	−0.06	1.12	4.43	−0.23	1.69	7808
CYP	−4.64	−1.00	0.06	1.12	7.68	0.10	1.68	21197
CZE	−6.74	−1.51	−0.16	0.89	5.36	−0.24	1.92	9047
DEU	−6.74	−0.44	1.06	2.72	7.92	1.13	2.53	223908
DNK	−6.74	−0.30	0.89	2.24	7.41	1.02	1.92	48014
EST	−3.62	−0.53	0.25	1.31	5.13	0.39	1.67	2905
EGY	−6.42	−1.10	−0.01	1.47	5.40	0.17	1.77	21438
ESP	−6.74	−1.70	−0.28	1.17	5.31	−0.32	2.13	42996
FIN	−6.36	−1.76	−0.46	1.12	6.40	−0.30	1.98	31509
FRA	−6.74	−1.33	0.11	1.86	7.66	0.36	2.33	201769
GBR	−6.74	−1.15	0.24	1.88	7.92	0.47	2.24	436789
GRC	−6.74	−0.47	0.48	1.59	6.55	0.65	1.63	61989

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				SIZE Level				
HKG	−8.79	−1.48	−0.47	0.90	7.00	−0.18	1.85	248900
HRV	−6.74	−0.74	0.41	1.63	6.09	0.46	1.81	17077
HUN	−6.74	−1.21	0.51	2.10	6.23	0.48	2.30	8965
IDN	−6.42	−1.02	0.14	1.43	6.08	0.26	1.83	75655
IRL	−6.74	−2.05	−0.81	0.68	4.83	−0.69	1.98	11162
ISR	−6.74	−0.78	0.29	1.59	7.92	0.49	1.86	102635
IND	−5.32	−1.26	0.18	2.00	8.39	0.50	2.34	588558
ISL	−6.74	−1.96	−1.02	−0.02	2.76	−1.01	1.55	6101
ITA	−6.74	−0.93	0.20	1.66	6.36	0.39	1.94	66316
JAM	−5.85	−1.51	0.01	1.01	3.02	−0.28	1.81	6303
JOR	−3.88	−0.87	−0.08	1.09	6.20	0.19	1.51	31852
JPN	−9.57	−0.80	0.25	1.53	7.00	0.47	1.73	874006
KOR	−11.31	−0.49	0.29	1.33	7.00	0.49	1.79	361339
KWT	−2.89	−0.35	0.55	1.39	5.14	0.63	1.35	27434
KAZ	−6.07	−2.06	−0.47	1.21	5.50	−0.47	1.92	1630
LKA	−6.42	−0.85	0.08	1.27	5.26	0.24	1.54	23010
LTU	−4.61	−0.92	0.18	1.13	4.08	0.11	1.57	6161
LUX	−6.74	−2.29	−0.52	0.43	4.33	−0.83	2.05	4760
LVA	−5.38	−1.41	−0.20	2.17	5.91	0.27	2.38	5053
MAR	−6.42	−1.30	−0.12	1.65	4.76	0.10	1.83	12174
MNE	−6.74	−2.83	−1.23	0.45	5.42	−1.20	2.34	6946
MKD	−6.46	−1.26	0.19	1.35	5.37	0.10	1.87	4924
MLT	−4.07	−1.02	−0.13	1.14	2.31	−0.04	1.37	2198
MEX	−6.42	−1.17	0.17	1.52	5.16	0.11	1.95	23478
MYS	−4.25	−0.23	0.66	1.77	6.47	0.82	1.58	212295
NGA	−6.42	−1.42	−0.26	1.60	6.22	−0.02	2.15	20603
NLD	−6.74	−1.88	−0.33	1.14	5.99	−0.24	2.20	39630
NOR	−6.74	−0.94	0.13	1.40	6.64	0.26	1.74	50197
NZL	−5.78	−1.50	−0.05	1.10	5.12	−0.18	1.89	21521
OMN	−6.42	−1.20	−0.07	0.99	4.71	−0.11	1.73	16591
PER	−6.42	−1.05	0.30	1.79	5.54	0.32	2.00	15058
PHL	−6.42	−1.44	−0.32	1.10	5.31	−0.08	1.83	46128
PAK	−6.42	−1.13	0.70	2.73	7.11	0.75	2.51	53294
POL	−5.64	−1.29	0.03	1.47	7.92	0.16	2.10	80636
PRT	−6.74	−1.95	−0.33	1.32	4.56	−0.42	2.48	17132
ROM	−6.74	−1.01	0.25	1.57	7.92	0.26	2.10	50874
SRB	−6.74	−0.34	1.03	2.47	7.92	1.05	2.10	27798
RUS	−6.74	−1.75	−0.29	1.27	7.92	−0.19	2.24	32145
SAU	−4.48	−0.75	0.14	1.46	5.34	0.41	1.56	18644
SWE	−6.74	−0.77	0.94	2.54	7.92	1.02	2.39	93003
SGP	−4.35	−0.65	0.33	1.59	7.00	0.57	1.71	135979
SVN	−6.74	−0.55	0.77	2.31	7.92	1.07	2.44	11639
SVK	−6.14	−0.44	0.98	3.02	7.92	1.46	2.62	4601
THA	−5.99	−0.86	0.10	1.25	6.48	0.30	1.61	113869
TUN	−3.41	−0.94	0.06	1.13	3.11	0.12	1.26	8490
TUR	−5.21	−1.25	−0.05	1.25	6.88	0.08	1.87	70773
TWN	−5.05	−0.80	0.03	0.89	6.09	0.12	1.41	163280
UKR	−6.74	−1.01	0.08	1.05	7.92	−0.03	1.65	9435
USA	−6.33	−1.98	−0.64	0.82	6.01	−0.51	2.01	1636779
VEN	−6.42	−1.74	−0.18	1.16	7.11	−0.44	2.57	5588
VNM	−5.04	−1.20	−0.26	0.81	6.58	−0.10	1.64	45199
ZAF	−6.42	−1.56	0.18	1.90	6.55	0.17	2.34	90870

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				SIZE Trend				
ARE	−0.94	−0.14	−0.02	0.08	1.81	−0.01	0.23	8455
ARG	−1.79	−0.16	−0.02	0.10	1.99	−0.02	0.32	15338
AUT	−2.02	−0.12	−0.01	0.09	2.11	−0.02	0.27	24512
AUS	−1.57	−0.18	−0.00	0.17	1.83	0.00	0.38	337212
BIH	−2.02	−0.02	0.00	0.02	2.11	0.01	0.19	24306
BGD	−1.79	−0.13	−0.02	0.09	1.99	−0.03	0.29	14586
BEL	−2.02	−0.11	−0.02	0.07	2.11	−0.02	0.25	40176
BGR	−2.02	−0.15	0.00	0.14	2.11	0.01	0.36	19050
BHR	−0.80	−0.06	0.01	0.09	1.99	0.02	0.17	3885
BRA	−1.79	−0.15	0.00	0.14	1.99	−0.01	0.35	63084
CAN	−1.89	−0.16	0.00	0.16	1.85	−0.00	0.37	258600
CHE	−2.02	−0.11	−0.01	0.08	2.11	−0.01	0.24	56729
CHL	−1.79	−0.10	−0.00	0.09	1.99	−0.00	0.22	35238
CHN	−0.94	−0.10	0.00	0.11	1.14	0.02	0.19	327242
COL	−1.45	−0.08	0.00	0.10	1.85	0.02	0.21	7808
CYP	−2.02	−0.17	0.00	0.17	2.11	0.00	0.35	21197
CZE	−2.02	−0.13	0.00	0.12	2.11	−0.01	0.26	9047
DEU	−2.02	−0.17	−0.03	0.09	2.11	−0.06	0.34	223908
DNK	−2.02	−0.14	−0.02	0.09	2.11	−0.03	0.28	48014
EST	−1.99	−0.12	−0.01	0.11	2.11	−0.00	0.27	2905
EGY	−1.79	−0.13	−0.02	0.10	1.99	0.01	0.27	21438
ESP	−2.02	−0.11	−0.00	0.10	2.11	0.00	0.26	42996
FIN	−2.02	−0.13	0.00	0.13	2.11	0.00	0.26	31509
FRA	−2.02	−0.11	0.00	0.12	2.11	0.00	0.28	201769
GBR	−2.02	−0.15	0.00	0.13	2.11	−0.02	0.34	436789
GRC	−2.02	−0.19	−0.03	0.13	2.11	−0.02	0.32	61989
HKG	−1.57	−0.17	−0.02	0.14	1.83	0.00	0.35	248900
HRV	−2.02	−0.13	−0.01	0.09	2.11	−0.02	0.24	17077
HUN	−1.99	−0.19	−0.05	0.08	2.11	−0.06	0.30	8965
IDN	−1.79	−0.18	−0.03	0.12	1.99	−0.01	0.33	75655
IRL	−2.02	−0.10	0.01	0.13	2.11	0.00	0.29	11162
ISR	−2.02	−0.15	−0.02	0.10	2.11	−0.03	0.31	102635
IND	−1.72	−0.22	−0.03	0.14	2.07	−0.03	0.36	588558
ISL	−2.02	−0.11	0.00	0.12	2.11	0.01	0.29	6101
ITA	−2.02	−0.11	−0.01	0.09	2.11	−0.00	0.23	66316
JAM	−1.79	−0.11	0.00	0.12	1.99	0.02	0.28	6303
JOR	−1.79	−0.10	0.01	0.12	1.99	0.02	0.24	31852
JPN	−1.57	−0.12	−0.01	0.09	1.83	−0.01	0.22	874006
KOR	−1.57	−0.17	−0.02	0.13	1.83	−0.01	0.33	361339
KWT	−1.79	−0.13	−0.02	0.09	1.99	−0.01	0.23	27434
KAZ	−1.79	−0.11	0.00	0.12	1.99	0.02	0.40	1630
LKA	−1.79	−0.12	−0.01	0.10	1.99	−0.00	0.23	23010
LTU	−2.02	−0.14	−0.01	0.11	2.11	−0.01	0.32	6161
LUX	−2.02	−0.09	0.00	0.10	2.11	0.01	0.21	4760
LVA	−2.02	−0.12	0.01	0.17	2.11	0.03	0.31	5053
MAR	−1.79	−0.09	−0.00	0.08	1.99	−0.00	0.19	12174
MNE	−2.02	−0.04	0.00	0.04	2.11	−0.02	0.35	6946
MKD	−1.45	−0.10	0.00	0.07	1.30	−0.01	0.19	4924
MLT	−1.23	−0.06	0.01	0.09	1.85	0.02	0.22	2198
MEX	−1.79	−0.12	−0.01	0.09	1.99	−0.02	0.25	23478
MYS	−1.79	−0.14	−0.02	0.09	1.99	−0.02	0.25	212295
NGA	−1.79	−0.16	−0.02	0.12	1.99	0.01	0.33	20603

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				SIZE Trend				
NLD	−2.02	−0.11	0.00	0.11	2.11	−0.01	0.26	39630
NOR	−2.02	−0.13	−0.00	0.13	2.11	0.00	0.33	50197
NZL	−1.57	−0.09	0.01	0.11	1.83	0.02	0.25	21521
OMN	−1.79	−0.10	−0.00	0.10	1.99	0.01	0.24	16591
PER	−1.79	−0.13	0.00	0.11	1.99	0.00	0.28	15058
PHL	−1.79	−0.15	−0.01	0.13	1.99	0.01	0.32	46128
PAK	−1.79	−0.19	−0.04	0.10	1.99	−0.03	0.29	53294
POL	−2.02	−0.21	−0.04	0.12	2.11	−0.05	0.36	80636
PRT	−2.02	−0.14	−0.02	0.09	2.11	−0.02	0.25	17132
ROM	−2.02	−0.15	0.00	0.19	2.11	0.04	0.40	50874
SRB	−2.02	−0.07	0.00	0.06	2.11	0.01	0.24	27798
RUS	−2.02	−0.15	0.00	0.11	2.11	−0.02	0.30	32145
SAU	−1.79	−0.10	−0.01	0.10	1.99	0.01	0.22	18644
SWE	−2.02	−0.15	−0.01	0.14	2.11	−0.00	0.34	93003
SGP	−1.57	−0.14	−0.02	0.10	1.83	−0.01	0.26	135979
SVN	−2.02	−0.16	−0.03	0.07	2.11	−0.05	0.31	11639
SVK	−2.02	−0.06	0.00	0.12	2.11	0.04	0.31	4601
THA	−1.79	−0.14	−0.02	0.12	1.99	−0.00	0.28	113869
TUN	−1.79	−0.11	−0.03	0.06	1.93	−0.01	0.20	8490
TUR	−2.02	−0.16	−0.03	0.12	2.11	−0.01	0.29	70773
TWN	−1.57	−0.12	−0.01	0.10	1.83	−0.01	0.22	163280
UKR	−2.02	−0.18	0.00	0.16	2.11	−0.01	0.41	9435
USA	−1.89	−0.15	−0.01	0.13	1.85	−0.02	0.33	1636779
VEN	−1.79	−0.17	−0.02	0.11	1.99	0.01	0.42	5588
VNM	−1.59	−0.17	−0.03	0.11	1.99	−0.03	0.25	45199
ZAF	−1.79	−0.16	−0.01	0.13	1.99	−0.03	0.35	90870
				M/B				
ARE	0.34	0.88	1.04	1.29	8.35	1.17	0.58	7325
ARG	0.19	0.84	1.02	1.28	28.09	1.51	2.64	13606
AUT	0.20	0.94	1.06	1.37	21.42	1.32	1.14	21408
AUS	0.18	0.91	1.32	2.35	15.15	2.25	2.67	308585
BIH	0.15	0.43	0.71	1.03	16.86	0.87	1.04	5452
BGD	0.25	1.12	1.52	2.34	28.09	2.29	3.04	12713
BEL	0.15	0.94	1.09	1.45	21.42	1.44	1.43	31529
BGR	0.15	0.66	0.92	1.26	21.42	1.21	1.44	10509
BHR	0.40	0.92	1.05	1.25	5.54	1.17	0.47	3016
BRA	0.19	0.84	1.07	1.59	28.09	2.44	5.24	54552
CAN	0.21	0.97	1.30	2.09	67.48	2.31	4.69	231165
CHE	0.16	0.99	1.15	1.65	21.42	1.58	1.46	53203
CHL	0.19	0.86	1.13	1.67	28.09	1.60	2.46	30924
CHN	0.66	1.45	2.06	3.12	44.10	2.69	2.51	302640
COL	0.23	0.80	1.04	1.29	28.09	1.21	1.00	6354
CYP	0.15	0.61	0.79	1.03	21.42	1.06	1.48	16638
CZE	0.15	0.66	0.92	1.16	9.28	1.02	0.60	6520
DEU	0.15	1.00	1.21	1.67	21.42	1.69	1.91	187029
DNK	0.15	0.96	1.06	1.44	21.42	1.56	1.81	44145
EST	0.17	0.94	1.16	1.71	21.42	1.65	1.88	2699
EGY	0.21	0.98	1.22	1.79	28.09	1.64	1.67	17947
ESP	0.15	0.95	1.11	1.46	21.42	1.41	1.23	38479
FIN	0.20	1.00	1.23	1.73	21.42	1.65	1.65	29826
FRA	0.15	0.94	1.13	1.56	21.42	1.56	1.72	167374
GBR	0.15	0.97	1.33	2.09	21.42	2.07	2.59	393515

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				M/B				
GRC	0.15	0.86	1.08	1.59	21.42	1.63	1.97	58088
HKG	0.18	0.72	1.00	1.56	15.15	1.55	1.95	232550
HRV	0.15	0.70	0.92	1.16	21.42	1.08	1.11	12986
HUN	0.15	0.74	0.99	1.34	21.42	1.20	0.99	7814
IDN	0.19	0.87	1.08	1.52	28.09	1.46	1.49	66142
IRL	0.15	0.99	1.22	1.72	21.42	1.69	1.78	10304
ISR	0.15	0.91	1.04	1.37	21.42	1.61	2.37	79367
IND	0.19	0.77	0.99	1.49	13.14	1.51	1.78	503429
ISL	0.31	1.09	1.28	1.63	21.42	1.71	2.27	4781
ITA	0.19	0.94	1.06	1.35	21.42	1.31	1.12	62869
JAM	0.19	0.87	1.03	1.35	23.38	1.25	0.89	5671
JOR	0.19	0.82	1.04	1.39	28.09	1.26	1.08	26329
JPN	0.18	0.85	1.00	1.24	15.15	1.22	1.05	851217
KOR	0.18	0.80	0.99	1.32	15.15	1.32	1.34	310063
KWT	0.19	0.87	1.12	1.52	28.09	1.33	0.90	24405
KAZ	0.23	0.89	0.99	1.15	9.35	1.13	0.58	980
LKA	0.24	0.94	1.12	1.55	28.09	1.53	1.65	20435
LTU	0.31	0.80	0.99	1.34	5.32	1.16	0.60	4756
LUX	0.33	0.74	0.97	1.19	21.42	1.15	1.22	3183
LVA	0.15	0.55	0.75	1.00	9.24	0.87	0.65	3351
MAR	0.19	1.07	1.27	1.83	15.95	1.63	0.97	11266
MNE	0.15	0.33	0.47	0.82	21.42	0.72	1.33	1830
MKD	0.15	0.64	0.90	1.06	21.42	1.20	2.32	2569
MLT	0.25	0.98	1.07	1.48	15.76	1.37	0.92	1499
MEX	0.19	0.80	1.05	1.47	10.84	1.24	0.72	20549
MYS	0.19	0.77	0.99	1.41	28.09	1.36	1.54	199783
NGA	0.19	0.89	1.15	1.79	28.09	1.72	1.82	16097
NLD	0.15	0.99	1.21	1.67	21.42	1.65	1.73	37649
NOR	0.15	0.95	1.14	1.70	21.42	1.77	2.13	45093
NZL	0.18	0.98	1.27	1.98	15.15	1.95	2.24	19175
OMN	0.19	0.99	1.17	1.49	7.38	1.33	0.61	13091
PER	0.19	0.79	1.11	1.63	28.09	1.48	1.34	12042
PHL	0.19	0.77	1.06	1.75	28.09	2.27	4.50	41089
PAK	0.19	0.84	1.01	1.33	28.09	1.33	1.46	32254
POL	0.15	0.85	1.10	1.64	21.42	1.62	1.99	64826
PRT	0.15	0.90	1.02	1.24	21.42	1.16	0.69	14576
ROM	0.15	0.64	0.87	1.20	21.42	1.21	1.98	14990
SRB	0.15	0.65	0.85	1.12	21.42	1.01	0.92	8895
RUS	0.15	0.80	1.06	1.52	21.42	1.43	1.67	22677
SAU	0.19	1.21	1.78	2.97	28.09	2.53	2.28	16903
SWE	0.15	1.03	1.38	2.22	21.42	2.16	2.48	83482
SGP	0.18	0.82	1.03	1.44	15.15	1.37	1.33	126002
SVN	0.15	0.67	0.84	1.02	21.42	0.92	0.67	7351
SVK	0.21	0.72	0.90	1.05	3.18	0.90	0.29	1433
THA	0.19	0.86	1.07	1.48	28.09	1.35	1.09	103458
TUN	0.19	0.96	1.08	1.41	8.34	1.35	0.74	7305
TUR	0.15	0.94	1.20	1.81	21.42	2.18	3.66	65658
TWN	0.29	0.93	1.15	1.62	15.15	1.45	0.96	149251
UKR	0.15	0.85	1.18	1.89	21.42	1.79	2.11	5743
USA	0.21	1.03	1.31	2.11	67.48	2.13	3.36	1558738
VEN	0.19	0.60	0.90	1.20	28.09	4.61	9.27	3895
VNM	0.19	0.82	0.94	1.15	18.99	1.12	0.74	40136
ZAF	0.19	0.89	1.20	1.84	28.09	1.79	2.58	83637

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				SIGMA				
ARE	0.01	0.09	0.12	0.16	0.43	0.13	0.06	6588
ARG	0.03	0.09	0.11	0.15	0.65	0.12	0.06	13237
AUT	0.01	0.07	0.09	0.14	1.16	0.12	0.10	22145
AUS	0.02	0.13	0.23	0.33	0.99	0.25	0.16	303340
BIH	0.03	0.11	0.16	0.21	0.73	0.17	0.09	4605
BGD	0.04	0.09	0.11	0.14	0.67	0.12	0.05	13621
BEL	0.02	0.07	0.09	0.12	1.42	0.11	0.09	33806
BGR	0.02	0.13	0.18	0.28	1.11	0.22	0.14	11475
BHR	0.03	0.07	0.09	0.12	0.24	0.10	0.04	2156
BRA	0.01	0.09	0.13	0.21	1.17	0.18	0.14	50791
CAN	0.03	0.10	0.17	0.27	1.04	0.22	0.16	240193
CHE	0.01	0.07	0.09	0.13	1.42	0.11	0.07	52144
CHL	0.01	0.06	0.08	0.11	0.80	0.10	0.06	26882
CHN	0.03	0.08	0.10	0.13	0.43	0.11	0.04	319334
COL	0.01	0.06	0.08	0.12	0.48	0.10	0.06	5582
CYP	0.02	0.15	0.21	0.28	1.42	0.25	0.17	16807
CZE	0.03	0.09	0.13	0.18	0.42	0.14	0.06	6736
DEU	0.01	0.10	0.14	0.24	1.42	0.22	0.22	202862
DNK	0.01	0.07	0.10	0.16	1.29	0.14	0.11	42207
EST	0.01	0.08	0.12	0.19	0.66	0.15	0.10	2728
EGY	0.01	0.08	0.12	0.18	1.17	0.14	0.08	18601
ESP	0.01	0.06	0.09	0.13	0.95	0.10	0.06	36527
FIN	0.01	0.08	0.11	0.15	1.42	0.13	0.09	29636
FRA	0.01	0.08	0.11	0.16	1.42	0.13	0.09	178571
GBR	0.01	0.08	0.12	0.19	1.31	0.15	0.10	379086
GRC	0.01	0.10	0.14	0.19	0.90	0.16	0.08	59683
HKG	0.02	0.11	0.16	0.23	0.99	0.18	0.11	240093
HRV	0.01	0.11	0.14	0.19	0.78	0.16	0.09	12081
HUN	0.02	0.09	0.13	0.19	0.72	0.16	0.09	7788
IDN	0.01	0.12	0.17	0.26	1.17	0.21	0.13	63481
IRL	0.03	0.08	0.11	0.18	1.42	0.16	0.15	9514
ISR	0.01	0.09	0.13	0.20	1.15	0.16	0.10	85316
IND	0.04	0.15	0.18	0.24	1.00	0.22	0.13	512581
ISL	0.03	0.08	0.11	0.14	0.61	0.12	0.07	4492
ITA	0.01	0.07	0.09	0.13	0.76	0.11	0.06	64042
JAM	0.03	0.12	0.15	0.19	0.84	0.17	0.07	4675
JOR	0.01	0.10	0.13	0.15	0.74	0.13	0.05	25430
JPN	0.02	0.08	0.11	0.16	0.99	0.13	0.07	851930
KOR	0.02	0.11	0.15	0.21	0.81	0.17	0.08	351483
KWT	0.01	0.10	0.12	0.16	0.58	0.13	0.05	23813
KAZ	0.01	0.10	0.13	0.20	1.03	0.17	0.13	794
LKA	0.03	0.11	0.15	0.20	1.00	0.17	0.09	20702
LTU	0.03	0.08	0.12	0.18	1.02	0.15	0.10	5587
LUX	0.02	0.07	0.10	0.13	0.51	0.11	0.05	3080
LVA	0.03	0.11	0.14	0.22	0.97	0.17	0.09	2971
MAR	0.02	0.08	0.10	0.12	0.54	0.11	0.05	10332
MNE	0.05	0.15	0.18	0.22	0.73	0.21	0.12	1023
MKD	0.01	0.08	0.11	0.16	0.54	0.13	0.07	2527
MLT	0.02	0.05	0.07	0.09	0.55	0.08	0.05	1298
MEX	0.01	0.07	0.09	0.13	1.17	0.11	0.07	19072
MYS	0.02	0.10	0.14	0.21	1.17	0.17	0.11	207042
NGA	0.01	0.11	0.14	0.17	0.55	0.14	0.06	17018

(*Continued*)

Table A.8. (*Continued*)

	Min	25%	Median	75%	Max	Mean	StdDev	# Observations
				SIGMA				
NLD	0.02	0.07	0.09	0.13	1.26	0.11	0.08	38145
NOR	0.03	0.10	0.14	0.20	1.10	0.17	0.11	43757
NZL	0.02	0.06	0.09	0.14	0.99	0.13	0.11	18895
OMN	0.01	0.06	0.09	0.12	0.98	0.10	0.06	8687
PER	0.02	0.08	0.12	0.17	0.62	0.13	0.07	10505
PHL	0.01	0.11	0.17	0.25	0.94	0.20	0.12	39571
PAK	0.03	0.11	0.15	0.24	1.17	0.22	0.19	42047
POL	0.01	0.12	0.16	0.25	1.42	0.20	0.14	76105
PRT	0.01	0.07	0.10	0.15	1.18	0.13	0.09	13651
ROM	0.01	0.16	0.22	0.33	1.42	0.26	0.16	20705
SRB	0.01	0.13	0.17	0.25	0.72	0.19	0.09	5816
RUS	0.03	0.10	0.13	0.22	1.25	0.17	0.12	19585
SAU	0.02	0.06	0.09	0.13	0.64	0.10	0.06	17911
SWE	0.01	0.09	0.14	0.25	1.42	0.20	0.17	87696
SGP	0.02	0.10	0.15	0.23	0.99	0.19	0.14	130132
SVN	0.01	0.07	0.10	0.15	1.14	0.14	0.13	7725
SVK	0.01	0.08	0.11	0.15	0.59	0.13	0.09	1031
THA	0.01	0.09	0.13	0.18	1.17	0.15	0.10	109182
TUN	0.01	0.06	0.07	0.09	0.52	0.08	0.04	7526
TUR	0.01	0.10	0.14	0.19	1.25	0.15	0.07	69316
TWN	0.02	0.08	0.10	0.12	0.63	0.10	0.04	160213
UKR	0.01	0.13	0.19	0.29	1.05	0.23	0.15	4148
USA	0.03	0.09	0.14	0.23	1.04	0.18	0.12	1590184
VEN	0.01	0.13	0.18	0.24	0.69	0.20	0.10	3680
VNM	0.01	0.11	0.14	0.19	0.61	0.15	0.06	42455
ZAF	0.01	0.09	0.13	0.22	1.17	0.20	0.19	79818

Table A.9. Exits classified as "Defaults".

Action type	Subcategory
	Default
Bankruptcy filling	Administration, Arrangement, Canadian CCAA, Chapter 7, Chapter 11, Chapter 15, Conservatorship, Insolvency, Japanese 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, Other, Unknown.
Delisting	Bankruptcy
Default Corporate Action	Bankruptcy, Coupon & Principal Payment, Coupon Payment Only, Debt Restructuring, Interest Payment, Loan Payment, Principal Payment, ADR (Japan only), Declared Sick(India Only), Unknown.

Table A.10. Exits classified as "Other Exits".

Action type	Subcategory
	Other Exits
Delisting	Unknown, Acquired/Merged, Assimilated with underlying shares, Bid price below minimum, Cancellation of listing, End of When- issued trading, Expired, 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, Matured, Not available, Not current in required filings, NP/FP finished, Privatized, Reorganization security called for redemptions, the company's request, Scheme of arrangement, Insufficient spread of holders, Selective capital reduction of the company.

Table A.11. Number of defaults and other exits of 78 economies from 1992 to 2014.

Economy: ARE						Economy:ARG					
		Defaults		Others				Defaults		Others	
Year	Active	#	%	#	%	Year	Active	#	%	#	%
1992	0	0	NaN	0	NaN	1992	1	0	0.00	0	0.00
1993	0	0	NaN	0	NaN	1993	1	0	0.00	0	0.00
1994	0	0	NaN	0	NaN	1994	23	0	0.00	2	8.00
1995	0	0	NaN	0	NaN	1995	87	0	0.00	14	13.86
1996	0	0	NaN	0	NaN	1996	93	0	0.00	25	21.19
1997	0	0	NaN	0	NaN	1997	84	0	0.00	26	23.64
1998	0	0	NaN	0	NaN	1998	72	2	1.82	36	32.73
1999	0	0	NaN	0	NaN	1999	72	1	0.98	29	28.43
2000	0	0	NaN	0	NaN	2000	66	1	1.11	23	25.56
2001	0	0	NaN	0	NaN	2001	50	2	2.35	33	38.82
2002	0	0	NaN	0	NaN	2002	64	9	10.47	13	15.12
2003	0	0	NaN	0	NaN	2003	68	2	2.38	14	16.67
2004	0	0	NaN	0	NaN	2004	65	0	0.00	13	16.67
2005	0	0	NaN	0	NaN	2005	68	0	0.00	5	6.85
2006	73	0	0.00	7	8.75	2006	70	0	0.00	7	9.09
2007	83	0	0.00	13	13.54	2007	75	0	0.00	9	10.71
2008	80	0	0.00	17	17.53	2008	68	0	0.00	16	19.05
2009	82	0	0.00	21	20.39	2009	67	1	1.30	9	11.69
2010	85	0	0.00	23	21.30	2010	67	1	1.35	6	8.11
2011	83	0	0.00	24	22.43	2011	64	0	0.00	9	12.33
2012	80	1	0.96	23	22.12	2012	64	0	0.00	7	9.86
2013	85	0	0.00	12	12.37	2013	66	0	0.00	4	5.71
2014	103	0	0.00	6	5.50	2014	63	0	0.00	5	7.35

Economy: AUT						Economy: AUS					
		Defaults		Others				Defaults		Others	
Year	Active	#	%	#	%	Year	Active	#	%	#	%
1992	84	0	0.00	3	3.45	1992	706	1	0.12	109	13.36
1993	101	0	0.00	8	7.34	1993	808	0	0.00	63	7.23
1994	110	0	0.00	2	1.79	1994	904	0	0.00	89	8.96
1995	118	0	0.00	2	1.67	1995	946	1	0.10	82	7.97
1996	116	1	0.82	5	4.10	1996	991	1	0.09	66	6.24
1997	118	0	0.00	5	4.07	1997	1009	3	0.27	99	8.91
1998	112	0	0.00	14	11.11	1998	1005	1	0.09	109	9.78
1999	108	0	0.00	17	13.60	1999	1041	2	0.18	97	8.51
2000	119	0	0.00	16	11.85	2000	1171	7	0.54	108	8.40
2001	119	1	0.69	24	16.67	2001	1166	30	2.31	105	8.07
2002	110	1	0.78	18	13.95	2002	1182	9	0.70	101	7.82
2003	107	0	0.00	20	15.75	2003	1204	9	0.69	96	7.33
2004	101	0	0.00	25	19.84	2004	1321	2	0.14	78	5.57
2005	101	0	0.00	16	13.68	2005	1437	7	0.46	89	5.81
2006	103	0	0.00	12	10.43	2006	1544	5	0.30	115	6.91
2007	107	0	0.00	11	9.32	2007	1709	4	0.22	113	6.19
2008	105	1	0.85	11	9.40	2008	1691	28	1.50	148	7.93
2009	100	2	1.75	12	10.53	2009	1663	30	1.66	111	6.15
2010	96	1	0.88	17	14.91	2010	1676	4	0.22	134	7.39
2011	86	0	0.00	18	17.31	2011	1687	0	0.00	176	9.45
2012	82	1	1.08	10	10.75	2012	1665	3	0.16	170	9.25
2013	83	0	0.00	15	15.31	2013	1638	4	0.22	158	8.78
2014	89	0	0.00	3	3.26	2014	1661	6	0.33	128	7.13

(*Continued*)

Table A.11. (*Continued*)

Economy: BIH

Year	Active	Defaults		Others	
		#	%	#	%
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	300	0	0.00	144	32.43
2007	288	0	0.00	306	51.52
2008	194	0	0.00	395	67.06
2009	168	0	0.00	616	78.57
2010	471	0	0.00	565	54.54
2011	591	0	0.00	735	55.43
2012	569	0	0.00	934	62.14
2013	542	0	0.00	934	63.28
2014	548	0	0.00	902	62.21

Economy: BGD

Year	Active	Defaults		Others	
		#	%	#	%
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	6	3.59
2000	129	0	0.00	52	28.73
2001	112	0	0.00	37	24.83
2002	107	0	0.00	21	16.41
2003	102	0	0.00	16	13.56
2004	100	0	0.00	15	13.04
2005	201	0	0.00	13	6.07
2006	205	0	0.00	15	6.82
2007	210	0	0.00	21	9.09
2008	222	0	0.00	16	6.72
2009	191	0	0.00	51	21.07
2010	216	0	0.00	20	8.47
2011	230	0	0.00	5	2.13
2012	239	0	0.00	3	1.24
2013	255	0	0.00	2	0.78
2014	273	0	0.00	0	0.00

Economy: BEL

Year	Active	Defaults		Others	
		#	%	#	%
1992	136	0	0.00	6	4.23
1993	138	0	0.00	8	5.48
1994	145	0	0.00	11	7.05
1995	149	0	0.00	10	6.29
1996	159	0	0.00	11	6.47
1997	162	0	0.00	18	10.00
1998	174	0	0.00	15	7.94
1999	191	1	0.50	8	4.00
2000	193	1	0.49	10	4.90
2001	186	2	1.00	13	6.47
2002	176	2	1.05	13	6.81
2003	177	2	1.04	14	7.25
2004	170	1	0.54	14	7.57
2005	171	1	0.54	12	6.52
2006	185	3	1.54	7	3.59
2007	221	0	0.00	54	19.64
2008	199	2	0.70	85	29.72
2009	197	2	0.80	52	20.72
2010	195	0	0.00	54	21.69
2011	176	1	0.41	65	26.86
2012	186	1	0.45	37	16.52
2013	169	1	0.42	68	28.57
2014	167	1	0.46	49	22.58

Economy: BGR

Year	Active	Defaults		Others	
		#	%	#	%
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	10	41.67
2001	21	0	0.00	8	27.59
2002	30	0	0.00	5	14.29
2003	30	0	0.00	11	26.83
2004	36	0	0.00	3	7.69
2005	130	1	0.67	19	12.67
2006	231	0	0.00	36	13.48
2007	241	2	0.64	71	22.61
2008	214	0	0.00	101	32.06
2009	206	0	0.00	82	28.47
2010	186	1	0.36	91	32.73
2011	171	0	0.00	81	32.14
2012	158	0	0.00	71	31.00
2013	165	0	0.00	72	30.38
2014	157	3	1.34	64	28.57

(*Continued*)

Table A.11. (*Continued*)

Economy: BHR

Year	Active	Defaults		Others	
		#	%	#	%
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	29	0	0.00	1	3.33
2005	37	0	0.00	2	5.13
2006	32	0	0.00	8	20.00
2007	36	0	0.00	7	16.28
2008	33	0	0.00	8	19.51
2009	32	0	0.00	14	30.43
2010	29	0	0.00	15	34.09
2011	25	0	0.00	18	41.86
2012	29	0	0.00	19	39.58
2013	29	0	0.00	12	29.27
2014	33	0	0.00	10	23.26

Economy: BRA

Year	Active	Defaults		Others	
		#	%	#	%
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	268	0	0.00	8	2.90
1995	275	0	0.00	97	26.08
1996	286	0	0.00	92	24.34
1997	263	0	0.00	132	33.42
1998	280	2	0.47	145	33.96
1999	318	2	0.48	101	23.99
2000	284	1	0.25	122	29.98
2001	271	1	0.25	134	33.00
2002	243	0	0.00	122	33.42
2003	273	3	0.83	87	23.97
2004	265	0	0.00	88	24.93
2005	263	1	0.31	63	19.27
2006	275	0	0.00	58	17.42
2007	346	0	0.00	36	9.42
2008	334	0	0.00	54	13.92
2009	331	0	0.00	37	10.05
2010	325	0	0.00	40	10.96
2011	321	1	0.28	35	9.80
2012	298	3	0.88	40	11.73
2013	288	9	2.74	32	9.73
2014	283	4	1.28	25	8.01

Economy: CAN

Year	Active	Defaults		Others	
		#	%	#	%
1992	938	1	0.09	115	10.91
1993	1135	0	0.00	77	6.35
1994	1324	0	0.00	58	4.20
1995	1451	0	0.00	76	4.98
1996	1622	0	0.00	82	4.81
1997	1784	4	0.21	129	6.73
1998	1764	9	0.44	254	12.53
1999	1203	9	0.46	727	37.49
2000	1124	8	0.60	195	14.69
2001	959	20	1.65	235	19.36
2002	947	4	0.39	80	7.76
2003	947	14	1.34	84	8.04
2004	1000	7	0.65	71	6.59
2005	1063	3	0.26	84	7.30
2006	1116	3	0.24	110	8.95
2007	1147	3	0.24	122	9.59
2008	1140	12	0.94	119	9.36
2009	1060	12	0.98	148	12.13
2010	1088	7	0.58	108	8.98
2011	1113	4	0.32	122	9.85
2012	1081	8	0.65	139	11.32
2013	1056	8	0.68	108	9.22
2014	1028	5	0.44	115	10.02

Economy: CHE

Year	Active	Defaults		Others	
		#	%	#	%
1992	138	0	0.00	31	18.34
1993	170	0	0.00	8	4.49
1994	176	0	0.00	17	8.81
1995	188	0	0.00	14	6.93
1996	205	0	0.00	14	6.39
1997	215	1	0.44	11	4.85
1998	224	0	0.00	12	5.08
1999	243	0	0.00	10	3.95
2000	255	0	0.00	16	5.90
2001	256	1	0.37	10	3.75
2002	248	1	0.38	15	5.68
2003	243	2	0.78	10	3.92
2004	235	1	0.40	11	4.45
2005	241	0	0.00	7	2.82
2006	242	1	0.39	14	5.45
2007	249	0	0.00	8	3.11
2008	247	0	0.00	12	4.63
2009	250	0	0.00	16	6.02
2010	246	0	0.00	16	6.11
2011	240	1	0.39	17	6.59
2012	233	1	0.40	17	6.77
2013	236	0	0.00	9	3.67
2014	233	0	0.00	16	6.43

(*Continued*)

Table A.11. (*Continued*)

Economy: CHL

Year	Active	Defaults		Others	
		#	%	#	%
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	141	0	0.00	5	3.42
1995	166	0	0.00	24	12.63
1996	173	0	0.00	44	20.28
1997	185	0	0.00	37	16.67
1998	173	0	0.00	56	24.45
1999	179	0	0.00	44	19.73
2000	169	0	0.00	41	19.52
2001	167	1	0.47	43	20.38
2002	160	1	0.47	50	23.70
2003	158	0	0.00	58	26.85
2004	164	0	0.00	37	18.41
2005	170	0	0.00	34	16.67
2006	169	0	0.00	44	20.66
2007	189	0	0.00	29	13.30
2008	149	0	0.00	51	25.50
2009	162	0	0.00	29	15.18
2010	164	0	0.00	36	18.00
2011	163	0	0.00	41	20.10
2012	167	0	0.00	49	22.69
2013	163	0	0.00	41	20.10
2014	170	0	0.00	33	16.26

Economy: CHN

Year	Active	Defaults		Others	
		#	%	#	%
1992	41	0	0.00	2	4.65
1993	148	0	0.00	0	0.00
1994	281	1	0.35	1	0.35
1995	313	6	1.88	0	0.00
1996	496	7	1.39	1	0.20
1997	718	17	2.31	2	0.27
1998	834	29	3.35	2	0.23
1999	928	27	2.82	1	0.10
2000	1050	28	2.59	1	0.09
2001	1150	46	3.82	7	0.58
2002	1201	49	3.86	21	1.65
2003	1257	46	3.47	24	1.81
2004	1343	111	7.51	25	1.69
2005	1360	97	6.58	17	1.15
2006	1365	77	5.12	62	4.12
2007	1443	60	3.75	98	6.12
2008	1574	49	2.91	62	3.68
2009	1657	52	2.99	28	1.61
2010	1959	39	1.91	45	2.20
2011	2256	22	0.94	60	2.57
2012	2424	18	0.72	55	2.20
2013	2397	15	0.59	146	5.71
2014	2454	4	0.14	310	11.20

Economy: COL

Year	Active	Defaults		Others	
		#	%	#	%
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	1	0	0.00	0	0.00
1995	46	0	0.00	27	36.99
1996	54	0	0.00	36	40.00
1997	51	0	0.00	44	46.32
1998	60	0	0.00	62	50.82
1999	52	0	0.00	62	54.39
2000	45	0	0.00	39	46.43
2001	53	0	0.00	20	27.40
2002	52	0	0.00	25	32.47
2003	54	0	0.00	15	21.74
2004	53	0	0.00	14	20.90
2005	62	0	0.00	10	13.89
2006	47	0	0.00	25	34.72
2007	48	0	0.00	14	22.58
2008	37	0	0.00	24	39.34
2009	44	0	0.00	10	18.52
2010	42	0	0.00	15	26.32
2011	41	0	0.00	11	21.15
2012	38	1	2.04	10	20.41
2013	41	0	0.00	13	24.07
2014	40	0	0.00	12	23.08

Economy: CYP

Year	Active	Defaults		Others	
		#	%	#	%
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	35	0	0.00	2	5.41
1997	40	0	0.00	1	2.44
1998	46	0	0.00	2	4.17
1999	52	0	0.00	2	3.70
2000	112	0	0.00	4	3.45
2001	137	0	0.00	6	4.20
2002	143	0	0.00	8	5.30
2003	137	0	0.00	19	12.18
2004	132	0	0.00	31	19.02
2005	138	0	0.00	23	14.29
2006	136	0	0.00	12	8.11
2007	137	0	0.00	8	5.52
2008	133	0	0.00	19	12.50
2009	113	0	0.00	34	23.13
2010	118	0	0.00	20	14.49
2011	86	0	0.00	54	38.57
2012	78	0	0.00	58	42.65
2013	55	2	1.69	61	51.69
2014	55	0	0.00	33	37.50

(*Continued*)

Table A.11. (*Continued*)

Economy: CZE

Year	Active	Defaults		Others	
		#	%	#	%
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	1	0	0.00	0	0.00
1995	52	0	0.00	1	1.89
1996	53	0	0.00	8	13.11
1997	271	0	0.00	357	56.85
1998	240	1	0.35	41	14.54
1999	144	4	1.55	110	42.64
2000	110	6	3.43	59	33.71
2001	82	2	1.26	75	47.17
2002	43	1	0.95	61	58.10
2003	35	0	0.00	37	51.39
2004	42	0	0.00	25	37.31
2005	24	0	0.00	24	50.00
2006	17	0	0.00	19	52.78
2007	13	0	0.00	12	48.00
2008	16	0	0.00	7	30.43
2009	13	0	0.00	9	40.91
2010	17	0	0.00	2	10.53
2011	18	1	4.35	4	17.39
2012	16	0	0.00	5	23.81
2013	13	0	0.00	7	35.00
2014	13	0	0.00	3	18.75

Economy: DNK

Year	Active	Defaults		Others	
		#	%	#	%
1992	154	0	0.00	19	10.98
1993	169	0	0.00	14	7.65
1994	172	0	0.00	23	11.79
1995	198	0	0.00	17	7.91
1996	216	0	0.00	11	4.85
1997	211	0	0.00	19	8.26
1998	209	0	0.00	28	11.81
1999	209	0	0.00	25	10.68
2000	208	1	0.44	20	8.73
2001	192	5	2.19	31	13.60
2002	175	3	1.44	31	14.83
2003	172	1	0.52	19	9.90
2004	170	1	0.54	15	8.06
2005	167	0	0.00	9	5.11
2006	183	0	0.00	6	3.17
2007	214	1	0.46	4	1.83
2008	216	0	0.00	11	4.85
2009	209	4	1.78	12	5.33
2010	200	0	0.00	15	6.98
2011	187	2	0.99	13	6.44
2012	176	2	1.05	12	6.32
2013	166	4	2.22	10	5.56
2014	154	2	1.17	15	8.77

Economy: DEU

Year	Active	Defaults		Others	
		#	%	#	%
1992	396	0	0.00	37	8.55
1993	416	0	0.00	32	7.14
1994	571	0	0.00	58	9.22
1995	595	0	0.00	64	9.71
1996	624	4	0.58	62	8.99
1997	625	1	0.14	78	11.08
1998	720	2	0.26	52	6.72
1999	903	2	0.21	50	5.24
2000	1030	2	0.18	60	5.49
2001	1035	21	1.89	53	4.78
2002	959	39	3.57	94	8.61
2003	896	19	1.91	79	7.95
2004	885	7	0.74	50	5.31
2005	905	5	0.53	40	4.21
2006	1053	4	0.37	34	3.12
2007	1201	4	0.32	62	4.89
2008	1282	18	1.29	99	7.08
2009	1251	10	0.70	177	12.31
2010	1294	1	0.07	146	10.13
2011	1324	3	0.18	331	19.96
2012	1170	11	0.75	294	19.93
2013	914	14	1.14	303	24.61
2014	889	4	0.41	84	8.60

Economy: EST

Year	Active	Defaults		Others	
		#	%	#	%
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	1	5.00
1999	19	0	0.00	1	5.00
2000	16	0	0.00	3	15.79
2001	14	0	0.00	3	17.65
2002	11	0	0.00	3	21.43
2003	11	0	0.00	0	0.00
2004	11	0	0.00	0	0.00
2005	12	0	0.00	1	7.69
2006	14	0	0.00	1	6.67
2007	16	0	0.00	1	5.88
2008	17	0	0.00	0	0.00
2009	15	0	0.00	2	11.76
2010	15	0	0.00	1	6.25
2011	15	0	0.00	0	0.00
2012	16	0	0.00	0	0.00
2013	16	0	0.00	0	0.00
2014	16	0	0.00	0	0.00

(*Continued*)

Table A.11. (*Continued*)

Economy: EGY

Year	Active	Defaults		Others	
		#	%	#	%
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	168	0	0.00	71	29.71
2007	200	0	0.00	123	38.08
2008	356	0	0.00	40	10.10
2009	219	0	0.00	182	45.39
2010	201	0	0.00	70	25.83
2011	236	0	0.00	15	5.98
2012	212	0	0.00	52	19.70
2013	241	0	0.00	6	2.43
2014	245	0	0.00	2	0.81

Economy: ESP

Year	Active	Defaults		Others	
		#	%	#	%
1992	144	0	0.00	38	20.88
1993	113	0	0.00	98	46.45
1994	244	0	0.00	8	3.17
1995	247	0	0.00	90	26.71
1996	268	0	0.00	73	21.41
1997	279	0	0.00	60	17.70
1998	240	0	0.00	99	29.20
1999	217	0	0.00	86	28.38
2000	216	0	0.00	51	19.10
2001	189	0	0.00	83	30.51
2002	209	2	0.74	61	22.43
2003	189	0	0.00	67	26.17
2004	158	0	0.00	57	26.51
2005	162	0	0.00	44	21.36
2006	160	0	0.00	43	21.18
2007	151	1	0.51	46	23.23
2008	153	2	1.14	20	11.43
2009	143	0	0.00	29	16.86
2010	141	1	0.62	19	11.80
2011	144	0	0.00	13	8.28
2012	135	2	1.28	19	12.18
2013	133	6	3.80	19	12.03
2014	142	1	0.63	15	9.49

Economy: FIN

Year	Active	Defaults		Others	
		#	%	#	%
1992	91	0	0.00	0	0.00
1993	93	0	0.00	2	2.11
1994	96	0	0.00	6	5.88
1995	103	0	0.00	4	3.74
1996	110	0	0.00	4	3.51
1997	122	0	0.00	1	0.81
1998	126	1	0.76	5	3.79
1999	145	0	0.00	9	5.84
2000	152	0	0.00	11	6.75
2001	152	0	0.00	11	6.75
2002	144	2	1.28	10	6.41
2003	138	1	0.66	12	7.95
2004	132	0	0.00	10	7.04
2005	132	0	0.00	7	5.04
2006	132	0	0.00	8	5.71
2007	130	0	0.00	4	2.99
2008	127	1	0.76	4	3.03
2009	125	1	0.78	2	1.56
2010	123	0	0.00	4	3.15
2011	121	1	0.81	1	0.81
2012	121	0	0.00	3	2.42
2013	122	1	0.79	3	2.38
2014	126	0	0.00	2	1.56

Economy: FRA

Year	Active	Defaults		Others	
		#	%	#	%
1992	620	0	0.00	61	8.96
1993	635	0	0.00	81	11.31
1994	688	0	0.00	96	12.24
1995	710	0	0.00	125	14.97
1996	757	0	0.00	113	12.99
1997	811	1	0.11	130	13.80
1998	844	0	0.00	164	16.27
1999	849	0	0.00	138	13.98
2000	912	2	0.20	92	9.15
2001	918	8	0.79	93	9.13
2002	875	5	0.50	111	11.20
2003	857	4	0.41	110	11.33
2004	839	3	0.32	103	10.90
2005	847	4	0.42	91	9.66
2006	904	7	0.71	79	7.98
2007	950	7	0.66	98	9.29
2008	904	11	1.04	144	13.60
2009	898	7	0.67	143	13.65
2010	847	2	0.20	174	17.01
2011	806	2	0.21	150	15.66
2012	770	0	0.00	158	17.03
2013	741	3	0.33	154	17.15
2014	763	1	0.11	113	12.88

(*Continued*)

Table A.11. (*Continued*)

Economy: GBR

Year	Active	Defaults		Others	
		#	%	#	%
1992	1075	1	0.09	87	7.48
1993	1181	0	0.00	46	3.75
1994	1277	0	0.00	45	3.40
1995	1405	0	0.00	62	4.23
1996	1604	0	0.00	66	3.95
1997	1706	0	0.00	107	5.90
1998	1690	0	0.00	195	10.34
1999	1550	1	0.05	289	15.71
2000	1665	3	0.16	216	11.46
2001	1685	10	0.54	147	7.98
2002	1640	15	0.82	169	9.27
2003	1576	6	0.34	193	10.87
2004	1747	2	0.11	149	7.85
2005	1994	2	0.09	202	9.19
2006	2169	0	0.00	235	9.78
2007	2227	1	0.04	261	10.49
2008	2053	27	1.11	353	14.51
2009	1843	35	1.59	321	14.60
2010	1769	3	0.15	260	12.80
2011	1693	10	0.51	259	13.20
2012	1580	20	1.09	242	13.14
2013	1558	10	0.57	197	11.16
2014	1611	6	0.34	160	9.00

Economy: GRC

Year	Active	Defaults		Others	
		#	%	#	%
1992	89	0	0.00	0	0.00
1993	94	0	0.00	0	0.00
1994	152	0	0.00	2	1.30
1995	179	0	0.00	2	1.10
1996	193	0	0.00	5	2.53
1997	207	0	0.00	5	2.36
1998	226	0	0.00	4	1.74
1999	254	0	0.00	7	2.68
2000	307	0	0.00	8	2.54
2001	312	0	0.00	12	3.70
2002	313	0	0.00	17	5.15
2003	316	0	0.00	10	3.07
2004	317	0	0.00	9	2.76
2005	301	0	0.00	21	6.52
2006	288	0	0.00	17	5.57
2007	281	0	0.00	14	4.75
2008	277	0	0.00	16	5.46
2009	271	0	0.00	21	7.19
2010	274	0	0.00	20	6.80
2011	234	0	0.00	49	17.31
2012	220	0	0.00	42	16.03
2013	200	0	0.00	41	17.01
2014	197	0	0.00	25	11.26

Economy: HKG

Year	Active	Defaults		Others	
		#	%	#	%
1992	352	0	0.00	11	3.03
1993	418	0	0.00	6	1.42
1994	459	0	0.00	13	2.75
1995	489	0	0.00	7	1.41
1996	517	0	0.00	19	3.54
1997	593	0	0.00	23	3.73
1998	621	2	0.31	27	4.15
1999	654	5	0.73	22	3.23
2000	734	5	0.66	20	2.64
2001	796	9	1.08	28	3.36
2002	905	4	0.42	36	3.81
2003	954	4	0.40	50	4.96
2004	990	0	0.00	56	5.35
2005	1016	1	0.09	69	6.35
2006	1061	4	0.36	40	3.62
2007	1157	2	0.17	30	2.52
2008	1174	6	0.49	33	2.72
2009	1219	5	0.40	23	1.84
2010	1300	1	0.08	26	1.96
2011	1353	1	0.07	27	1.96
2012	1403	2	0.14	44	3.04
2013	1475	5	0.33	27	1.79
2014	1597	0	0.00	25	1.54

Economy: HRV

Year	Active	Defaults		Others	
		#	%	#	%
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	29	0	0.00	3	9.38
2003	37	0	0.00	6	13.95
2004	48	0	0.00	11	18.64
2005	53	0	0.00	9	14.52
2006	210	0	0.00	16	7.08
2007	243	0	0.00	54	18.18
2008	171	0	0.00	124	42.03
2009	162	0	0.00	80	33.06
2010	152	1	0.49	50	24.63
2011	142	0	0.00	69	32.70
2012	131	1	0.53	57	30.16
2013	118	0	0.00	62	34.44
2014	130	0	0.00	42	24.42

(*Continued*)

Table A.11. (*Continued*)

Economy: HUN

Year	Active	Defaults		Others	
		#	%	#	%
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	36	0	0.00	0	0.00
1996	37	0	0.00	9	19.57
1997	38	0	0.00	9	19.15
1998	43	0	0.00	5	10.42
1999	54	0	0.00	6	10.00
2000	50	1	1.72	7	12.07
2001	48	0	0.00	8	14.29
2002	39	0	0.00	12	23.53
2003	42	0	0.00	4	8.70
2004	38	0	0.00	8	17.39
2005	35	0	0.00	7	16.67
2006	38	0	0.00	4	9.52
2007	34	0	0.00	5	12.82
2008	37	0	0.00	1	2.63
2009	39	0	0.00	0	0.00
2010	43	0	0.00	1	2.27
2011	44	0	0.00	6	12.00
2012	46	0	0.00	4	8.00
2013	47	1	1.92	4	7.69
2014	45	0	0.00	10	18.18

Economy: IDN

Year	Active	Defaults		Others	
		#	%	#	%
1992	124	0	0.00	27	17.88
1993	152	0	0.00	27	15.08
1994	174	0	0.00	46	20.91
1995	207	0	0.00	40	16.19
1996	230	1	0.38	30	11.49
1997	251	2	0.71	29	10.28
1998	240	19	6.23	46	15.08
1999	254	19	6.53	18	6.19
2000	256	14	4.62	33	10.89
2001	270	14	4.28	43	13.15
2002	265	6	1.80	62	18.62
2003	298	2	0.63	19	5.96
2004	290	5	1.40	62	17.37
2005	273	2	0.57	77	21.88
2006	302	0	0.00	56	15.64
2007	322	2	0.52	64	16.49
2008	291	0	0.00	92	24.02
2009	324	3	0.78	59	15.28
2010	361	2	0.49	46	11.25
2011	381	1	0.24	43	10.12
2012	411	1	0.22	40	8.85
2013	440	1	0.21	37	7.74
2014	461	3	0.61	25	5.11

Economy: IRL

Year	Active	Defaults		Others	
		#	%	#	%
1992	30	0	0.00	4	11.76
1993	37	0	0.00	4	9.76
1994	38	0	0.00	4	9.52
1995	36	0	0.00	2	5.26
1996	43	0	0.00	0	0.00
1997	49	0	0.00	3	5.77
1998	50	0	0.00	5	9.09
1999	51	0	0.00	5	8.93
2000	58	0	0.00	6	9.38
2001	55	0	0.00	5	8.33
2002	48	0	0.00	7	12.73
2003	43	0	0.00	5	10.42
2004	42	0	0.00	3	6.67
2005	42	0	0.00	2	4.55
2006	47	0	0.00	2	4.08
2007	51	0	0.00	2	3.77
2008	49	0	0.00	3	5.77
2009	44	1	2.04	4	8.16
2010	40	0	0.00	5	11.11
2011	38	0	0.00	2	5.00
2012	33	0	0.00	5	13.16
2013	33	1	2.78	2	5.56
2014	35	0	0.00	2	5.41

Economy: ISR

Year	Active	Defaults		Others	
		#	%	#	%
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	9	0	0.00	0	0.00
1995	82	0	0.00	2	2.38
1996	626	0	0.00	6	0.95
1997	632	0	0.00	20	3.07
1998	611	0	0.00	42	6.43
1999	610	0	0.00	54	8.13
2000	596	0	0.00	74	11.04
2001	548	0	0.00	175	24.20
2002	540	2	0.28	169	23.77
2003	530	0	0.00	165	23.74
2004	512	2	0.34	83	13.90
2005	517	0	0.00	53	9.30
2006	543	0	0.00	40	6.86
2007	594	0	0.00	25	4.04
2008	566	0	0.00	45	7.36
2009	566	0	0.00	26	4.39
2010	550	1	0.17	50	8.32
2011	544	1	0.17	43	7.31
2012	488	0	0.00	82	14.39
2013	475	2	0.39	36	7.02
2014	443	1	0.21	36	7.50

(*Continued*)

Table A.11. (*Continued*)

Economy: IND

Year	Active	Defaults		Others	
		#	%	#	%
1992	1484	1	0.06	145	8.90
1993	1832	0	0.00	193	9.53
1994	2728	0	0.00	262	8.76
1995	4024	2	0.05	338	7.75
1996	4077	3	0.06	1038	20.28
1997	3021	11	0.22	1911	38.66
1998	2619	9	0.22	1519	36.63
1999	2916	13	0.32	1125	27.75
2000	2558	11	0.29	1289	33.41
2001	2285	6	0.18	1111	32.66
2002	2644	6	0.18	752	22.10
2003	2618	14	0.35	1363	34.12
2004	2553	7	0.20	874	25.45
2005	2509	7	0.22	682	21.33
2006	2854	10	0.32	307	9.68
2007	2982	15	0.45	302	9.15
2008	3048	25	0.69	537	14.88
2009	3127	38	1.10	288	8.34
2010	3604	9	0.20	936	20.58
2011	3372	9	0.21	881	20.67
2012	3550	26	0.65	425	10.62
2013	3461	31	0.77	530	13.18
2014	3840	10	0.25	203	5.01

Economy: ISL

Year	Active	Defaults		Others	
		#	%	#	%
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	26	0	0.00	0	0.00
1997	33	0	0.00	3	8.33
1998	44	0	0.00	2	4.35
1999	60	0	0.00	8	11.76
2000	59	0	0.00	18	23.38
2001	64	0	0.00	13	16.88
2002	54	0	0.00	15	21.74
2003	42	0	0.00	22	34.38
2004	32	0	0.00	13	28.89
2005	26	0	0.00	12	31.58
2006	24	0	0.00	6	20.00
2007	26	0	0.00	4	13.33
2008	13	4	13.33	13	43.33
2009	10	1	5.88	6	35.29
2010	8	0	0.00	3	27.27
2011	7	0	0.00	5	41.67
2012	11	0	0.00	1	8.33
2013	14	0	0.00	3	17.65
2014	15	0	0.00	3	16.67

Economy: ITA

Year	Active	Defaults		Others	
		#	%	#	%
1992	185	0	0.00	4	2.12
1993	181	0	0.00	9	4.74
1994	196	0	0.00	12	5.77
1995	207	0	0.00	15	6.76
1996	213	1	0.44	15	6.55
1997	220	0	0.00	23	9.47
1998	226	0	0.00	17	7.00
1999	253	0	0.00	7	2.69
2000	274	0	0.00	24	8.05
2001	281	0	0.00	17	5.70
2002	276	1	0.34	14	4.81
2003	262	5	1.72	23	7.93
2004	257	3	1.11	10	3.70
2005	264	0	0.00	12	4.35
2006	274	0	0.00	16	5.52
2007	296	0	0.00	15	4.82
2008	287	1	0.32	21	6.80
2009	277	3	1.00	21	6.98
2010	278	1	0.34	16	5.42
2011	280	0	0.00	22	7.28
2012	276	2	0.65	29	9.45
2013	275	2	0.67	22	7.36
2014	294	1	0.32	16	5.14

Economy: JAM

Year	Active	Defaults		Others	
		#	%	#	%
1992	0	0	NaN	0	NaN
1993	24	0	0.00	6	20.00
1994	34	0	0.00	5	12.82
1995	34	0	0.00	4	10.53
1996	30	0	0.00	10	25.00
1997	28	0	0.00	7	20.00
1998	28	0	0.00	5	15.15
1999	28	0	0.00	7	20.00
2000	31	0	0.00	3	8.82
2001	32	0	0.00	2	5.88
2002	32	0	0.00	0	0.00
2003	31	0	0.00	3	8.82
2004	32	0	0.00	1	3.03
2005	32	0	0.00	4	11.11
2006	33	0	0.00	2	5.71
2007	34	0	0.00	4	10.53
2008	36	0	0.00	3	7.69
2009	35	0	0.00	5	12.50
2010	42	0	0.00	0	0.00
2011	44	0	0.00	6	12.00
2012	41	0	0.00	9	18.00
2013	44	0	0.00	4	8.33
2014	46	0	0.00	5	9.80

(*Continued*)

Table A.11. (*Continued*)

Economy: JOR

Year	Active	Defaults		Others	
		#	%	#	%
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	65	0	0.00	13	16.67
1997	89	0	0.00	16	15.24
1998	109	0	0.00	30	21.58
1999	105	0	0.00	49	31.82
2000	110	0	0.00	50	31.25
2001	117	0	0.00	40	25.48
2002	114	0	0.00	33	22.45
2003	133	0	0.00	21	13.64
2004	137	0	0.00	16	10.46
2005	154	0	0.00	14	8.33
2006	191	0	0.00	12	5.91
2007	202	0	0.00	20	9.01
2008	220	0	0.00	14	5.98
2009	219	0	0.00	32	12.75
2010	218	0	0.00	23	9.54
2011	211	0	0.00	36	14.57
2012	209	0	0.00	31	12.92
2013	194	0	0.00	37	16.02
2014	235	0	0.00	13	5.24

Economy: JPN

Year	Active	Defaults		Others	
		#	%	#	%
1992	2531	2	0.08	21	0.82
1993	2609	3	0.11	25	0.95
1994	2748	0	0.00	17	0.61
1995	2928	1	0.03	18	0.61
1996	3077	4	0.13	22	0.71
1997	3207	5	0.15	28	0.86
1998	3264	12	0.36	36	1.09
1999	3318	6	0.18	47	1.39
2000	3449	12	0.34	60	1.70
2001	3557	14	0.39	62	1.71
2002	3593	33	0.89	92	2.47
2003	3613	18	0.48	103	2.76
2004	3726	13	0.34	77	2.02
2005	3798	9	0.23	93	2.38
2006	3925	2	0.05	89	2.22
2007	3978	6	0.15	100	2.45
2008	3902	32	0.79	110	2.72
2009	3784	31	0.79	131	3.32
2010	3686	8	0.21	130	3.40
2011	3626	6	0.16	98	2.63
2012	3576	6	0.16	102	2.77
2013	3565	3	0.08	85	2.33
2014	3603	0	0.00	43	1.18

Economy: KOR

Year	Active	Defaults		Others	
		#	%	#	%
1992	634	0	0.00	1	0.16
1993	643	0	0.00	0	0.00
1994	670	0	0.00	0	0.00
1995	698	0	0.00	1	0.14
1996	740	6	0.80	3	0.40
1997	1015	36	3.38	15	1.41
1998	902	92	8.36	106	9.64
1999	957	19	1.86	44	4.31
2000	1150	12	1.00	40	3.33
2001	1274	20	1.51	30	2.27
2002	1441	15	1.01	32	2.15
2003	1491	11	0.72	30	1.96
2004	1503	9	0.58	52	3.32
2005	1545	8	0.50	57	3.54
2006	1625	2	0.12	12	0.73
2007	1699	2	0.12	14	0.82
2008	1736	5	0.28	35	1.97
2009	1722	8	0.44	83	4.58
2010	1737	10	0.54	98	5.31
2011	1750	3	0.16	84	4.57
2012	1729	8	0.44	77	4.24
2013	1737	11	0.61	66	3.64
2014	1786	4	0.22	60	3.24

Economy: KWT

Year	Active	Defaults		Others	
		#	%	#	%
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	1	1.89
1997	66	0	0.00	2	2.94
1998	67	0	0.00	1	1.47
1999	70	0	0.00	6	7.89
2000	69	0	0.00	11	13.75
2001	73	0	0.00	0	0.00
2002	76	0	0.00	6	7.32
2003	94	0	0.00	0	0.00
2004	100	0	0.00	3	2.91
2005	137	0	0.00	4	2.84
2006	159	0	0.00	4	2.45
2007	172	0	0.00	16	8.51
2008	176	0	0.00	14	7.37
2009	181	2	0.93	31	14.49
2010	182	0	0.00	42	18.75
2011	160	1	0.44	65	28.76
2012	183	0	0.00	37	16.82
2013	187	0	0.00	24	11.37
2014	182	0	0.00	28	13.33

(*Continued*)

Table A.11. (*Continued*)

Economy: KAZ

Year	Active	Defaults		Others	
		#	%	#	%
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	7	0	0.00	5	41.67
2003	8	0	0.00	5	38.46
2004	14	0	0.00	11	44.00
2005	3	0	0.00	15	83.33
2006	3	0	0.00	3	50.00
2007	22	0	0.00	13	37.14
2008	23	0	0.00	11	32.35
2009	19	4	9.09	21	47.73
2010	10	0	0.00	21	67.74
2011	14	0	0.00	9	39.13
2012	15	0	0.00	10	40.00
2013	13	0	0.00	12	48.00
2014	14	0	0.00	11	44.00

Economy: LKA

Year	Active	Defaults		Others	
		#	%	#	%
1992	0	0	NaN	0	NaN
1993	1	0	0.00	0	0.00
1994	1	0	0.00	0	0.00
1995	122	0	0.00	1	0.81
1996	137	0	0.00	38	21.71
1997	137	0	0.00	34	19.88
1998	153	0	0.00	30	16.39
1999	151	0	0.00	35	18.82
2000	147	0	0.00	38	20.54
2001	166	0	0.00	22	11.70
2002	175	0	0.00	25	12.50
2003	177	0	0.00	28	13.66
2004	189	0	0.00	12	5.97
2005	205	0	0.00	10	4.65
2006	209	0	0.00	13	5.86
2007	218	0	0.00	8	3.54
2008	214	0	0.00	14	6.14
2009	221	0	0.00	9	3.91
2010	238	0	0.00	2	0.83
2011	259	0	0.00	9	3.36
2012	275	0	0.00	4	1.43
2013	276	0	0.00	2	0.72
2014	278	0	0.00	8	2.80

Economy: LTU

Year	Active	Defaults		Others	
		#	%	#	%
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	33	0	0.00	5	13.16
2001	33	0	0.00	11	25.00
2002	41	0	0.00	3	6.82
2003	39	0	0.00	9	18.75
2004	40	0	0.00	1	2.44
2005	40	0	0.00	0	0.00
2006	39	0	0.00	2	4.88
2007	37	0	0.00	3	7.50
2008	38	0	0.00	0	0.00
2009	38	0	0.00	1	2.56
2010	38	0	0.00	2	5.00
2011	33	1	2.50	6	15.00
2012	32	0	0.00	1	3.03
2013	31	1	2.94	2	5.88
2014	32	0	0.00	3	8.57

Economy: LUX

Year	Active	Defaults		Others	
		#	%	#	%
1992	2	0	0.00	1	33.33
1993	2	0	0.00	1	33.33
1994	2	0	0.00	0	0.00
1995	32	0	0.00	9	21.95
1996	30	0	0.00	16	34.78
1997	38	0	0.00	10	20.83
1998	32	0	0.00	14	30.43
1999	34	0	0.00	12	26.09
2000	31	0	0.00	14	31.11
2001	28	0	0.00	14	33.33
2002	28	0	0.00	9	24.32
2003	27	0	0.00	11	28.95
2004	35	0	0.00	7	16.67
2005	38	0	0.00	6	13.64
2006	37	0	0.00	15	28.85
2007	35	0	0.00	10	22.22
2008	27	0	0.00	14	34.15
2009	23	0	0.00	9	28.13
2010	20	1	3.45	8	27.59
2011	14	0	0.00	10	41.67
2012	14	0	0.00	5	26.32
2013	19	0	0.00	2	9.52
2014	16	0	0.00	7	30.43

(*Continued*)

Table A.11. (*Continued*)

Economy: LVA

Year	Active	Defaults		Others	
		#	%	#	%
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	16	0	0.00	1	5.88
2001	34	0	0.00	9	20.93
2002	35	0	0.00	4	10.26
2003	33	0	0.00	4	10.81
2004	27	0	0.00	10	27.03
2005	32	0	0.00	3	8.57
2006	31	0	0.00	4	11.43
2007	32	0	0.00	6	15.79
2008	27	0	0.00	8	22.86
2009	28	0	0.00	9	24.32
2010	32	0	0.00	4	11.11
2011	27	1	2.78	8	22.22
2012	29	0	0.00	5	14.71
2013	29	0	0.00	8	21.62
2014	24	0	0.00	12	33.33

Economy: MAR

Year	Active	Defaults		Others	
		#	%	#	%
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	40	0	0.00	3	6.98
1998	48	0	0.00	1	2.04
1999	47	0	0.00	5	9.62
2000	51	0	0.00	2	3.77
2001	52	0	0.00	7	11.86
2002	51	0	0.00	7	12.07
2003	50	0	0.00	7	12.28
2004	48	0	0.00	7	12.73
2005	54	0	0.00	2	3.57
2006	56	0	0.00	6	9.68
2007	69	0	0.00	3	4.17
2008	77	0	0.00	1	1.28
2009	75	0	0.00	2	2.60
2010	73	0	0.00	4	5.19
2011	74	0	0.00	1	1.33
2012	76	0	0.00	1	1.30
2013	73	0	0.00	4	5.19
2014	73	0	0.00	3	3.95

Economy: MNE

Year	Active	Defaults		Others	
		#	%	#	%
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	33	0	0.00	20	37.74
2004	52	0	0.00	62	54.39
2005	77	0	0.00	66	46.15
2006	105	0	0.00	84	44.44
2007	140	0	0.00	94	40.17
2008	93	0	0.00	139	59.91
2009	92	0	0.00	90	49.45
2010	79	0	0.00	104	56.83
2011	56	0	0.00	214	79.26
2012	45	0	0.00	216	82.76
2013	53	0	0.00	65	55.08
2014	225	0	0.00	183	44.85

Economy: MKD

Year	Active	Defaults		Others	
		#	%	#	%
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	61	0	0.00	61	50.00
2006	84	0	0.00	71	45.81
2007	94	0	0.00	73	43.71
2008	71	0	0.00	78	52.35
2009	68	0	0.00	68	50.00
2010	64	0	0.00	58	47.54
2011	59	0	0.00	69	53.91
2012	52	1	0.86	63	54.31
2013	42	0	0.00	76	64.41
2014	83	0	0.00	36	30.25

(*Continued*)

Table A.11. (*Continued*)

Economy: MLT

Year	Active	Defaults		Others	
		#	%	#	%
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	1	12.50
2000	9	0	0.00	0	0.00
2001	9	0	0.00	2	18.18
2002	9	0	0.00	2	18.18
2003	10	0	0.00	3	23.08
2004	11	0	0.00	2	15.38
2005	11	0	0.00	2	15.38
2006	13	0	0.00	0	0.00
2007	14	0	0.00	3	17.65
2008	14	0	0.00	6	30.00
2009	12	0	0.00	4	25.00
2010	12	0	0.00	2	14.29
2011	14	0	0.00	2	12.50
2012	19	0	0.00	1	5.00
2013	20	0	0.00	2	9.09
2014	21	0	0.00	2	8.70

Economy: MEX

Year	Active	Defaults		Others	
		#	%	#	%
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	99	0	0.00	25	20.16
1995	98	0	0.00	32	24.62
1996	105	0	0.00	20	16.00
1997	116	0	0.00	23	16.55
1998	114	0	0.00	19	14.29
1999	111	1	0.72	26	18.84
2000	107	1	0.80	17	13.60
2001	107	1	0.79	19	14.96
2002	98	0	0.00	28	22.22
2003	104	3	2.42	17	13.71
2004	110	0	0.00	10	8.33
2005	100	0	0.00	25	20.00
2006	105	0	0.00	10	8.70
2007	103	0	0.00	17	14.17
2008	93	2	1.68	24	20.17
2009	101	2	1.75	11	9.65
2010	106	2	1.65	13	10.74
2011	106	1	0.78	22	17.05
2012	105	0	0.00	12	10.26
2013	113	6	4.80	6	4.80
2014	112	1	0.83	8	6.61

Economy: MYS

Year	Active	Defaults		Others	
		#	%	#	%
1992	351	0	0.00	8	2.23
1993	399	0	0.00	2	0.50
1994	457	0	0.00	7	1.51
1995	517	0	0.00	2	0.39
1996	602	0	0.00	0	0.00
1997	692	0	0.00	2	0.29
1998	697	14	1.92	20	2.74
1999	703	8	1.11	12	1.66
2000	735	8	1.06	15	1.98
2001	737	9	1.18	18	2.36
2002	767	8	1.00	27	3.37
2003	821	3	0.36	21	2.49
2004	901	3	0.33	18	1.95
2005	981	1	0.10	27	2.68
2006	997	5	0.48	29	2.81
2007	967	6	0.58	70	6.71
2008	934	14	1.39	61	6.05
2009	920	14	1.43	48	4.89
2010	926	18	1.84	32	3.28
2011	927	5	0.52	33	3.42
2012	909	6	0.63	40	4.19
2013	899	5	0.54	30	3.21
2014	897	1	0.11	15	1.64

Economy: NGA

Year	Active	Defaults		Others	
		#	%	#	%
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	123	0	0.00	22	15.17
2003	75	0	0.00	66	46.81
2004	113	0	0.00	41	26.62
2005	131	0	0.00	24	15.48
2006	136	0	0.00	33	19.53
2007	166	0	0.00	26	13.54
2008	179	0	0.00	44	19.73
2009	188	0	0.00	25	11.74
2010	179	0	0.00	24	11.82
2011	159	0	0.00	35	18.04
2012	161	0	0.00	19	10.56
2013	177	0	0.00	20	10.15
2014	176	0	0.00	13	6.88

(*Continued*)

Table A.11. (*Continued*)

Economy: NLD

Year	Active	Defaults		Others	
		#	%	#	%
1992	158	0	0.00	6	3.66
1993	167	0	0.00	4	2.34
1994	174	0	0.00	6	3.33
1995	187	0	0.00	4	2.09
1996	193	1	0.50	5	2.51
1997	201	0	0.00	14	6.51
1998	211	0	0.00	10	4.52
1999	215	0	0.00	20	8.51
2000	204	1	0.44	20	8.89
2001	181	5	2.39	23	11.00
2002	161	11	5.82	17	8.99
2003	153	1	0.59	16	9.41
2004	145	0	0.00	10	6.45
2005	140	0	0.00	9	6.04
2006	137	1	0.69	7	4.83
2007	136	0	0.00	8	5.56
2008	128	1	0.71	11	7.86
2009	123	3	2.29	5	3.82
2010	120	0	0.00	6	4.76
2011	116	0	0.00	7	5.69
2012	111	0	0.00	10	8.26
2013	105	1	0.88	7	6.19
2014	107	1	0.88	5	4.42

Economy: NOR

Year	Active	Defaults		Others	
		#	%	#	%
1992	75	0	0.00	9	10.71
1993	92	0	0.00	2	2.13
1994	110	0	0.00	3	2.65
1995	131	0	0.00	2	1.50
1996	155	0	0.00	3	1.90
1997	195	0	0.00	7	3.47
1998	217	0	0.00	18	7.66
1999	201	0	0.00	30	12.99
2000	194	1	0.44	32	14.10
2001	215	2	0.81	31	12.50
2002	201	5	2.07	35	14.52
2003	186	3	1.31	40	17.47
2004	196	0	0.00	22	10.09
2005	235	0	0.00	14	5.62
2006	251	0	0.00	44	14.92
2007	268	0	0.00	42	13.55
2008	244	4	1.38	42	14.48
2009	224	6	2.25	37	13.86
2010	218	1	0.41	26	10.61
2011	219	1	0.43	12	5.17
2012	213	0	0.00	15	6.58
2013	200	2	0.90	20	9.01
2014	204	0	0.00	16	7.27

Economy: NZL

Year	Active	Defaults		Others	
		#	%	#	%
1992	29	0	0.00	1	3.33
1993	31	0	0.00	0	0.00
1994	40	0	0.00	0	0.00
1995	43	0	0.00	1	2.27
1996	45	0	0.00	3	6.25
1997	48	0	0.00	0	0.00
1998	50	0	0.00	1	1.96
1999	56	0	0.00	0	0.00
2000	61	0	0.00	1	1.61
2001	70	0	0.00	0	0.00
2002	75	0	0.00	0	0.00
2003	87	0	0.00	0	0.00
2004	102	0	0.00	1	0.97
2005	108	0	0.00	0	0.00
2006	113	0	0.00	0	0.00
2007	122	0	0.00	1	0.81
2008	115	0	0.00	13	10.16
2009	122	0	0.00	9	6.87
2010	123	0	0.00	14	10.22
2011	122	1	0.74	12	8.89
2012	120	0	0.00	19	13.67
2013	123	2	1.47	11	8.09
2014	133	0	0.00	10	6.99

Economy: OMN

Year	Active	Defaults		Others	
		#	%	#	%
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	50	0	0.00	2	3.85
1997	73	0	0.00	7	8.75
1998	58	0	0.00	50	46.30
1999	63	0	0.00	31	32.98
2000	60	0	0.00	40	40.00
2001	47	0	0.00	50	51.55
2002	72	0	0.00	19	20.88
2003	80	0	0.00	28	25.93
2004	93	0	0.00	22	19.13
2005	86	0	0.00	35	28.93
2006	98	0	0.00	30	23.44
2007	99	0	0.00	46	31.72
2008	85	0	0.00	45	34.62
2009	87	0	0.00	39	30.95
2010	92	0	0.00	39	29.77
2011	114	0	0.00	35	23.49
2012	113	0	0.00	25	18.12
2013	116	0	0.00	1	0.85
2014	119	0	0.00	2	1.65

(*Continued*)

Table A.11. (*Continued*)

Economy: PER

Year	Active	Defaults #	Defaults %	Others #	Others %
1992	1	0	0.00	0	0.00
1993	1	0	0.00	0	0.00
1994	25	0	0.00	0	0.00
1995	99	0	0.00	20	16.81
1996	95	0	0.00	46	32.62
1997	123	0	0.00	35	22.15
1998	109	0	0.00	62	36.26
1999	93	0	0.00	69	42.59
2000	86	0	0.00	65	43.05
2001	64	0	0.00	63	49.61
2002	75	0	0.00	49	39.52
2003	68	0	0.00	47	40.87
2004	77	0	0.00	41	34.75
2005	78	0	0.00	43	35.54
2006	76	0	0.00	39	33.91
2007	93	0	0.00	25	21.19
2008	81	0	0.00	50	38.17
2009	90	0	0.00	35	28.00
2010	91	0	0.00	32	26.02
2011	82	0	0.00	37	31.09
2012	82	0	0.00	38	31.67
2013	67	0	0.00	46	40.71
2014	76	0	0.00	27	26.21

Economy: PHL

Year	Active	Defaults #	Defaults %	Others #	Others %
1992	83	0	0.00	21	20.19
1993	110	1	0.78	18	13.95
1994	126	0	0.00	28	18.18
1995	156	0	0.00	16	9.30
1996	177	0	0.00	14	7.33
1997	186	0	0.00	20	9.71
1998	176	1	0.49	29	14.08
1999	186	3	1.49	12	5.97
2000	169	2	0.97	36	17.39
2001	163	3	1.46	40	19.42
2002	161	5	2.35	47	22.07
2003	174	5	2.33	36	16.74
2004	176	7	3.00	50	21.46
2005	181	3	1.36	36	16.36
2006	189	2	0.91	28	12.79
2007	191	2	0.90	30	13.45
2008	185	1	0.47	29	13.49
2009	203	2	0.88	23	10.09
2010	207	0	0.00	17	7.59
2011	218	0	0.00	14	6.03
2012	222	0	0.00	15	6.33
2013	224	0	0.00	15	6.28
2014	232	0	0.00	6	2.52

Economy: PAK

Year	Active	Defaults #	Defaults %	Others #	Others %
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	243	0	0.00	119	32.87
1999	338	0	0.00	123	26.68
2000	368	0	0.00	155	29.64
2001	317	0	0.00	178	35.96
2002	429	0	0.00	96	18.29
2003	456	0	0.00	68	12.98
2004	500	0	0.00	41	7.58
2005	493	0	0.00	85	14.71
2006	469	0	0.00	99	17.43
2007	480	0	0.00	83	14.74
2008	240	0	0.00	300	55.56
2009	514	0	0.00	67	11.53
2010	492	0	0.00	52	9.56
2011	505	0	0.00	102	16.80
2012	457	0	0.00	88	16.15
2013	462	0	0.00	21	4.35
2014	461	1	0.20	29	5.91

Economy: POL

Year	Active	Defaults #	Defaults %	Others #	Others %
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	26	0	0.00	19	42.22
1995	58	0	0.00	0	0.00
1996	77	0	0.00	0	0.00
1997	129	0	0.00	2	1.53
1998	186	0	0.00	3	1.59
1999	211	0	0.00	2	0.94
2000	217	1	0.44	8	3.54
2001	221	1	0.44	4	1.77
2002	205	2	0.88	21	9.21
2003	190	3	1.44	15	7.21
2004	207	0	0.00	8	3.72
2005	234	1	0.41	7	2.89
2006	247	0	0.00	12	4.63
2007	316	0	0.00	9	2.77
2008	418	0	0.00	2	0.48
2009	452	0	0.00	11	2.38
2010	536	0	0.00	7	1.29
2011	711	0	0.00	17	2.34
2012	807	7	0.83	28	3.33
2013	837	5	0.56	43	4.86
2014	844	2	0.22	52	5.79

(*Continued*)

Table A.11. (*Continued*)

Economy: PRT

Year	Active	Defaults		Others	
		#	%	#	%
1992	1	0	0.00	0	0.00
1993	69	0	0.00	12	14.81
1994	81	0	0.00	11	11.96
1995	91	0	0.00	18	16.51
1996	92	0	0.00	23	20.00
1997	94	0	0.00	26	21.67
1998	87	0	0.00	33	27.50
1999	88	0	0.00	25	22.12
2000	86	0	0.00	17	16.50
2001	70	0	0.00	21	23.08
2002	62	0	0.00	20	24.39
2003	63	0	0.00	7	10.00
2004	68	0	0.00	6	8.11
2005	65	0	0.00	6	8.45
2006	62	0	0.00	13	17.33
2007	58	0	0.00	9	13.43
2008	57	0	0.00	8	12.31
2009	56	0	0.00	9	13.85
2010	57	0	0.00	5	8.06
2011	55	2	3.13	7	10.94
2012	55	0	0.00	4	6.78
2013	51	0	0.00	9	15.00
2014	53	1	1.72	4	6.90

Economy: ROM

Year	Active	Defaults		Others	
		#	%	#	%
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	78	0	0.00	1	1.27
1999	341	0	0.00	28	7.59
2000	362	0	0.00	89	19.73
2001	338	0	0.00	175	34.11
2002	288	0	0.00	193	40.12
2003	280	0	0.00	172	38.05
2004	299	0	0.00	119	28.47
2005	324	1	0.20	179	35.52
2006	514	0	0.00	159	23.63
2007	717	0	0.00	704	49.54
2008	596	0	0.00	411	40.81
2009	466	0	0.00	456	49.46
2010	526	0	0.00	315	37.46
2011	451	1	0.11	479	51.45
2012	361	0	0.00	371	50.68
2013	360	2	0.28	344	48.73
2014	384	0	0.00	234	37.86

Economy: SRB

Year	Active	Defaults		Others	
		#	%	#	%
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	212	0	0.00	35	14.17
2006	465	0	0.00	274	37.08
2007	482	0	0.00	950	66.34
2008	389	0	0.00	708	64.54
2009	301	0	0.00	514	63.07
2010	432	0	0.00	474	52.32
2011	263	0	0.00	1250	82.62
2012	245	0	0.00	282	53.51
2013	150	0	0.00	401	72.78
2014	157	2	0.59	182	53.37

Economy: RUS

Year	Active	Defaults		Others	
		#	%	#	%
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	77	0	0.00	22	22.22
1998	26	2	1.59	98	77.78
1999	34	0	0.00	45	56.96
2000	66	0	0.00	55	45.45
2001	71	0	0.00	77	52.03
2002	52	0	0.00	105	66.88
2003	77	0	0.00	65	45.77
2004	101	3	1.76	66	38.82
2005	171	1	0.41	74	30.08
2006	218	1	0.25	174	44.27
2007	309	0	0.00	180	36.81
2008	264	0	0.00	257	49.33
2009	306	9	2.16	101	24.28
2010	325	1	0.22	124	27.56
2011	285	2	0.41	197	40.70
2012	264	1	0.23	163	38.08
2013	191	1	0.18	364	65.47
2014	197	1	0.38	63	24.14

(*Continued*)

Table A.11. (*Continued*)

Economy: SAU

Year	Active	Defaults		Others	
		#	%	#	%
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	60	0	0.00	4	6.25
2001	63	0	0.00	4	5.97
2002	65	0	0.00	3	4.41
2003	68	0	0.00	2	2.86
2004	71	0	0.00	0	0.00
2005	76	0	0.00	0	0.00
2006	84	0	0.00	0	0.00
2007	105	0	0.00	2	1.87
2008	126	0	0.00	1	0.79
2009	133	0	0.00	1	0.75
2010	145	0	0.00	0	0.00
2011	147	0	0.00	1	0.68
2012	155	0	0.00	1	0.64
2013	158	1	0.62	2	1.24
2014	168	0	0.00	0	0.00

Economy: SWE

Year	Active	Defaults		Others	
		#	%	#	%
1992	116	0	0.00	3	2.52
1993	141	0	0.00	2	1.40
1994	170	0	0.00	2	1.16
1995	184	0	0.00	0	0.00
1996	220	0	0.00	15	6.38
1997	263	0	0.00	26	9.00
1998	296	0	0.00	21	6.62
1999	338	1	0.28	19	5.31
2000	372	2	0.49	38	9.22
2001	364	4	1.00	33	8.23
2002	348	7	1.82	30	7.79
2003	337	3	0.82	27	7.36
2004	349	1	0.27	23	6.17
2005	374	2	0.52	12	3.09
2006	422	0	0.00	19	4.31
2007	499	1	0.19	13	2.53
2008	509	2	0.37	30	5.55
2009	498	4	0.75	33	6.17
2010	502	2	0.38	29	5.44
2011	496	2	0.38	34	6.39
2012	478	1	0.19	46	8.76
2013	479	3	0.60	22	4.37
2014	527	3	0.54	26	4.68

Economy: SGP

Year	Active	Defaults		Others	
		#	%	#	%
1992	177	0	0.00	11	5.85
1993	198	0	0.00	4	1.98
1994	232	0	0.00	3	1.28
1995	249	1	0.39	6	2.34
1996	269	1	0.36	9	3.23
1997	295	1	0.32	18	5.73
1998	318	4	1.19	13	3.88
1999	354	4	1.07	15	4.02
2000	424	0	0.00	18	4.07
2001	435	2	0.43	31	6.62
2002	444	2	0.42	32	6.69
2003	498	1	0.19	15	2.92
2004	571	1	0.17	12	2.05
2005	622	4	0.62	15	2.34
2006	664	2	0.29	24	3.48
2007	708	0	0.00	20	2.75
2008	705	3	0.40	41	5.47
2009	714	15	1.97	31	4.08
2010	724	0	0.00	34	4.49
2011	704	1	0.13	54	7.11
2012	703	0	0.00	38	5.13
2013	707	0	0.00	31	4.20
2014	698	0	0.00	40	5.42

Economy: SVN

Year	Active	Defaults		Others	
		#	%	#	%
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	71	0	0.00	7	8.97
1999	95	0	0.00	7	6.86
2000	109	0	0.00	21	16.15
2001	118	0	0.00	36	23.38
2002	100	0	0.00	44	30.56
2003	103	0	0.00	19	15.57
2004	111	0	0.00	20	15.27
2005	87	0	0.00	36	29.27
2006	75	0	0.00	28	27.18
2007	62	0	0.00	23	27.06
2008	66	0	0.00	15	18.52
2009	56	1	1.22	25	30.49
2010	71	1	1.23	9	11.11
2011	60	0	0.00	17	22.08
2012	56	2	3.28	3	4.92
2013	49	2	3.45	7	12.07
2014	51	2	3.64	2	3.64

(*Continued*)

Table A.11. (*Continued*)

Economy: SVK

Year	Active	Defaults		Others	
		#	%	#	%
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	12	0	0.00	7	36.84
1999	12	0	0.00	26	68.42
2000	12	0	0.00	13	52.00
2001	13	0	0.00	15	53.57
2002	20	0	0.00	16	44.44
2003	43	0	0.00	22	33.85
2004	42	0	0.00	34	44.74
2005	44	0	0.00	25	36.23
2006	52	0	0.00	37	41.57
2007	24	0	0.00	52	68.42
2008	37	0	0.00	26	41.27
2009	32	0	0.00	31	49.21
2010	51	0	0.00	17	25.00
2011	50	0	0.00	47	48.45
2012	49	0	0.00	30	37.97
2013	46	0	0.00	20	30.30
2014	44	0	0.00	33	42.86

Economy: THA

Year	Active	Defaults		Others	
		#	%	#	%
1992	277	0	0.00	1	0.36
1993	328	0	0.00	2	0.61
1994	371	0	0.00	1	0.27
1995	400	1	0.24	9	2.20
1996	420	7	1.57	20	4.47
1997	371	19	4.18	65	14.29
1998	343	18	4.35	53	12.80
1999	327	13	3.50	31	8.36
2000	309	19	5.31	30	8.38
2001	312	9	2.65	19	5.59
2002	335	3	0.85	14	3.98
2003	363	4	1.06	12	3.17
2004	403	2	0.47	22	5.15
2005	428	3	0.66	24	5.27
2006	464	0	0.00	12	2.52
2007	466	2	0.41	16	3.31
2008	464	1	0.20	26	5.30
2009	474	8	1.62	11	2.23
2010	478	5	1.02	7	1.43
2011	480	2	0.40	12	2.43
2012	495	1	0.20	7	1.39
2013	522	1	0.19	6	1.13
2014	554	0	0.00	7	1.25

Economy: TUN

Year	Active	Defaults		Others	
		#	%	#	%
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	1	2.94
2000	37	0	0.00	1	2.63
2001	40	0	0.00	4	9.09
2002	41	0	0.00	1	2.38
2003	42	0	0.00	2	4.55
2004	42	0	0.00	1	2.33
2005	45	0	0.00	6	11.76
2006	48	0	0.00	1	2.04
2007	48	0	0.00	4	7.69
2008	49	0	0.00	4	7.55
2009	51	0	0.00	0	0.00
2010	54	0	0.00	2	3.57
2011	56	0	0.00	1	1.75
2012	57	0	0.00	0	0.00
2013	66	0	0.00	0	0.00
2014	74	0	0.00	0	0.00

Economy: TUR

Year	Active	Defaults		Others	
		#	%	#	%
1992	8	0	0.00	0	0.00
1993	15	0	0.00	0	0.00
1994	29	0	0.00	0	0.00
1995	197	0	0.00	4	1.99
1996	222	0	0.00	1	0.45
1997	247	0	0.00	10	3.89
1998	275	0	0.00	3	1.08
1999	271	0	0.00	10	3.56
2000	296	2	0.63	18	5.70
2001	284	0	0.00	17	5.65
2002	286	0	0.00	8	2.72
2003	284	0	0.00	6	2.07
2004	296	0	0.00	0	0.00
2005	302	0	0.00	3	0.98
2006	315	0	0.00	4	1.25
2007	318	0	0.00	7	2.15
2008	315	0	0.00	5	1.56
2009	315	0	0.00	3	0.94
2010	336	0	0.00	1	0.30
2011	360	0	0.00	3	0.83
2012	393	0	0.00	8	2.00
2013	411	0	0.00	7	1.67
2014	415	0	0.00	16	3.71

(*Continued*)

Table A.11. (*Continued*)

Economy: TWN

Year	Active	Defaults		Others	
		#	%	#	%
1992	228	0	0.00	2	0.87
1993	252	0	0.00	0	0.00
1994	285	0	0.00	1	0.35
1995	329	0	0.00	0	0.00
1996	362	0	0.00	0	0.00
1997	394	0	0.00	1	0.25
1998	411	3	0.71	8	1.90
1999	449	8	1.74	4	0.87
2000	515	7	1.31	13	2.43
2001	578	5	0.85	8	1.35
2002	634	6	0.90	28	4.19
2003	669	1	0.15	13	1.90
2004	723	4	0.54	8	1.09
2005	732	4	0.53	19	2.52
2006	733	2	0.27	15	2.00
2007	747	2	0.26	18	2.35
2008	764	2	0.26	17	2.17
2009	781	2	0.25	2	0.25
2010	805	1	0.12	9	1.10
2011	822	0	0.00	7	0.84
2012	839	0	0.00	5	0.59
2013	850	0	0.00	6	0.70
2014	857	1	0.12	4	0.46

Economy: UKR

Year	Active	Defaults		Others	
		#	%	#	%
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	26	0	0.00	22	45.83
1999	36	0	0.00	41	53.25
2000	62	0	0.00	29	31.87
2001	25	0	0.00	75	75.00
2002	11	0	0.00	39	78.00
2003	18	0	0.00	18	50.00
2004	30	0	0.00	25	45.45
2005	59	0	0.00	23	28.05
2006	102	0	0.00	50	32.89
2007	160	0	0.00	70	30.43
2008	114	0	0.00	117	50.65
2009	84	1	0.45	138	61.88
2010	57	0	0.00	81	58.70
2011	55	0	0.00	39	41.49
2012	61	0	0.00	38	38.38
2013	70	0	0.00	65	48.15
2014	86	0	0.00	44	33.85

Economy: USA

Year	Active	Defaults		Others	
		#	%	#	%
1992	5259	14	0.26	107	1.99
1993	5886	27	0.44	160	2.63
1994	6640	21	0.30	252	3.65
1995	6979	16	0.22	381	5.17
1996	7534	21	0.26	419	5.25
1997	7763	54	0.65	530	6.35
1998	7442	80	0.95	860	10.26
1999	7078	91	1.12	938	11.57
2000	6843	123	1.59	780	10.07
2001	6089	200	2.84	756	10.73
2002	5641	148	2.35	506	8.04
2003	5269	90	1.54	471	8.08
2004	5240	37	0.65	373	6.60
2005	5217	36	0.64	378	6.71
2006	5182	26	0.47	374	6.70
2007	5108	25	0.45	467	8.34
2008	4854	71	1.34	367	6.93
2009	4577	106	2.12	317	6.34
2010	4487	33	0.68	308	6.38
2011	4342	35	0.74	326	6.93
2012	4263	36	0.79	264	5.79
2013	4326	12	0.26	209	4.60
2014	4489	6	0.13	178	3.81

Economy: VEN

Year	Active	Defaults		Others	
		#	%	#	%
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	13	0	0.00	0	0.00
1995	15	0	0.00	4	21.05
1996	14	0	0.00	2	12.50
1997	48	0	0.00	16	25.00
1998	45	0	0.00	21	31.82
1999	39	0	0.00	22	36.07
2000	38	0	0.00	12	24.00
2001	29	1	2.38	12	28.57
2002	20	0	0.00	20	50.00
2003	25	0	0.00	10	28.57
2004	28	0	0.00	8	22.22
2005	28	0	0.00	8	22.22
2006	27	0	0.00	7	20.59
2007	23	0	0.00	7	23.33
2008	25	0	0.00	30	54.55
2009	26	0	0.00	24	48.00
2010	20	0	0.00	13	39.39
2011	29	0	0.00	17	36.96
2012	15	0	0.00	18	54.55
2013	15	0	0.00	10	40.00
2014	19	0	0.00	3	13.64

(*Continued*)

Table A.11. (*Continued*)

Economy: VNM						Economy: ZAF					
		Defaults		Others				Defaults		Others	
Year	Active	#	%	#	%	Year	Active	#	%	#	%
1992	0	0	NaN	0	NaN	1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN	1993	389	0	0.00	39	9.11
1994	0	0	NaN	0	NaN	1994	418	0	0.00	19	4.35
1995	0	0	NaN	0	NaN	1995	463	0	0.00	28	5.70
1996	0	0	NaN	0	NaN	1996	491	0	0.00	11	2.19
1997	0	0	NaN	0	NaN	1997	533	0	0.00	21	3.79
1998	0	0	NaN	0	NaN	1998	572	2	0.32	56	8.89
1999	0	0	NaN	0	NaN	1999	594	3	0.46	52	8.01
2000	4	0	0.00	0	0.00	2000	543	6	0.98	61	10.00
2001	8	0	0.00	0	0.00	2001	466	9	1.56	101	17.53
2002	18	0	0.00	0	0.00	2002	352	8	1.69	112	23.73
2003	21	0	0.00	0	0.00	2003	329	1	0.26	54	14.06
2004	23	0	0.00	0	0.00	2004	292	2	0.59	44	13.02
2005	28	0	0.00	0	0.00	2005	296	2	0.60	37	11.04
2006	47	0	0.00	0	0.00	2006	305	0	0.00	27	8.13
2007	196	0	0.00	1	0.51	2007	332	0	0.00	39	10.51
2008	272	0	0.00	4	1.45	2008	340	0	0.00	24	6.59
2009	340	0	0.00	23	6.34	2009	320	1	0.28	34	9.58
2010	565	0	0.00	13	2.25	2010	314	1	0.30	20	5.97
2011	616	1	0.16	22	3.44	2011	315	2	0.60	19	5.65
2012	629	0	0.00	25	3.82	2012	296	5	1.54	24	7.38
2013	627	0	0.00	43	6.42	2013	294	2	0.61	30	9.20
2014	628	0	0.00	28	4.27	2014	294	0	0.00	26	8.13

APPENDIX B: PERFORMANCE ANALYSIS

Table B.1. Accuracy Ratios (AR) and Area Under Receiver Operating Characteristic (AUROC) for different economies.

	AR				AUROC			
Economy	**1 mth**	**1 yr**	**2 yr**	**5 yr**	**1 mth**	**1 yr**	**2 yr**	**5 yr**
AUS	0.80603	0.63274	0.51594	0.36999	0.90304	0.81687	0.75925	0.68912
CHN	0.60457	0.53739	0.46332	0.33183	0.80247	0.7712	0.73731	0.68274
HKG	0.70149	0.44421	0.33395	0.20389	0.85076	0.72248	0.66791	0.60489
IND	0.73231	0.66097	0.58881	0.49055	0.86617	0.83078	0.79511	0.74707
IDN	0.69731	0.65018	0.54695	0.368	0.84874	0.8263	0.77666	0.69486
JPN	0.91423	0.83118	0.77437	0.64468	0.95712	0.91572	0.88756	0.82392
MYS	0.84328	0.74558	0.65791	0.43071	0.92166	0.87324	0.83021	0.72078
PHL	0.68449	0.61364	0.58001	0.47825	0.8423	0.80768	0.79189	0.74541
SGP	0.77625	0.64113	0.4552	0.27882	0.88814	0.82089	0.72865	0.64287
KOR	0.88684	0.72984	0.65553	0.61903	0.94344	0.86554	0.82941	0.8142
TWN	0.86677	0.76161	0.66961	0.53656	0.9334	0.88102	0.83543	0.7708
THA	0.84278	0.75877	0.70885	0.58174	0.92143	0.88019	0.85643	0.79786
USA	0.94023	0.81905	0.71019	0.52212	0.97013	0.90998	0.85652	0.76622
CAN	0.92736	0.79555	0.66059	0.48893	0.96369	0.8981	0.83138	0.7483
BEL	0.76721	0.69499	0.64589	0.39672	0.88362	0.84777	0.82361	0.70087
DNK	0.84635	0.79821	0.66393	0.50546	0.9232	0.89946	0.83312	0.75616
FRA	0.8732	0.69108	0.62499	0.53728	0.93661	0.84578	0.81309	0.77039
DEU	0.88707	0.71919	0.60644	0.48547	0.94356	0.86029	0.80507	0.74775
ITA	0.89852	0.75521	0.59574	0.36672	0.94927	0.87783	0.7986	0.68613
NLD	0.80585	0.75583	0.63412	0.54381	0.90295	0.87838	0.81845	0.77564
NOR	0.96153	0.81033	0.62428	0.34192	0.98077	0.90542	0.81307	0.67424
POL	0.87637	0.73846	0.55185	0.49	0.93819	0.86949	0.77685	0.74706
RUS	0.82506	0.42621	0.12216	−0.05421	0.91255	0.71394	0.56357	0.48234
ZAF	0.91861	0.83785	0.71211	0.4368	0.95932	0.91918	0.85696	0.72201
SWE	0.87077	0.71557	0.61629	0.38511	0.9354	0.85811	0.80893	0.69492
GBR	0.90208	0.73162	0.58461	0.38983	0.95105	0.8661	0.79318	0.69755
BRA	0.85778	0.68637	0.57881	0.51346	0.9289	0.84356	0.79029	0.75853
MEX	0.74152	0.70161	0.64899	0.55752	0.87081	0.85149	0.82609	0.78307
Developed Asia-Pacific	0.85903	0.72784	0.64715	0.54558	0.92953	0.86422	0.82438	0.77548
Emerging MKT	0.82869	0.74468	0.66825	0.51325	0.91437	0.87275	0.83524	0.76086
North America	0.93922	0.81734	0.70669	0.52052	0.96962	0.90911	0.85473	0.76525
Europe	0.87711	0.72454	0.59937	0.42936	0.93856	0.86257	0.80054	0.71724

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

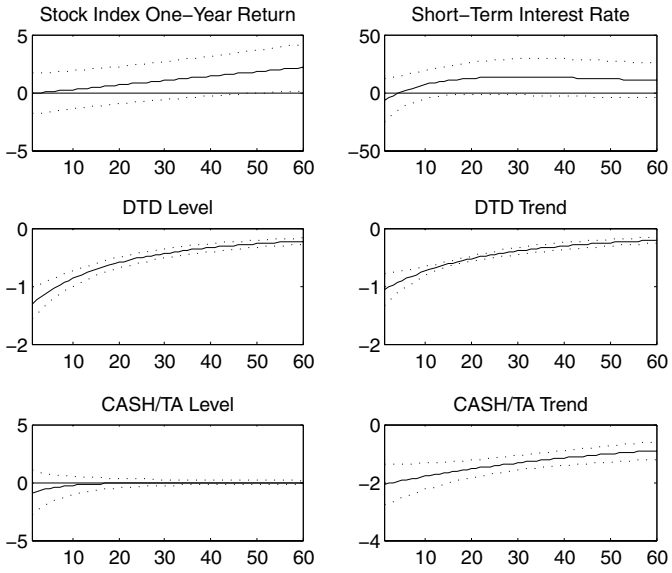


Figure B.1. Plots of US default parameters across all horizons for the Stock index one-year return, short-term interest rate, DTD Level, DTD Trend, CASH/TA Level and CASH/TA Trend. Solid lines are the parameter estimates and dashed lines are the 90% confidence level. Horizontal axis is the horizon in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

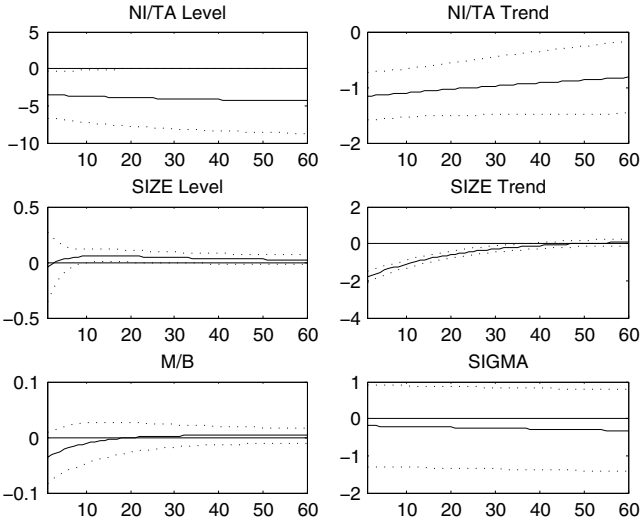
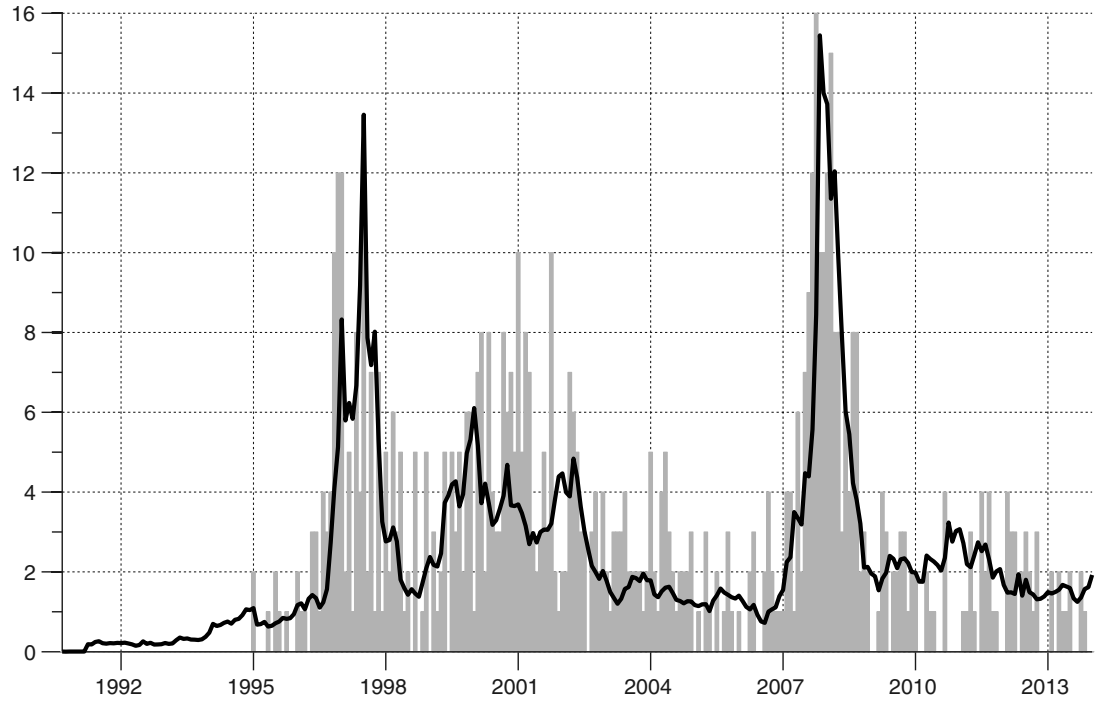
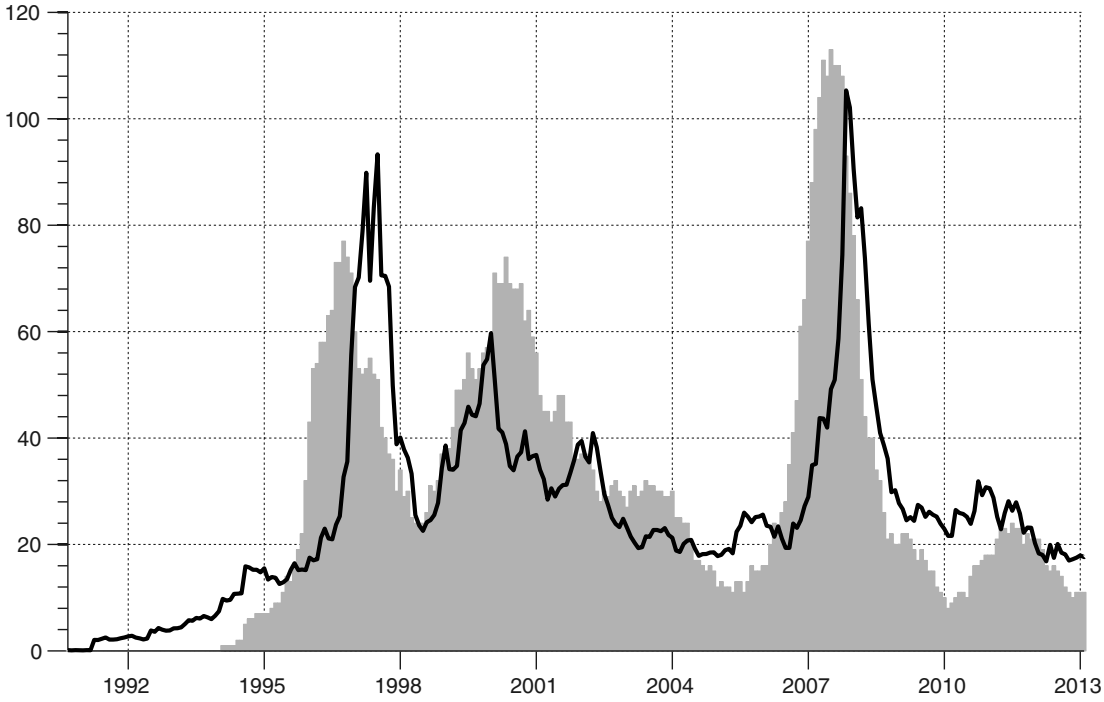


Figure B.2. Plots of US default parameters across all horizons for the NI/TA Level, NI/TA Trend, SIZE Level, SIZE Trend, M/B and SIGMA. Solid lines are the parameter estimates and dashed lines are the 90% confidence level. Horizontal axis is the horizon in months.

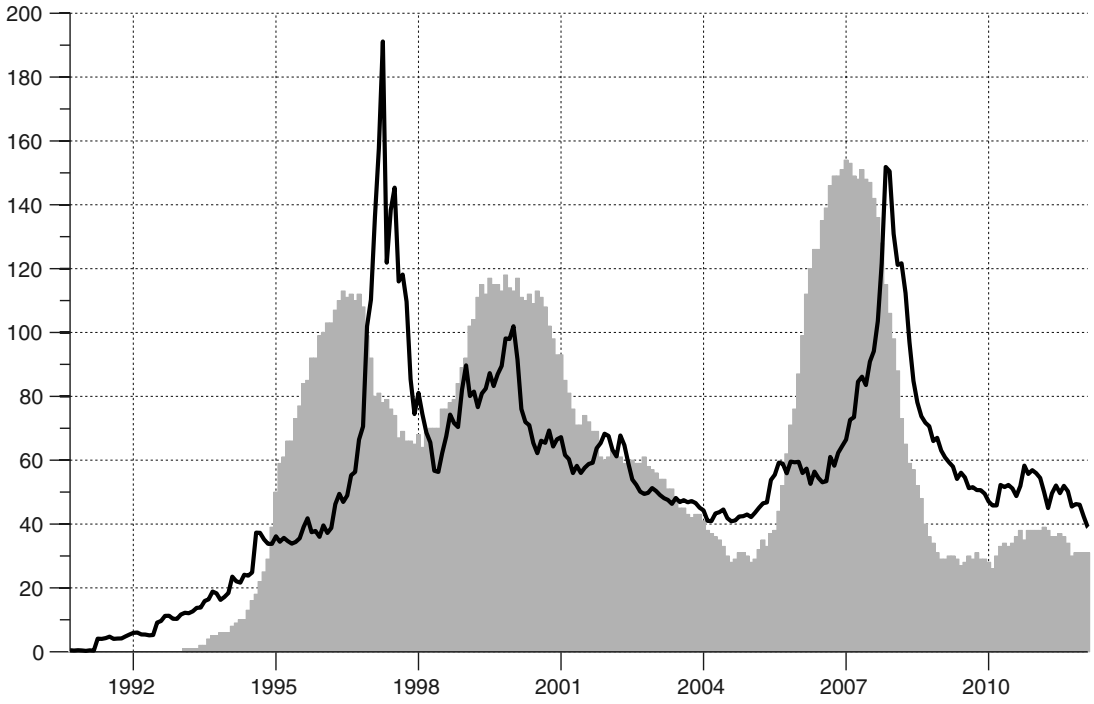


(a) Predicted defaults (line) versus actual (bars), horizon = 1 month.

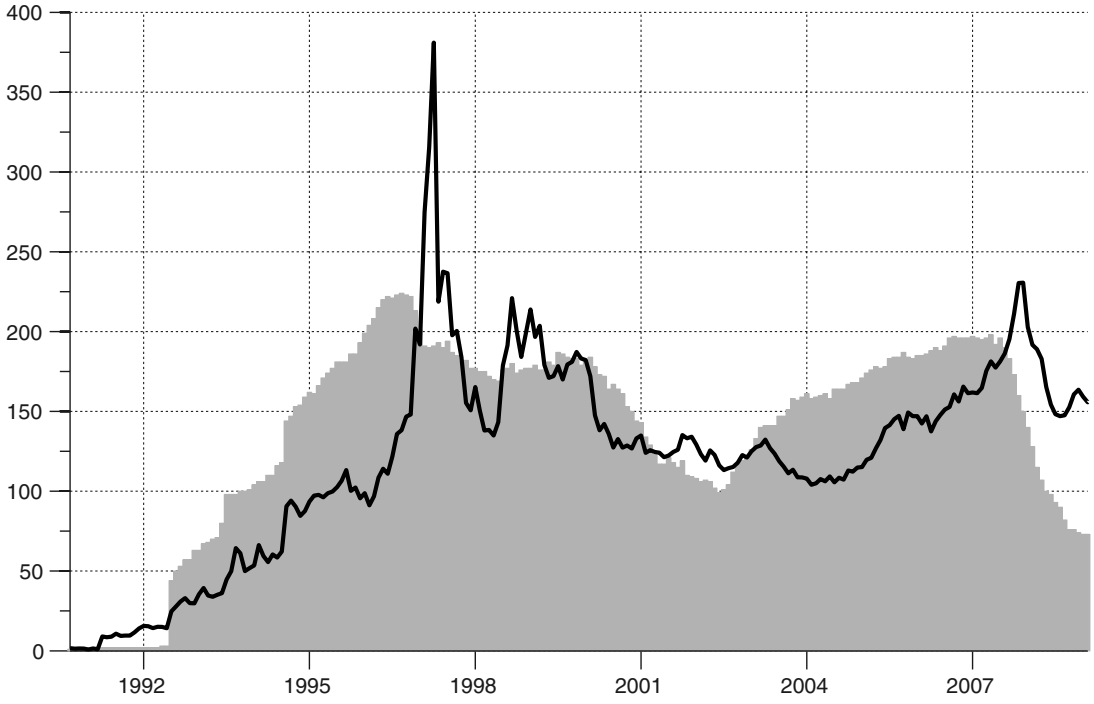


(b) Predicted defaults (line) versus actual (bars), horizon = 12 months.

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

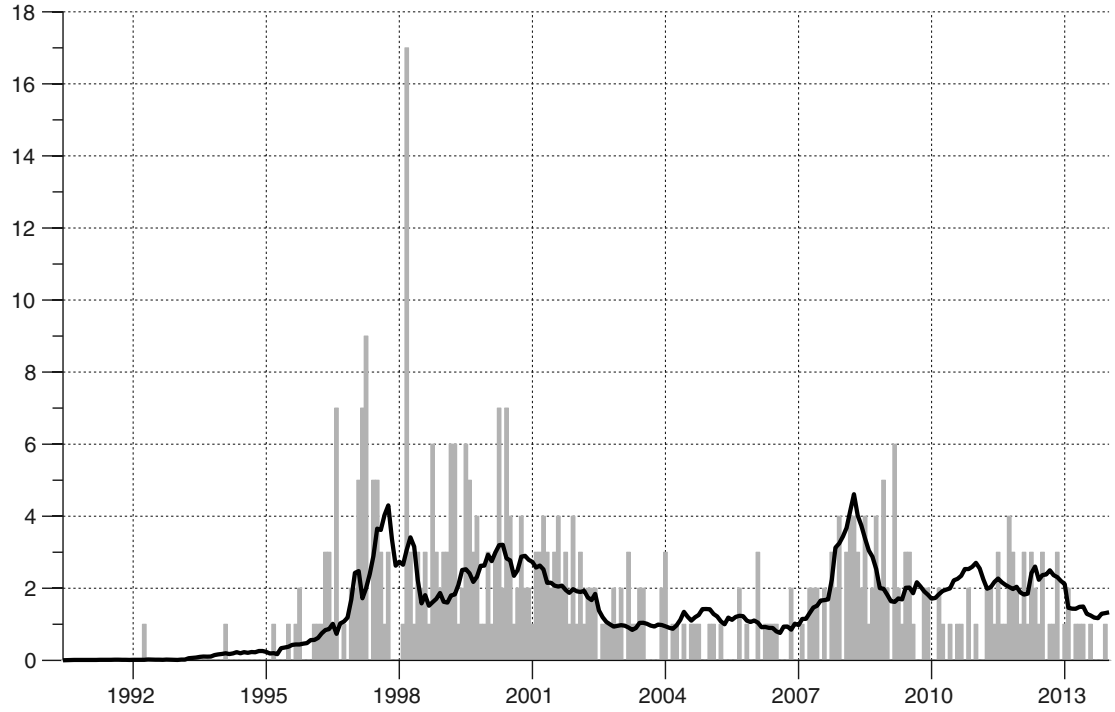


(c) Predicted defaults (line) versus actual (bars), horizon = 24 months.

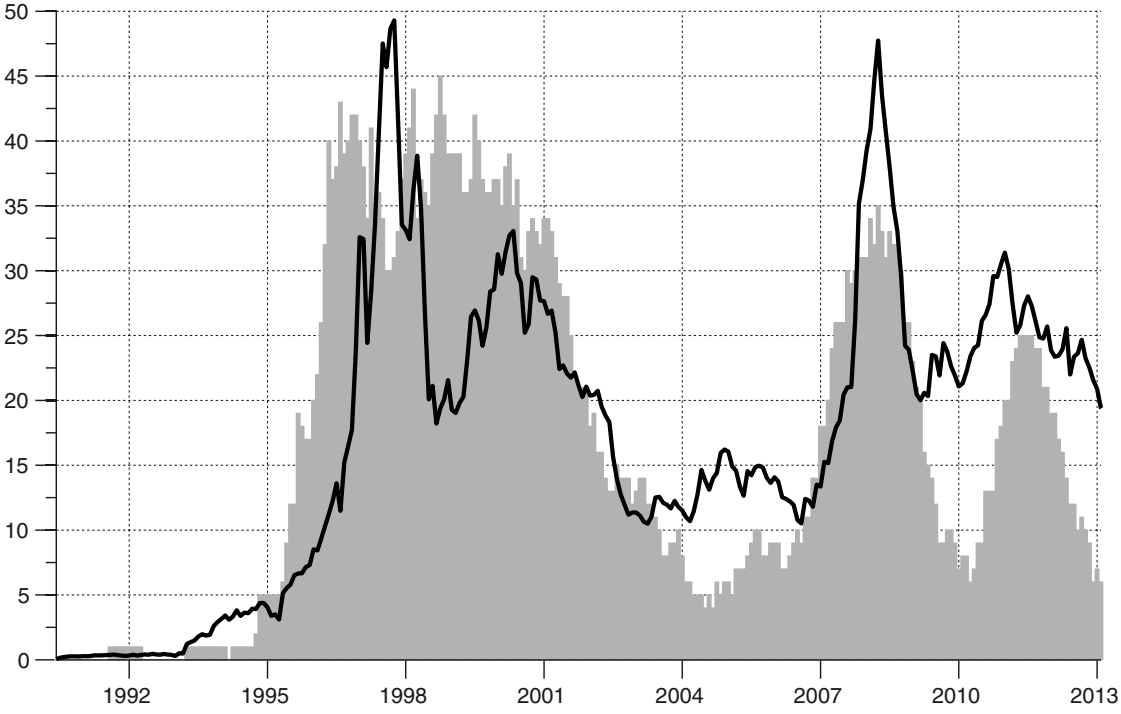


(d) Predicted defaults (line) versus actual (bars), horizon = 60 months.

Figure B.3. (*Continued*)

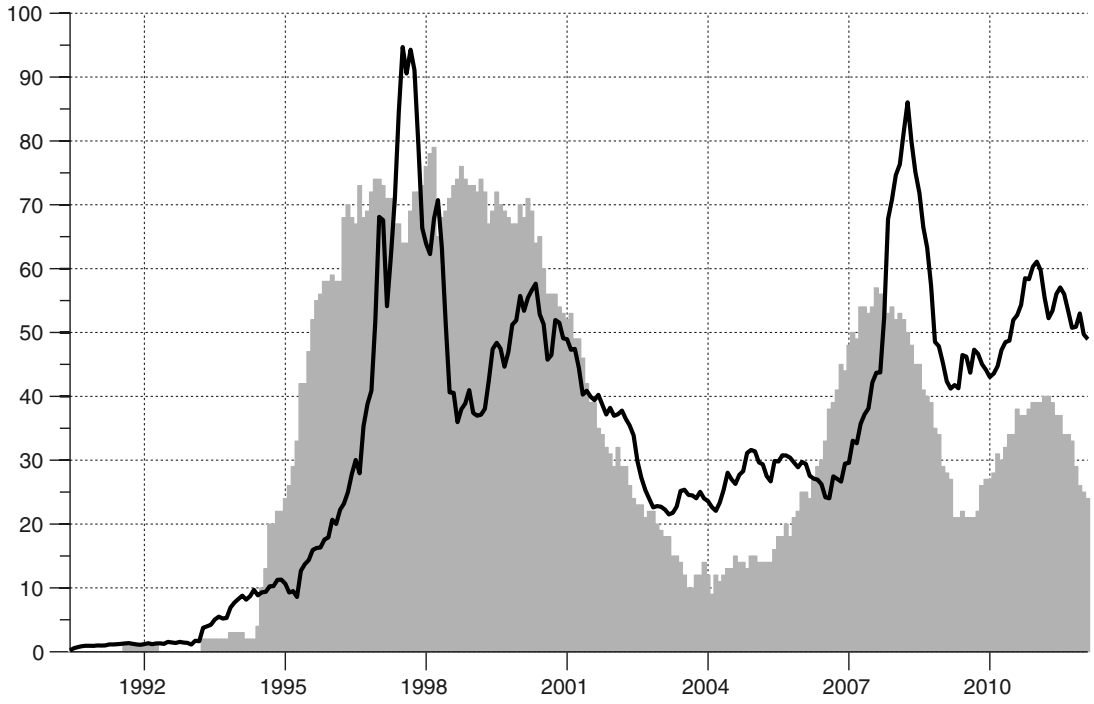


(a) Predicted defaults (line) versus actual (bars), horizon = 1 month.

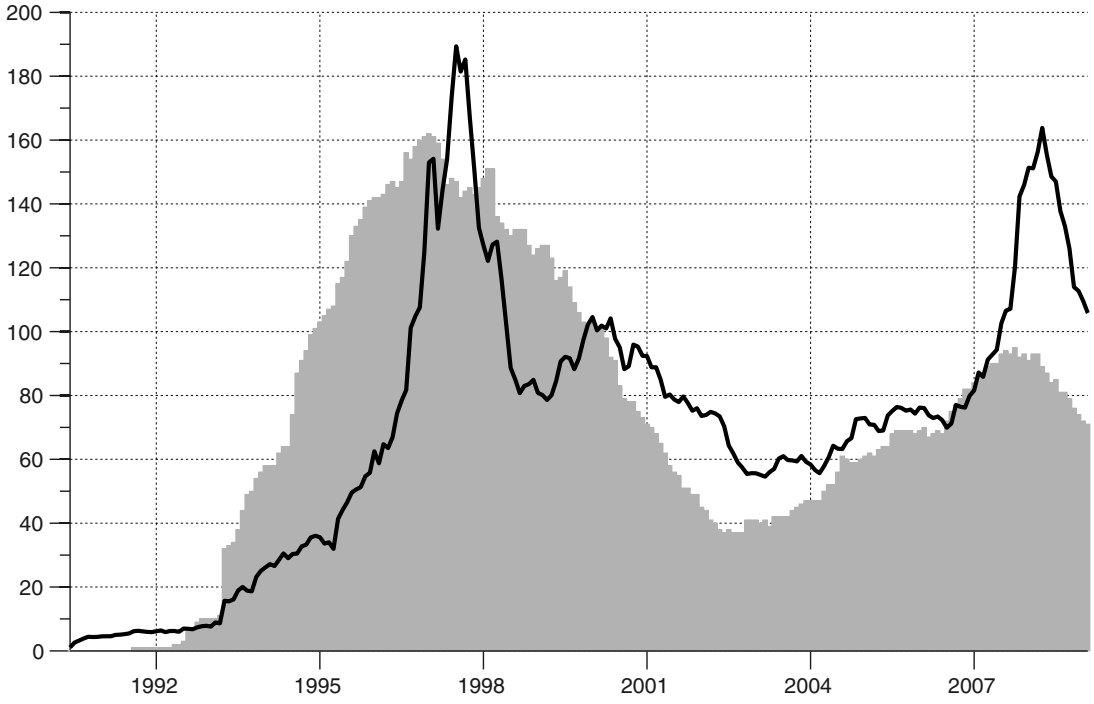


(b) Predicted defaults (line) versus actual (bars), horizon = 12 months.

Figure B.4. Performance test for the emerging market, in sample.

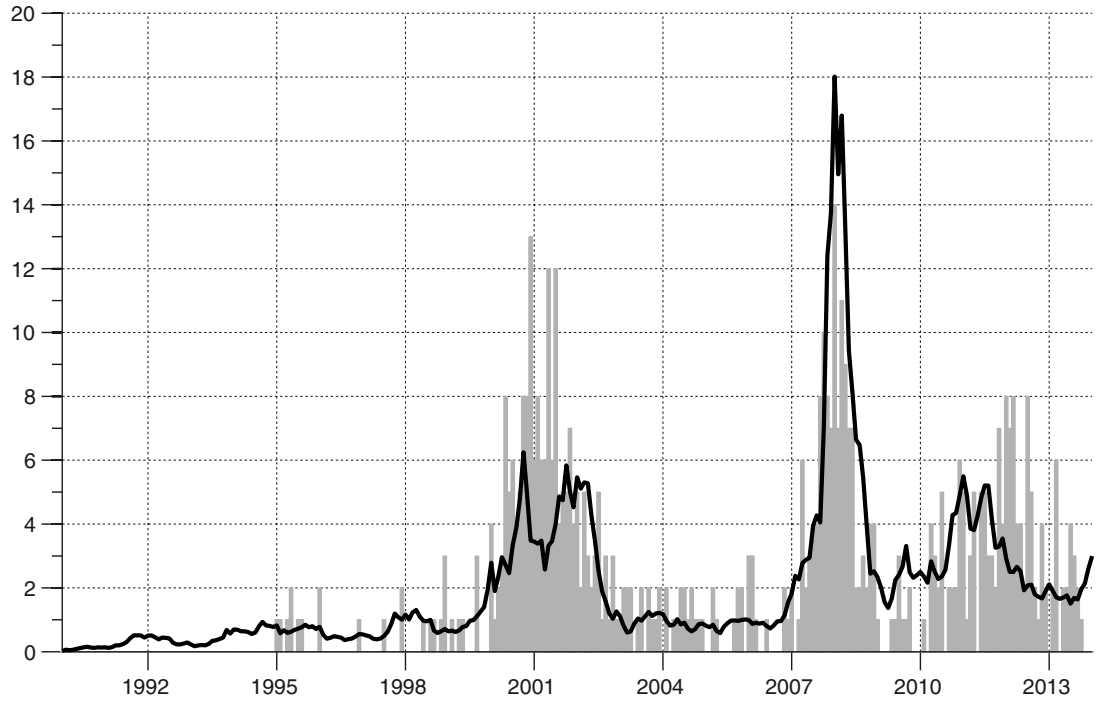


(c) Predicted defaults (line) versus actual (bars), horizon = 24 months.

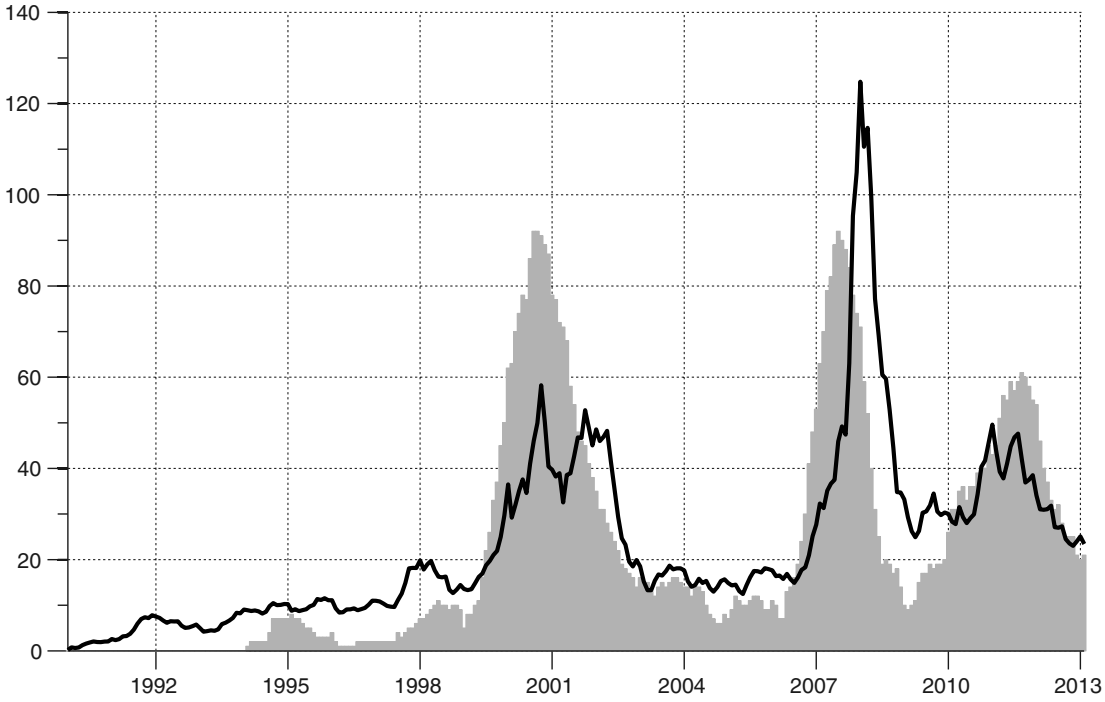


(d) Predicted defaults (line) versus actual (bars), horizon = 60 months.

Figure B.4. (*Continued*)

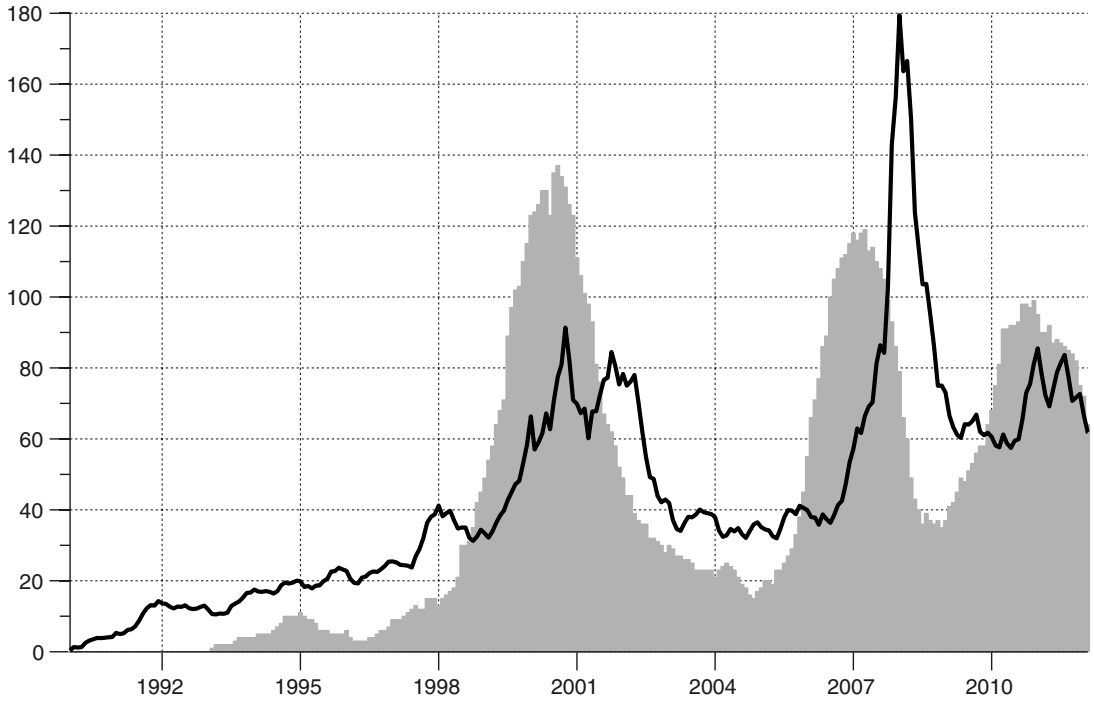


(a) Predicted defaults (line) versus actual (bars), horizon = 1 month.

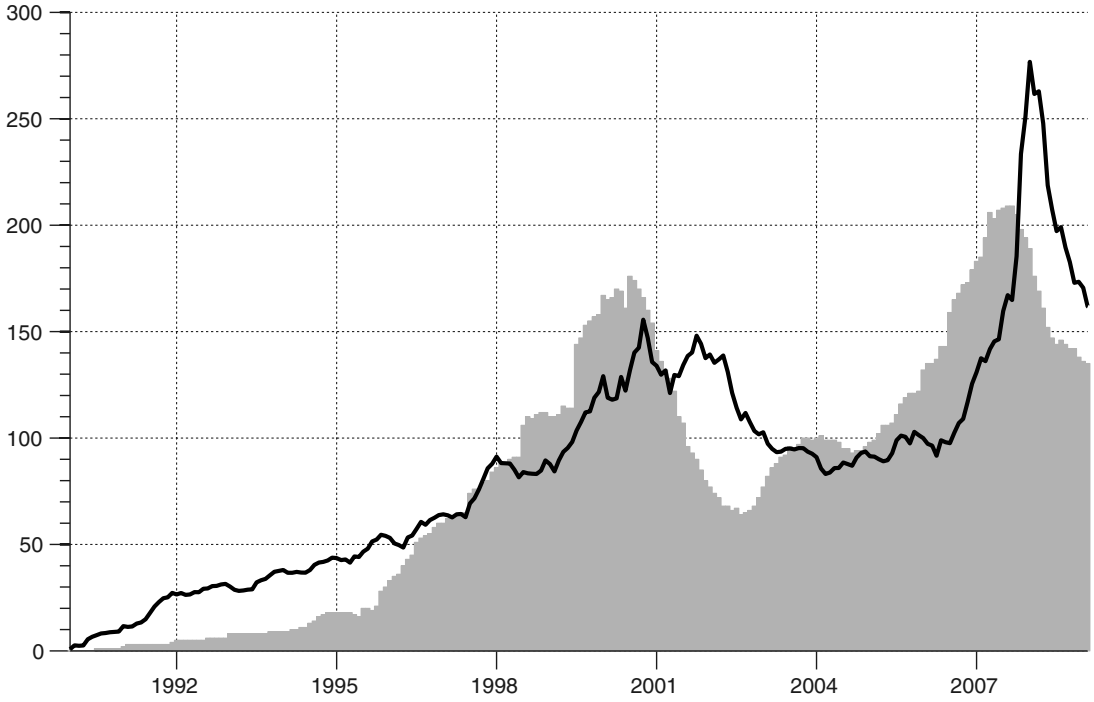


(b) Predicted defaults (line) versus actual (bars), horizon = 12 months.

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

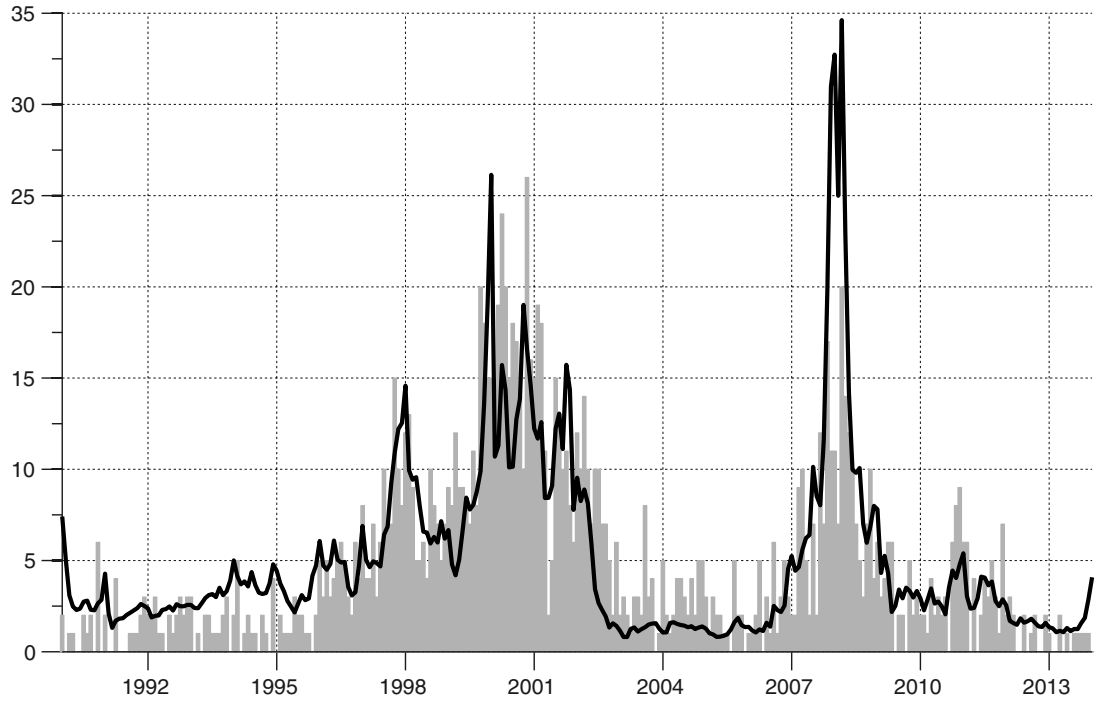


(c) Predicted defaults (line) versus actual (bars), horizon = 24 months.

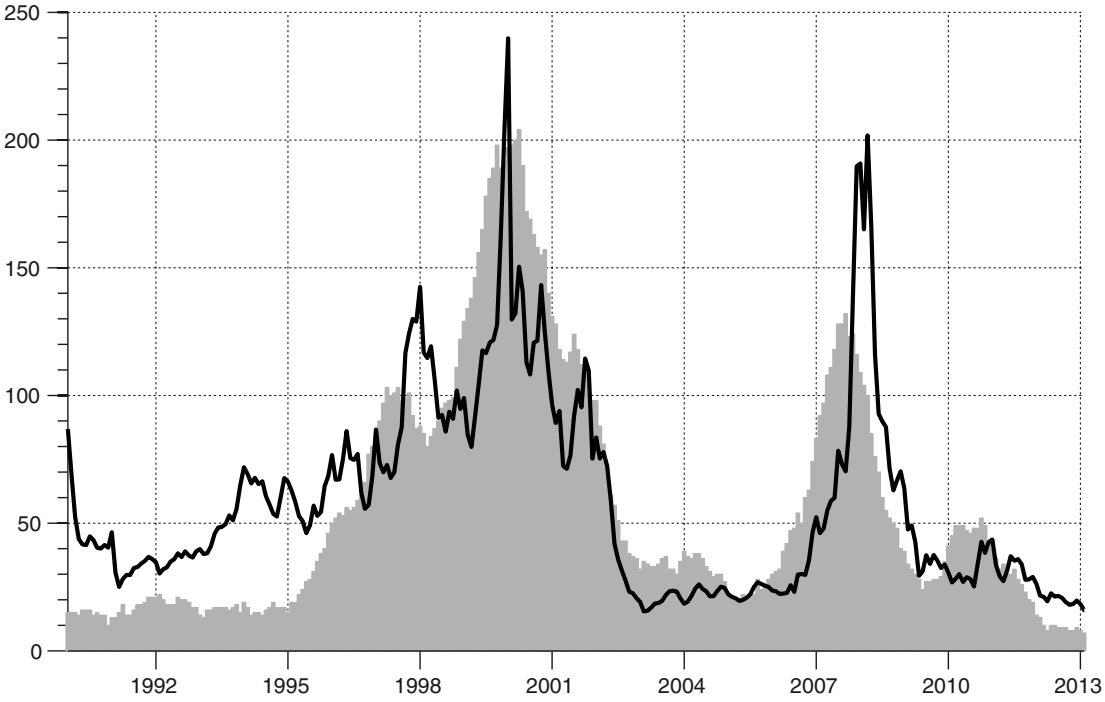


(d) Predicted defaults (line) versus actual (bars), horizon = 60 months.

Figure B.5. (*Continued*)

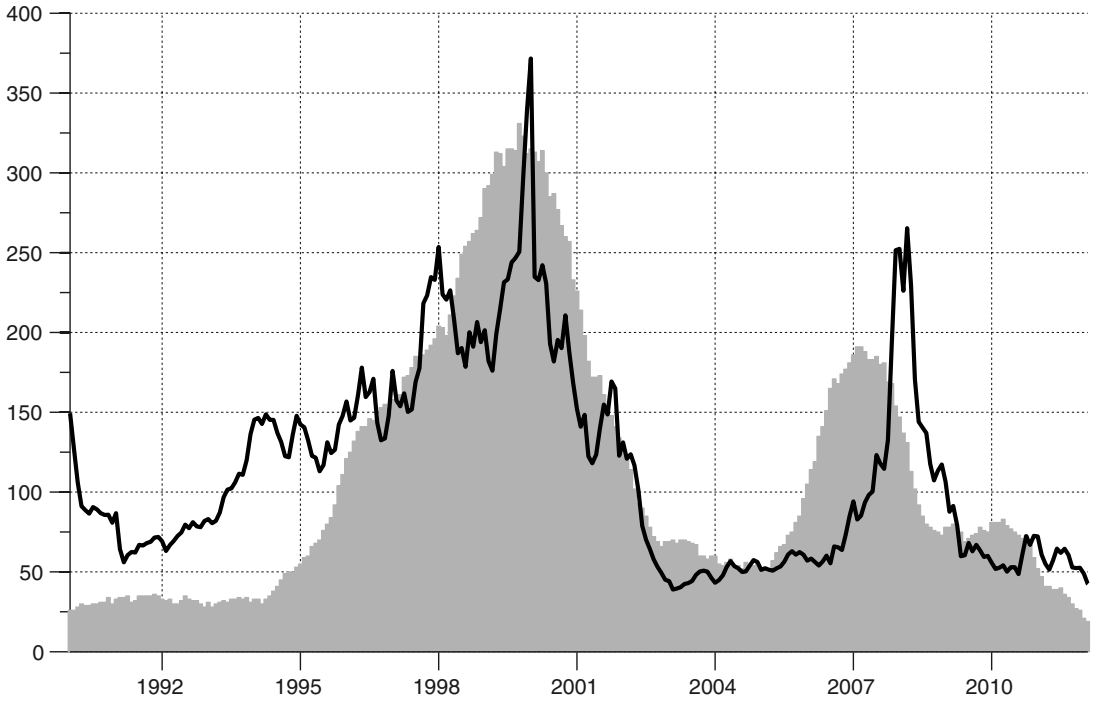


(a) Predicted defaults (line) versus actual (bars), horizon = 1 month.

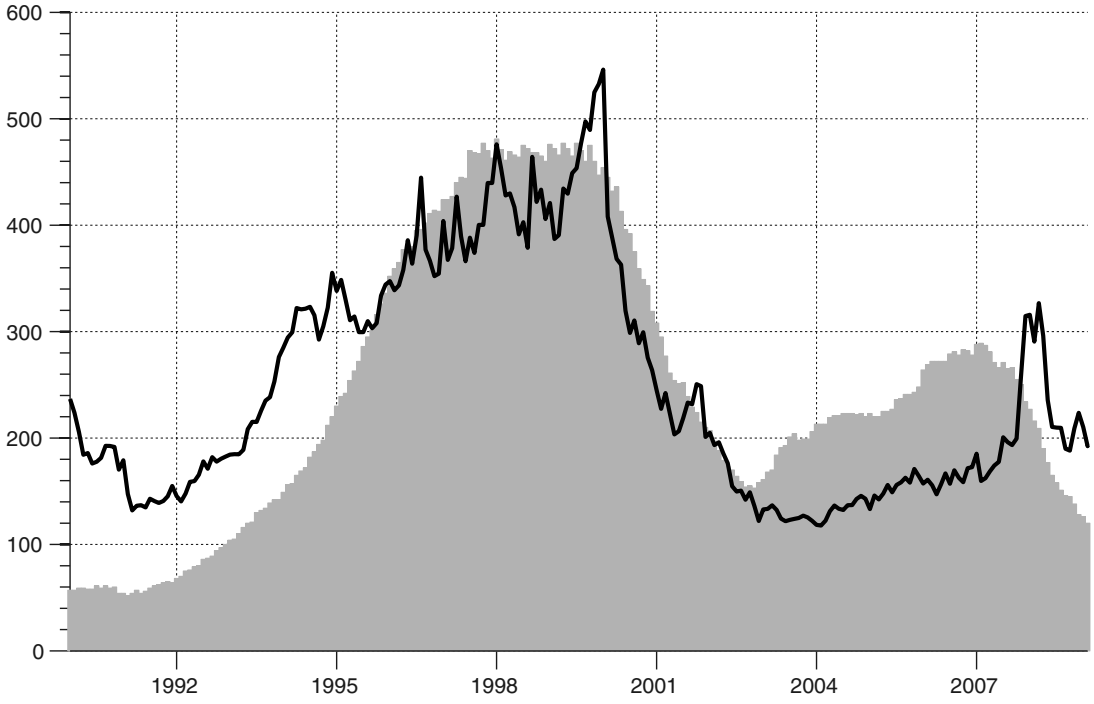


(b) Predicted defaults (line) versus actual (bars), horizon = 12 months.

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

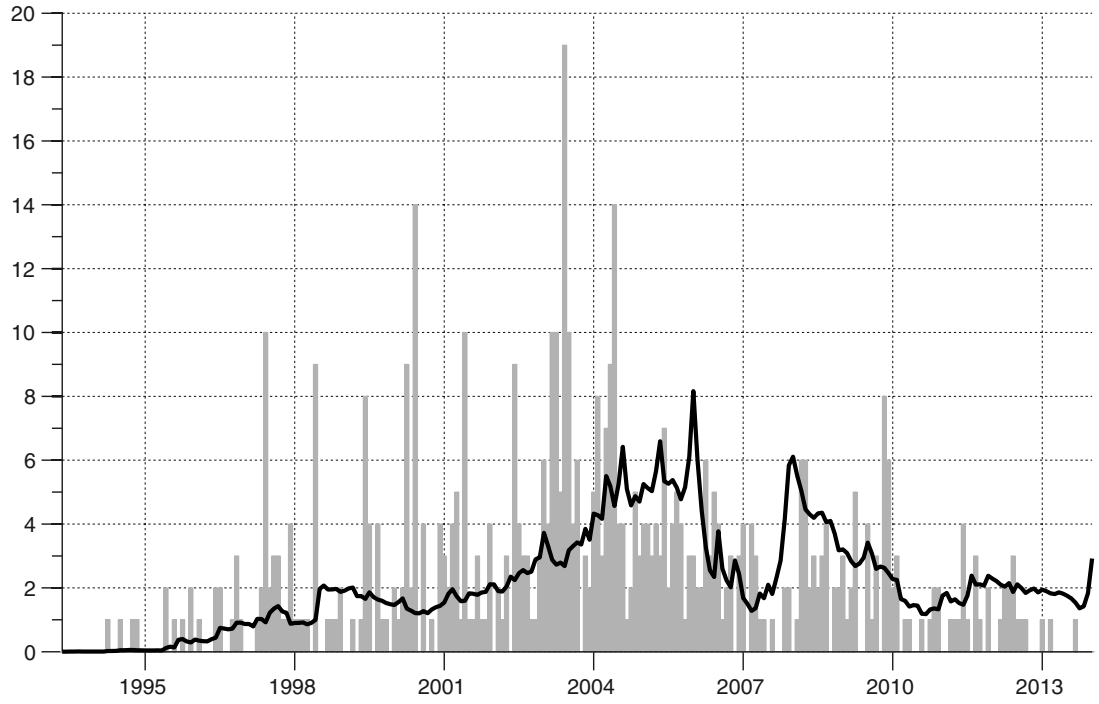


(c) Predicted defaults (line) versus actual (bars), horizon = 24 months.

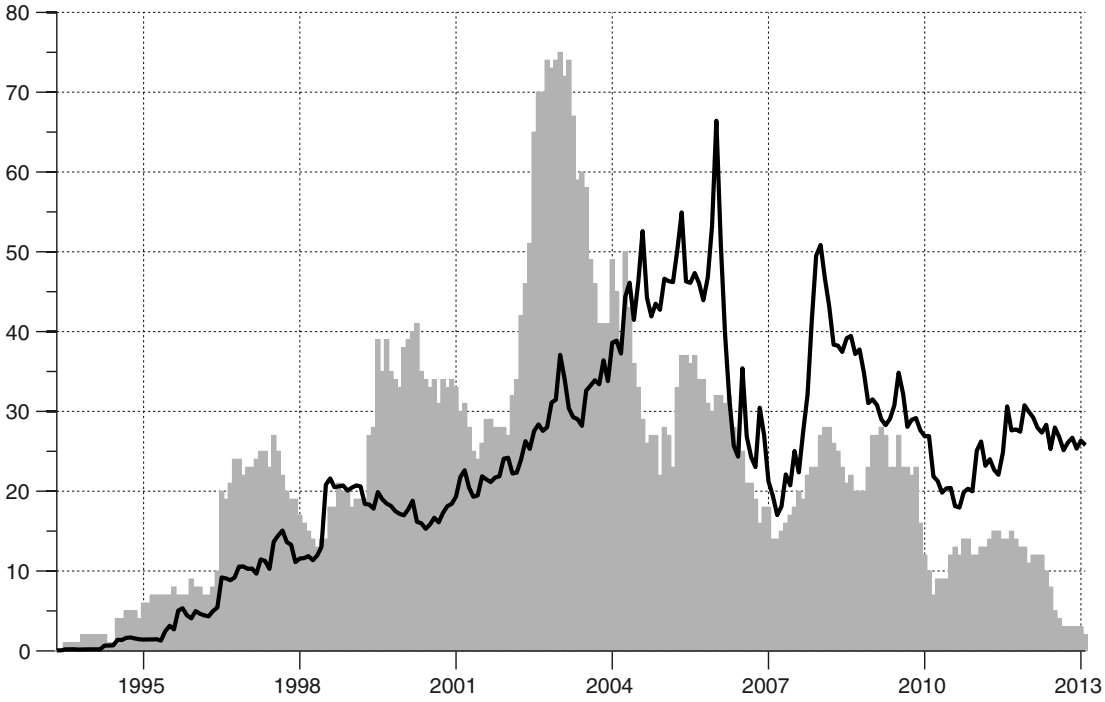


(d) Predicted defaults (line) versus actual (bars), horizon = 60 months.

Figure B.6. (*Continued*)

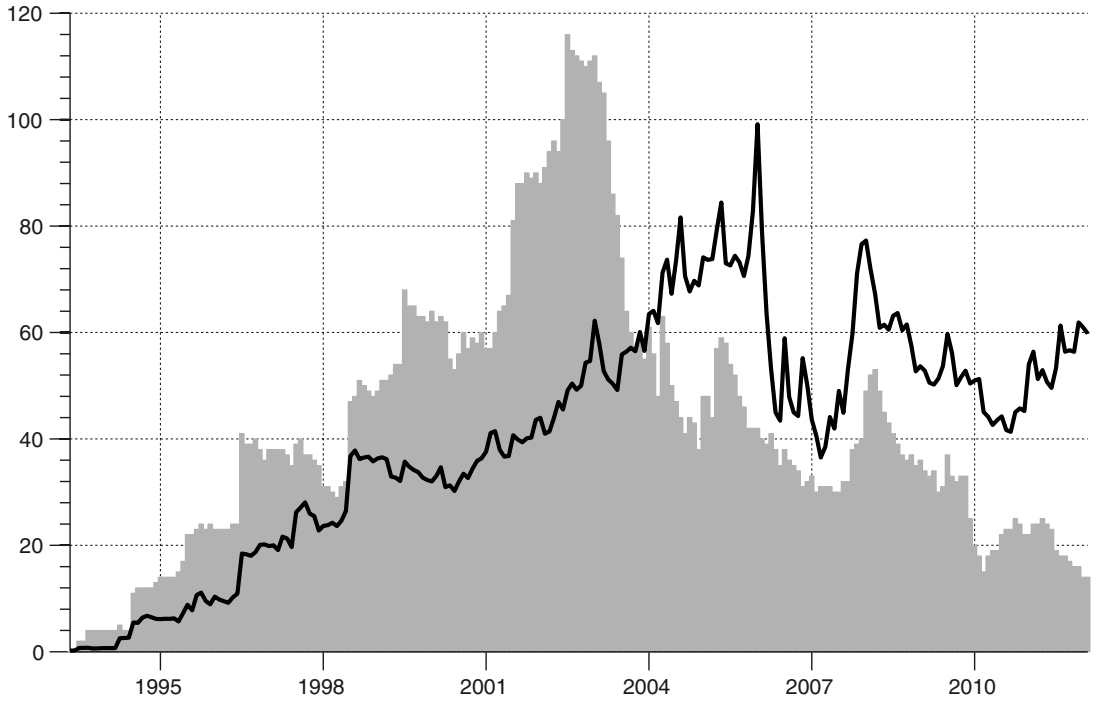


(a) Predicted defaults (line) versus actual (bars), horizon = 1 month.

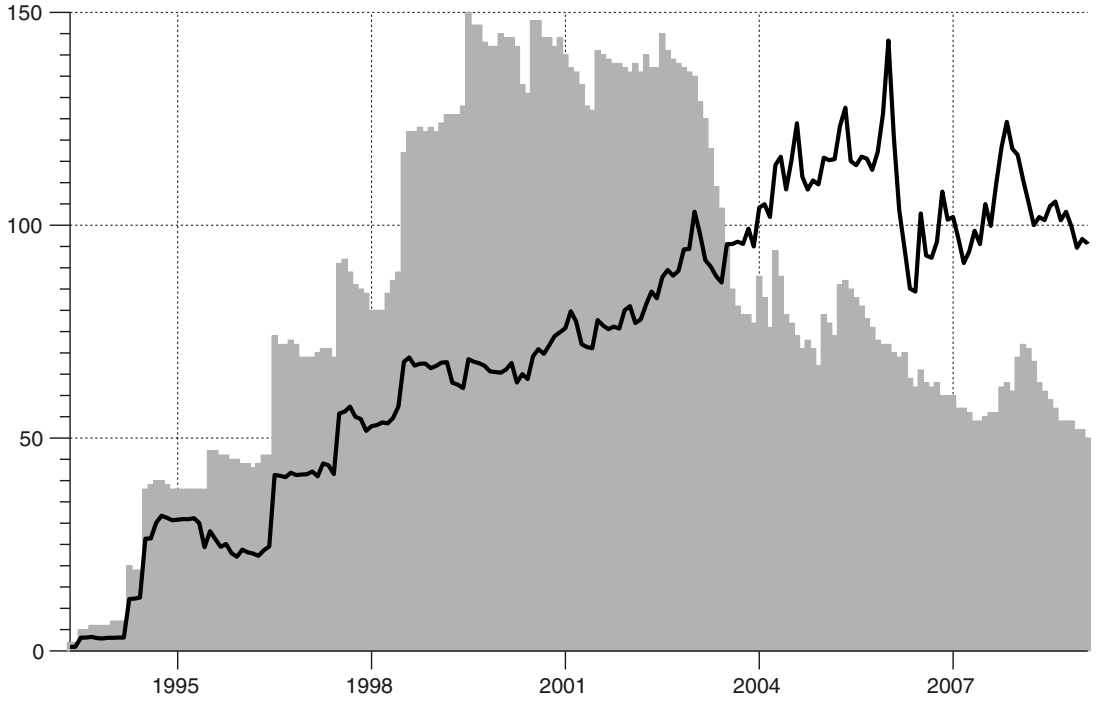


(b) Predicted defaults (line) versus actual (bars), horizon = 12 months.

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

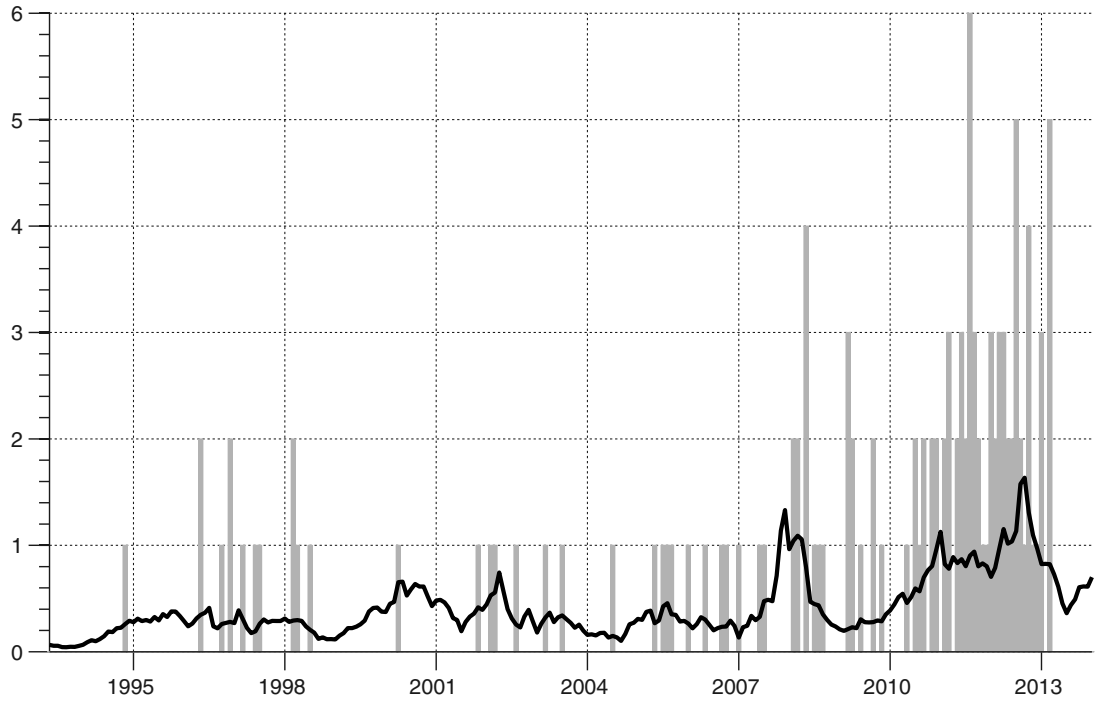


(c) Predicted defaults (line) versus actual (bars), horizon = 24 months.

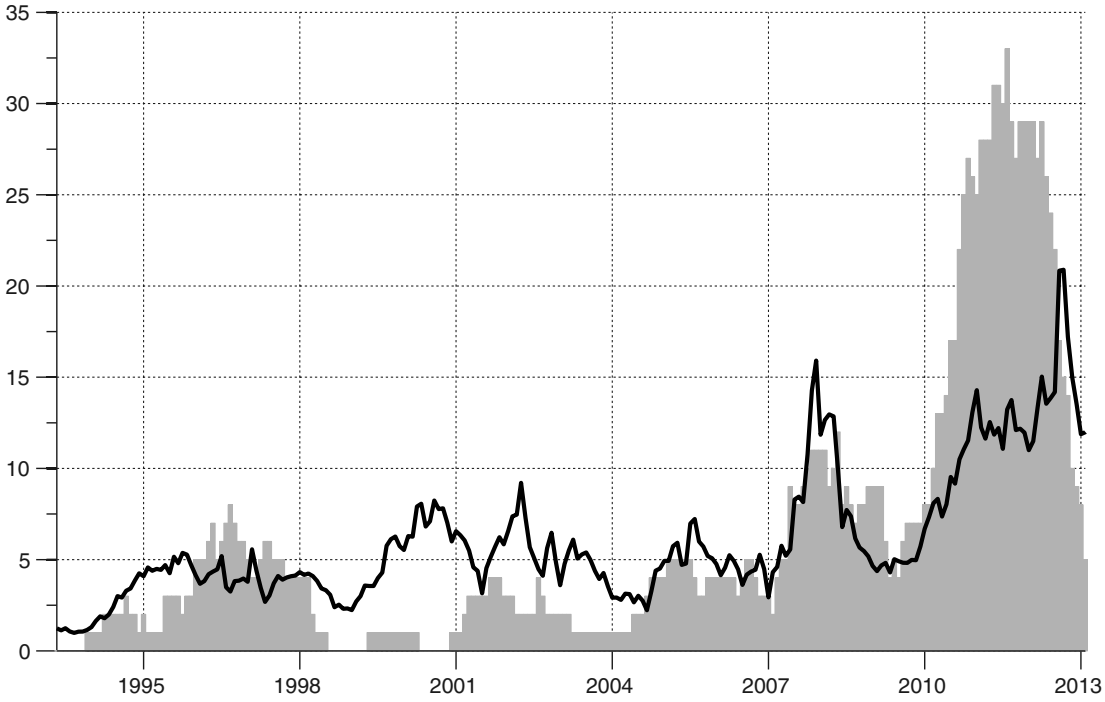


(d) Predicted defaults (line) versus actual (bars), horizon = 60 months.

Figure B.7. (*Continued*)

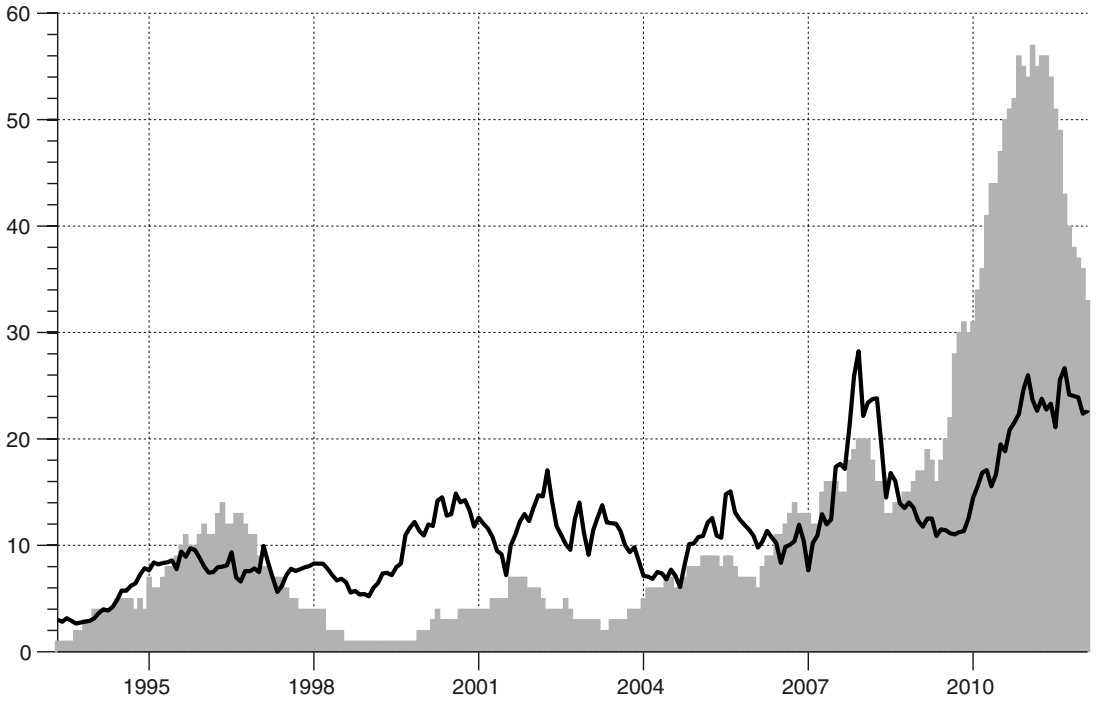


(a) Predicted defaults (line) versus actual (bars), horizon = 1 month.

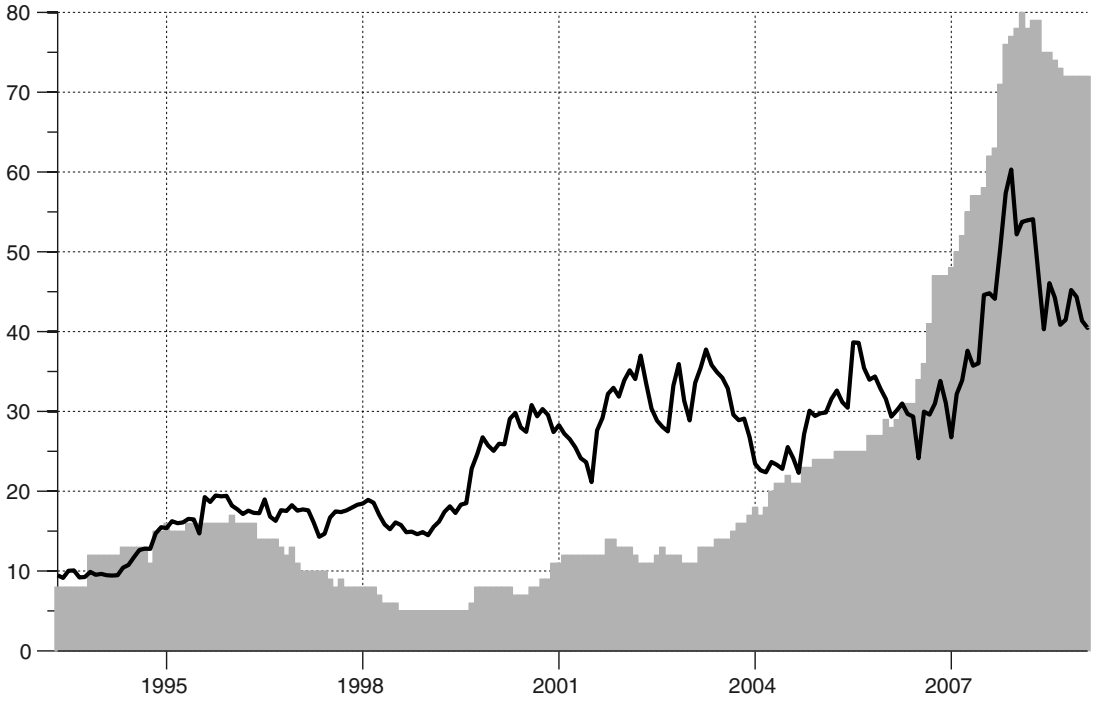


(b) Predicted defaults (line) versus actual (bars), horizon = 12 months.

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



(c) Predicted defaults (line) versus actual (bars), horizon = 24 months.



(d) Predicted defaults (line) versus actual (bars), horizon = 60 months.

Figure B.8. (*Continued*)

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