NUS Credit Research Initiative Technical Report

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This updated document describes the implementation of the system which the Credit Research Initiative (CRI) at 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, the CRI covers over 70,000 exchange-listed firms (including delisted ones) in 133 economies around the world (see Table A.1). Of them, over 36,000 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 system, see Duan and Van Laere [2012].

The system used by the CRI will evolve as new innovations and enhancements are applied. The main changes reflected in this 2020 version of technical report are the operational implementations: (1) New smart data launch for the CRI Systematically Important Financial Institution (CriSIFI), (2) New launch of the Probability of Default implied Rating 2.0 version (PDiR2.0), (3) Modified likelihood function for Indian firms accommodating new default data, (4) New common covariates and some changes in covariates, (5) Changes in parameter estimation, and (6) Expansion of coverage to include Qatar.

As of this reference date, the current operational CRI system has been implemented with the model parameters calibrated on January 2020 by using available data up to December 31st 2019 (henceforth, December calibration). Therefore, all subsequent empirical results (e.g., Tables and Figures in Appendix) are estimated based on December calibration. Further updated versions of the technical report and new addenda may be available via the web portal and will include any changes to the system since the publication of this version.

In the remainder of this technical report, the PD model and its computational details will be explained in details. As an application of the model, the computation of AS and CVI will

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be discussed in a much concise manner. Wherever no confusion is caused, "the model" refers to the PD model. The sections are organized as follows. Section 1 describes the forward-intensity framework for the PD model which was pioneered in Duan et al. [2012]. The description includes monthly calibration procedures, which are performed on a monthly basis, and individual firm's PD computations, which are performed on a daily basis.

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

While Section 1 sketches the framework of the model, Section 3 fills in the implementation details that are necessary for application, given real world issues such as bad or missing data. The technical details needed to develop an operational system are also provided, including details on the monthly calibration, daily computation of individual firm's PDs, and aggregation of PDs. Firms' distance-to-default (DTD) in a Merton-type model is one of the firm-specific variables. The DTD formulation adopted by the CRI system modifies the standard one to allow a meaningful calculation of DTD for financial firms. While most academic studies on default prediction exclude financial firms from consideration, it is important to include them due to the fact that the financial sector is vital to every economy. The calculation for DTD is detailed in this section.

Section 4 shows empirical analyses for economies currently under the CRI coverage. Initially, all the economies adopted the same set of extant variables used in Duan et al. [2012]. In 2018, we took one step forward by designing new variables to improve default prediction and started applying variable selection specific to certain economies (e.g. China). For details, refer to Subsection 2.1. Sections 5 and 6 explain how the CVI and AS are formulated. A detailed theoretical background can be found in Duan [2014]. Section 7 introduces a new CRI product "CriSIFI" that aims at identifying the systemic risks of all banks and insurers under the CRI coverage. The methodology that maps the PDs to the Probability of Default implied Rating (PDiR) is explained in Section 8. Section 9 discusses future developments.

1 Model Description

The quantitative model that is currently being used by the CRI is a forward-intensity model introduced in Duan et al. [2012]. Certain aspects of the estimation technique 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, PDs are forecast from a horizon of one month up to a horizon of five years. At the CRI website, for every firm, the probabilities of that firm defaulting within one month, three months, six months, one year, two years, three years, and five years are given. The ability to assess credit quality for different horizons presents 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 structure, 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, making their estimation unrealistic. For example, applying the two common variables and two firm-specific variables as in Duffie et al. [2007] to a sample of 10,000 firms would give rise to 20,002 state variables.

Given the complexity in modeling the dynamics of state variables, the Duffie et al. [2007] approach will be difficult to implement if different forecast horizons are of interest. The key innovation of the forward-intensity approach is that that model can be consistently and efficiently calibrated and the PDs for different horizons can be easily computed using only the value of the input variables at the time of default prediction. Thus, the model's specification and implementation become 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 referred to as model calibration. 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 share the same parameter values along with each firm's variables in order to compute the firm's PD.

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

1.1 Modeling Framework

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

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

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

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

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

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

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

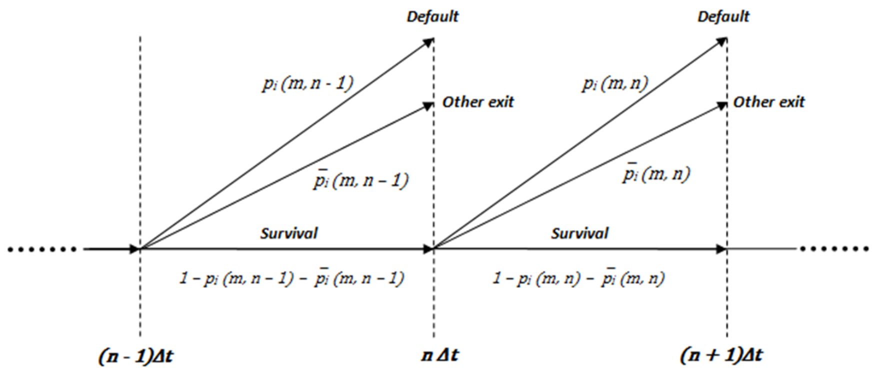

Figure 1: Default-other exit-survival tree for firm i, viewed from time $t = m\Delta t$.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

In the current implementation of the forward-intensity model in the CRI, the maximum forecast horizon is 60 months (5 years) and there are 16 input variables plus the intercept in general, so there are 60 sets of β and $\bar{\beta}$. While this is a large set of parameters, as will be seen in Subsections 1.2 and 1.3, the calibration is tractable because the default parameters can be calibrated separately from the other exit parameters, and the total number of parameters are greatly reduced after constraining the term-structure of the parameter estimates to be Nelson-Siegel functions.

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

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

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

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

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:

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

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.

1.2 Pseudo-Likelihood Function

The empirical data set used for calibration can be described as follows. For the economy as a whole, there are N end of month observations, indexed as $n = 1, \ldots, N$. 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 i^{th} firm in the n^{th} month is $X_i(n)$. The set of all observations for all firms is denoted by X.

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

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

1.2.1 Pseudo likelihood function for the parameters' estimation

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

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

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

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

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

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

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

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

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

$$\begin{aligned}
&P_\ell^{\bar{\beta}}(\bar{\beta};\tau_i,\bar{\tau}_i,X_i(m)) \\
&\quad = 1_{\{t_{0i}\le m,\min(\tau_i,\bar{\tau}_i)>m+\ell\}} \exp\left\{-\Delta t\sum_{j=0}^{\ell-1} H(\bar{\beta}(j),X_i(m))\right\} \\
&\qquad + 1_{\{t_{0i}\le m,\tau_i\le\bar{\tau}_i,\tau_i\le m+\ell\}} \exp\left\{-\Delta t\sum_{j=0}^{\tau_i-m-2} H(\bar{\beta}(j),X_i(m))\right\} \\
&\qquad + 1_{\{t_{0i}\le m,\bar{\tau}_i\le\tau_i,\bar{\tau}_i\le m+\ell\}} \exp\left\{-\Delta t\sum_{j=0}^{\bar{\tau}_i-m-2} H(\bar{\beta}(j),X_i(m))\right\} \\
&\qquad\quad \times \{1-\exp[-\Delta t\, H(\bar{\beta}(\bar{\tau}_i-m-1),X_i(m))]\} \\
&\quad + 1_{\{t_{0i}>m\}} + 1_{\{\min(\tau_i,\bar{\tau}_i)\le m\}}.
\end{aligned} \tag{13}$$

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

$$\mathcal{L}_\ell^{\beta}(\beta;\tau,\bar{\tau},X) = \prod_{m=1}^{N-1}\prod_{i=1}^{I} P_\ell^{\beta}(\beta;\tau_i,\bar{\tau}_i,X_i(m)) \tag{14}$$

$$\mathcal{L}_\ell^{\bar{\beta}}(\bar{\beta};\tau,\bar{\tau},X) = \prod_{m=1}^{N-1}\prod_{i=1}^{I} P_\ell^{\bar{\beta}}(\bar{\beta};\tau_i,\bar{\tau}_i,X_i(m)). \tag{15}$$

With the definitions given in Eqs. (13) and (15), it can be seen that:

$$\mathcal{L}_\ell(\beta,\bar{\beta};\tau,\bar{\tau},X) = \mathcal{L}_\ell^{\beta}(\beta;\tau,\bar{\tau},X)\mathcal{L}_\ell^{\bar{\beta}}(\bar{\beta};\tau,\bar{\tau},X). \tag{16}$$

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

1.2.2 Modified pseudo likelihood function for India's default data

TransUnion Credit Information Bureau India Limited (CIBIL)[1] has been publicly releasing the list of Indian defaulted firms in each quarter from Q1/2001 onwards. This additional data source enriches the CRI default database, and its net effect is to significantly increase the number of defaults for Indian firms from the original 512 to 1,336 as observed in September 2019. However, our PD modeling framework is built on a fundamental time period of one month but the CIBIL only provides the calendar quarter of a default occurrence. In order to utilize these partially observed information, the likelihood function in (12) has to be modified when estimating the default intensity parameters for Indian firms.[2]

We partition the data for Indian firms into two categories to reflect the two types of default information:

$$X = (X_I, X_C),$$

where $X_I = \{X_i\}_{i=1}^{I}$ with X_i containing variables for firm i whose default date (τ_i), other-exit date ($\bar{\tau}_i$), or survival is fully observed, whereas $X_C = \{X_c\}_{c=1}^{C}$ represents the data for defaulted firms reported by the CIBIL and yet not in the CRI's original default list. In other words, we only know the default quarter of firm c, i.e., τ_c is partially observed. Naturally, $I + C$ is the total number of Indian firms.

The likelihood function for defaults of Indian firms can then be written as:

$$\mathcal{L}_{\ell}^{\beta}(\beta;\tau,\bar{\tau},X) = \prod_{m=1}^{N-1}\Big[\prod_{i=1}^{I} P_{\ell}^{\beta}(\beta;\tau_i,\bar{\tau}_i,X_i(m)) \prod_{c=1}^{C} \tilde{P}_{\ell}^{\beta}(\beta;\tau_c,\bar{\tau}_c,X_c(m))\Big] \tag{17}$$

where $P_{\ell}^{\beta}(\cdot)$ is the original decomposed likelihood function in (12) applied to all i's, and $\tilde{P}_{\ell}^{\beta}(\cdot)$ is the modified likelihood reflecting partial default information for all c's.

Let t_c^* be the last month of the quarter preceding the reported default quarter of firm c. The modified likelihood function below reflects the fact that at $t_c^* + 3$ the exact default month is still unknown, but the likelihood can be assessed by applying a prior probability distribution over the three months in the defaulting quarter, tallied from other default cases for which we know their defaulting months. Denote this prior probability distribution by w_1, w_2 and w_3.

There are three cases to deal with for this subset of CIBIL reported defaulting firms. To reflect the fact that the default becomes known only at the end of the quarter, the modified likelihood for firm c can be decomposed as:

$$\tilde{P}_{\ell}^{\beta}(\beta;\tau_c,\bar{\tau}_c,X_c(m)) = 1_{\{t_{0,c}\le m\le t_c^*+3 \ \& \ m+\ell<t_c^*+3\}} P_{\ell}^{\beta}(\beta;\tau_c = t_c^*+3,\bar{\tau}_c,X_c(m)) \tag{18a}$$

$$+ 1_{\{t_{0,c}\le m\le t_c^*+3 \ \& \ m+\ell\ge t_c^*+3\}} \sum_{\kappa=1}^{3} w_{\kappa}\cdot \mathrm{Prob}_m\{\tau_c = t_c^*+\kappa\} \tag{18b}$$

$$+ 1_{\{t_{0,c}>m\}}, \tag{18c}$$

where $\mathrm{Prob}_m\{\tau_c = t_c^* + \kappa\}$ denotes the probability at the prediction time m for firm c defaulting at $t_c^* + \kappa$, which can be computed per the forward-intensity model as explained in (8). The second term on the right-hand side, i.e., the equation (18b), reflects the fact that we do not know the exact default month after a default has been reported. The best one can do is to weight the probabilities that firm c defaults in either one of the three months with the prior distribution. The third item in the equation basically addresses firms for which data only become available after the prediction time.

In terms of the CRI implementation[3], we specify the weight w_k in (18b) as the proportion of the observed default months in a quarter. For example, as observed in September 2019,

[1] https://www.cibil.com

[2] The likelihood function for other exits of Indian firms remains unchanged.

[3] From 14th October 2019, the CRI-PD model for India has reflected the change in its estimation methodology that incorporates the CIBIL reported default events.

46% of the total default firms is in the third month of the defaulting quarter, whereas each of the remaining two months constitutes approximately 27%. For the CRI website displays, the exact default date for a CIBIL firm is placed as the average day based on the observed sample distribution on defaulting date in a quarter.

1.3 Parameter Estimation

Previously, the CRI system produced default predictions to a horizon of two years (CRI [2012]). An extension of the forecast horizon to five years has been implemented as of the PD released on April 1 2013. This extension to a five-year horizon is done by constraining the term-structure of the parameter estimates to be Nelson-Siegel (Nelson and Siegel [1987]; hereafter NS) functions of the forward-starting time. Horizon-specific parameters β and $\bar{\beta}$ can be obtained from the continuous NS function by using the forward prediction horizon as an input. The term-structures are further constrained so that the effect of risk factors on the forward intensity goes to zero as the horizon increases. This allows tractable and parsimonious extrapolations for horizons beyond five years.

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

Technically speaking, horizons of arbitrary length can be calculated by extrapolation using the forward-intensity function. However, such a extension is better accompanied by a model calibration including default events being predicted over longer horizons. The current CRI model calibration is limited to default events within five years of a prediction time. Knowing that the CRI data now spanning over 30 years, it is certainly reasonable to calibrate the model with default events up to, say, 10-year prediction horizon if a need for longer-horizon PDs becomes evident.

1.3.1 Smoothed parameters

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

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

First, it will significantly reduce the number of parameters. For example, using 16 covariates for forward default intensities up to 60 months would require a joint estimation of $17 \times 60 = 1020$ parameters. Here, 17 comes from adding an intercept to the intensity function with 16 covariates. If the coefficients corresponding to each covariate are represented by the

NS function of 4 parameters, there will be at most $17 \times 4 = 68$ 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 17 NS functions estimated with predictions up to 60 months can be used for prediction, say, over 72 months.

The NS function with four free parameters is:

$$r(t; \varrho_0, \varrho_1, \varrho_2, d) = \varrho_0 + \varrho_1 \frac{1 - \exp(-t/d)}{t/d} + \varrho_2 \left[\frac{1 - \exp(-t/d)}{t/d} - \exp(-t/d) \right], \tag{19}$$

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 and $\bar{\beta}$ are obtained from 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 16 covariates and an intercept, there will be a total of $16 \times 3 + 1 \times 4 = 52$ parameters, provided that the calibration group does not carry a structural break.

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

For China, we have 15 input variables (an intercept plus 14 covariates) due to the different variable selection specific to the economy (see Subsection 2.1). In addition, we further revise the parameter estimation for the North America calibration group and Chinese firms. For details, refer to Subsection 1.3.2.

1.3.2 Structural break

The North America calibration group (the US and Canada) has incorporated the following two specific changes. First, we include a dummy variable on the intercept for financial firms to account for differences that have not been duly reflected through other covariates. Second, we apply a structural break to this financial-sector intercept dummy to address the change in September 2008 after Lehman Brothers defaulted.

The structural break for the North America calibration group is treated as an impulse response. The key is to allow the different rates of transition, characterized by $\widetilde{\alpha}_1(\tau) > 0$ and $\widetilde{\alpha}_2(\tau) > 0$, before and after the break point t_0 (September 2008), respectively. Before t_0, for example, the coefficient for the financial–sector intercept dummy, $\beta(t, \tau; t_0)$, has the form:

$$\beta(t, \tau; t_0) = \widetilde{\beta}(\tau) + \widetilde{\gamma}(\tau) \times \frac{1}{1 + e^{-\widetilde{\alpha}_1(\tau)(t - t_0)}},$$

where t denotes the default prediction time, and τ denotes a forward starting time ranging from 0 (1 month) to 59/12 (5 years). $\widetilde{\alpha}_1(\tau)$, $\widetilde{\beta}(\tau)$, and $\widetilde{\gamma}(\tau)$ are characterized by the NS function in Eq. (19). After t_0, the coefficient for the financial–sector intercept dummy is governed by

$\widetilde{\alpha}_2(\tau)$ instead of $\widetilde{\alpha}_1(\tau)$:

$$\beta(t,\tau;t_0) = \widetilde{\beta}(\tau) + \widetilde{\gamma}(\tau) \times \frac{1}{1+e^{-\widetilde{\alpha}_2(\tau)(t_0-t)}}.$$

Therefore, $\beta(t,\tau;t_0)$ moves from $\widetilde{\beta}(\tau)$ to $\widetilde{\beta}(\tau) + 1/2\widetilde{\gamma}(\tau)$ as t advances toward t_0, and reverts back to $\widetilde{\beta}(\tau)$ as t goes past t_0.

Our treatment on Chinese firms differs from that for the North American calibration group in two aspects. First, we apply a structural break to both the intercept and the DTD level. Second, we model the structural break by a step function allowing for different rates of transition to and away from the break point. As implemented earlier, the treatment is the same for intercept term and the coefficient for the DTD level, but the transition rates are different. Here, we describe generically for one of these two structural breaks. Before t_0 (December 2004), $\beta(t,\tau;t_0)$ has the following form:

$$\beta(t,\tau;t_0) = \widetilde{\beta}(\tau) + \widetilde{\gamma}(\tau) \times \frac{1}{1+e^{-\widetilde{\alpha}_1(\tau)(t-t_0)}},$$

After t_0, the two variables are governed by $\widetilde{\alpha}_2(\tau)$:

$$\beta(t,\tau;t_0) = \widetilde{\beta}(\tau) + \widetilde{\gamma}(\tau) \times \frac{1}{1+e^{-\widetilde{\alpha}_2(\tau)(t-t_0)}}.$$

Therefore, $\beta(t,\tau;t_0)$ smoothly transits from $\widetilde{\beta}(\tau)$ to $\widetilde{\beta}(\tau) + 1/2\widetilde{\gamma}(\tau)$ as t moves toward t_0, and then continues to $\widetilde{\beta}(\tau) + \widetilde{\gamma}(\tau)$ as t moves beyond t_0.

1.3.3 Parameter estimation by SMC

Reliably estimating a system involving 52 parameters for 16 covariates and an intercept presents a numerical challenge. Moreover, the number of parameters can be greater than 52 if there are more than 16 covariates or structural breaks. 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 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:

$$\mathcal{L}_{m,\min(N-m,\ell)}(\theta) = \prod_{i=1}^{I} P_{\min(N-m,\ell)}\left(\beta(\theta), \bar{\beta}(\theta); \tau_i, \bar{\tau}_i, X_i(m)\right), \quad (20)$$

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

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

$$\gamma_n(\theta) \propto \prod_{m=1}^{n-1} \mathcal{L}_{m,\min(N-m,\ell)}(\theta)\pi(\theta), \text{ for } n = 2, \ldots, N, \tag{21}$$

In the CRI implementation, $\pi(\theta)$ is set to 1 (i.e., a uniform or improper prior) instead of the previous normal/truncated normal priors. This revision frees the estimation algorithm from needing an ad hoc prior belief to start the process. Despite this change, the estimation results remain qualitatively similar, reflecting the fact that our dataset is quite large and the prior's effect is only marginal.

One can apply the sequential batch-resampling routine of Chopin [2002] 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: To provide the initial particle cloud from which the algorithm can start, an initial random sample from the normal distribution is drawn ($\theta^{(k,0)} \sim \mathcal{N}(\boldsymbol{\mu}, \Sigma)$, $w^{(k,0)} = 1/K$). Of course, the support of the normal distribution must contain the true parameter value θ_0. In the CRI implementation, $\boldsymbol{\mu}$ and σ are chosen based on cumulative knowledge on parameters' locations and dispersions to speed up optimization.

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

$$\overline{\gamma}_{n+1,p}(\theta) \propto \gamma_n(\theta)\mathcal{L}^{\xi_p}_{n,\min(N-n,\ell)}(\theta), \text{ for } p = 0, \ldots, P_{n+1}. \tag{22}$$

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

- *Reweighting Step:* At the beginning of each tempering step, p, a reweighting procedure is run:
$$\overline{w}^{(k,n+1,p-1)} \times \mathcal{L}^{\xi_p - \xi_{p-1}}_{n,\min(N-n,\ell)}(\overline{\theta}^{(k,n+1,p)}), \tag{23}$$
where ξ_p is chosen to ensure that a minimum effective sample size (ESS) is maintained, where ESS is defined as
$$\text{ESS} = \frac{\left(\sum_{k=1}^{K} \overline{w}^{(k,n+1,p)}\right)^2}{\sum_{k=1}^{K} \left(\overline{w}^{(k,n+1,p)}\right)^2}. \tag{24}$$

The newly adopted minimum ESS is 25% of the sample size, which equals 250 with the CRI's use of the SMC sample for 1,000 parameter particles. This is done by a grid search, where the ESS is evaluated at a grid of candidate values for ξ_p. The one that produces the ESS that is larger than and closest to 250 is chosen. By changing the criterion from 500 to 250, bigger steps for ξ_p are taken to speed the algorithm without adversely affecting the quality of the estimation result.

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:

$$\overline{\theta}^{(k,n+1,p)} = \overline{\theta}^{(k,n+1,p-1)}, \tag{25}$$

$$\begin{aligned}\overline{w}^{(k,n+1,p)} &= \overline{w}^{(k,n+1,p-1)} \times \frac{\overline{\gamma}_{n+1,p}(\overline{\theta}^{(k,n+1,p)})}{\overline{\gamma}_{n+1,p-1}(\overline{\theta}^{(k,n+1,p)})} \\ &= \overline{w}^{(k,n+1,p-1)} \times \mathcal{L}^{\xi_p-\xi_{p-1}}_{n,\min(N-n,\ell)}(\overline{\theta}^{(k,n+1,p)}).\end{aligned} \tag{26}$$

To avoid particle impoverishment in sequential importance sampling where most of the weights are concentrated in a small number of particles, a resample-move step is run.

- *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

$$\overline{\theta}^{(k,n+1,p)} = \overline{\theta}^{(I^{(k,n+1,p)},n+1,p)}, \tag{27}$$

$$\overline{w}^{(k,n+1,p)} = \frac{1}{K}. \tag{28}$$

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

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

$$\alpha = \min\left(1, \frac{\overline{\gamma}_{n+1,p}(\theta^{*(k)})\mathcal{Q}_{n+1,p}(\overline{\theta}^{(k,n+1,p)} \mid \theta^{*(k)})}{\overline{\gamma}_{n+1,p}(\overline{\theta}^{(k,n+1,p)})\mathcal{Q}_{n+1,p}(\theta^{*(k)} \mid \overline{\theta}^{(k,n+1,p)})}\right). \tag{29}$$

  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, we define three (or four) NS parameters corresponding to each covariate as one block. A mixture distribution is designed to combine with equal probabilities: (1) a block independent normal distribution using the means and the standard deviations derived from the existing particle set, and (2) a random walk proposal based on a scaled-down covariance matrix used in the block independent proposal; that is,

$$\theta^{*(k)} \sim \frac{1}{2}\mathcal{N}(\boldsymbol{\mu},\Sigma) + \frac{1}{2}\mathcal{N}\left(\overline{\theta}^{(k,n+1,p)},\Sigma^*\right),$$

where $\boldsymbol{\mu}$ is the sample mean vector of $\overline{\theta}^{(k,n+1,p)}$ and Σ is the covariance matrix with a block diagonal structure, i.e., the covariances across blocks are all zero. $\sigma^{*2}_{i,j}$, which is the (i,j)–th element of Σ^*, is set to be $(0.2\sigma_{i,j})^2$ (the (i,j)–th element of Σ), to propose around the original values. Mixing the independent and random walk proposals can effectively boost the support (i.e., a higher ESS) by offering local alternatives to those parameters with already high likelihood, especially when there exists discrepancies between the true distribution and its approximating normal distribution.

Moreover, we do not propose to replace an entire parameter particle, and implement a random block proposal. For each particle, say, comprising sixteen blocks (i.e., covariates), we randomly select a random number of blocks (from five to ten) and only propose new values for the selected blocks, while keeping the remaining blocks at their original values. This design can increase the acceptance rate and still offer rich enough replacements. To ensure a good replacement for every block, we perform multiple such Metropolis-Hastings steps each time until the accumulated acceptance rate exceeds 100% and the ESS reaches at least 75% of sample size.

Finally, proposed particles must satisfy some pre-defined constraints. First, the NS parameter d must be positive. Second, particles must produce an increasing or decreasing structure of the NS function for the first five months in order to ensure the smoothness of the term structure of the forward-intensity parameters. Third, the coefficients for some covariates, such as the level and trend of liquidity, are required to be non–positive over all forward starting times.

Using the mixture proposal creates a minor complication. The sampler for the truncated values does not carry the same norming constant due to the inclusion of the random walk proposal so that it cannot be ignored in the importance weight. To address the issue, we treat those sampled parameters violating the above mentioned constraints as if there were legitimate particles, but assign the likelihood $\overline{\gamma}_{n+1,p}(\theta^{*(k)})$ of any such proposed particle a value of 0. In short, such particles will never be accepted.

Final tempering step: When $p = P_{n+1}$ is reached (i.e., ξ_p reaches 1), a representation of $\gamma_{n+1}(\theta)$ is:

$$(\theta^{(k,n+1)}, w^{(k,n+1)}) = (\overline{\theta}^{(k,n+1,P_{n+1})}, \overline{w}^{(k,n+1,P_{n+1})}). \tag{30}$$

Additional Metropolis–Hastings moves are performed until the accumulated acceptance rate exceeds 200% instead of 100% at the prior steps. This is to improve the final quality of the SMC sample of parameter particles in representing the target distribution.

Re–initialization: Recall that our SMC approach is the expanding–data SMC technique according to the classification in Duan and Fulop [2013]. Although the expanding data approach is more computationally efficient, we noticed that approximation errors may sometimes get accumulated after repeatedly updating the SMC parameter particle set by adding data one month at a time. We thus introduce a parameter re-initialization every 10 sequential updating time steps to remove the potentially accumulated approximation errors. Re-initialization is the same as the initialization at the beginning of the SMC, except that the relevant means and variances-covariances are computed with the updated SMC parameter particle set so that re-initialization can take advantage of updated information on the sampling distribution.

1.3.4 Statistical inference

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

$$\hat{\theta}_n = \frac{1}{\sum_{k=1}^{K} w^{(k,n)}} \sum_{k=1}^{K} w^{(k,n)} \theta^{(k,n)}. \tag{31}$$

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. (21) 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 in the full-sample run. To test, for example, the hypothesis of the kth element of $\overline{\theta}^{(k,n+1,p)} = \overline{\theta}^{(I^{(k,n+1,p)},n+1,p)}$, denoted by $\overline{\omega}^{(k,n+1,p)} = \frac{1}{K}$, equal to a, one has:

$$t^* = \frac{\sqrt{N-1}\left(\hat{\theta}_N^{(k)} - a\right)}{\sqrt{\hat{\delta}_{k,N}}} \xrightarrow{d} \frac{W(1)}{\left[\int_0^1 (W(r) - rW(1))^2 dr\right]^{1/2}}, \tag{32}$$

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

$$\hat{C}_N = \frac{1}{(N-1)^2} \sum_{n=2}^{N} n^2 (\hat{\theta}_n - \hat{\theta}_N)(\hat{\theta}_n - \hat{\theta}_N)'. \tag{33}$$

The statistical inference on the structural break parameters are again based on Shao's self-normalized statistic (see Subsection 1.3.2). Since the parameters in connection with the structural break cannot be identified using the data before the break point, the sequence of parameter estimates used in Shao's self-normalized statistic can only start from the break point onward. In the CRI implementation, all parameter estimates, break or non-break related, start from the break point. Denote by T the endpoint of the data set and t_0 again the structural break point. The number of points in the sequence, N, used to compute the norming matrix and the confidence intervals (see Eq. (33)) therefore equals $T - t_0 + 1$.

The right-hand-side random variable for t^* in Eq. (32) 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.

1.3.5 Periodic updating

In reality, portfolio credit risk models need to be updated periodically as new data arrive and/or old data are revised. With one new month of data, this means that the final date index N is increased to $N + 1$. For this monthly real-time updating procedure, we always apply re-initialization, where the relevant means and variances–covariances used to generate the initial particle cloud are computed with the updated SMC parameter particle set from the previous run up to time N. Then one can apply the same recursive procedure, as described in Subsection 1.3.3. Furthermore, one can update all self-normalized statistics shown in Subsection 1.3.4 to reflect the additional one more pseudo-posterior means to the sequence.

As for this technical report, the initial parameter estimation by SMC is carried out for all calibration groups on January 2020 using (December calibration) the data up to the end of December 2019. Additional implementation details on the calibration are given in Section 3.

2 Input Variables and Data

Subsection 2.1 describes the input variables used in the quantitative model. In principle, the same set of input variables is common to most of the economies under the CRI's coverage.

Going further, the CRI system starts to identify different input variables specific to different economies (e.g., China and India). The effect of each of the variables on the PD output will be discussed in the empirical analysis of Section 4.

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

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

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

2.1 Input Variables

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

In Duan et al. [2012], different variables that are commonly used in the literature were tested as candidates for the elements of $W(n)$ and $U_i(n)$: the 2 common variables and 10 firm-specific variables were selected as having the greatest predictive power for corporate defaults in the United States. In the current stage of development, the set of 16 covariates beyond the past 12 variables, as described below, is generally used for all economies but China. In an ongoing effort, future development will include variable selection for firms in different economies.

- Common variables

  The vector $W(n)$ contains four 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 standardized from the data available point until now;
  3. Financial Aggregate DTD: median DTD of financial firms in each economy/country inclusive of those foreign financial firms whose primary stock exchange is in this economy/country;
  4. Non–financial Aggregate DTD: median DTD of non–financial firms in each economy/country inclusive of those foreign financial firms whose primary stock exchange is in this economy/country.

Stock index return incorporates the following two treatments. First, we use unified currencies for 6 groups of economies: China (CNY), India (INR), Asia-Pacific Developed (USD), Emerging Market (USD), Europe (EUR), and North America (USD). Second, we winsorize the unified return over the range of [5%, 95%] for 3 groups of economies: Asia-Pacific Developed, Emerging Market, and Europe.

Interest rate is standardized in the way of demeaning each series and then scaling the demeaned values so that the standard deviation equals one, except for China and India. The treatment specific to the Eurozone is detailed in Subsection 3.3.

Each of the aggregate DTDs is only applicable to firms in the corresponding category. In short, the number of covariates used for default prediction is 16 including 12 firm–specific variables, as will be discussed below. China, however, differs from other economies/countries where the two aggregate DTDs are not applicable, because they offer no informational value above and beyond what have already been captured. The number of covariates for China is thus still 14.

- Firm-specific variables

  The 12 firm-specific input variables are transformations of measures of 6 different firm characteristics. The 6 firm characteristics are:

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

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

Liquidity is measured as a log ratio of cash and short-term investments to total assets for financial firms and a log ratio of current assets to current liabilities for non–financial firms. Profitability is measured as a ratio of net income to total assets. Relative size is measured as a log ratio of market capitalization to the economy's median market capitalization.

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

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

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.

As of this technical report, we further conduct additional treatments on liquidity and size. First, the level and trend of liquidity are respectively allowed to be sector–specific: financial firms, and non–financial firms. For financial firms, we take natural logarithm on the existing liquidity definition: log[(Cash + Short–term investments) / Total assets]. For non–financial

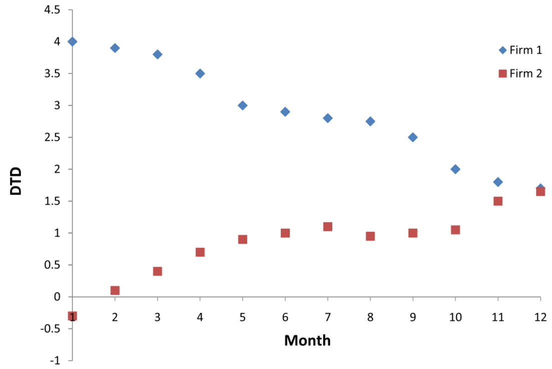

Figure 2: Two firms with all current values equal to each other, but DTD trending in the opposite direction.

firms, we refine liquidity as log(Current assets / Current liabilities) with the two current items in their financial statements. Second, size is redefined through the unified currency discussed above and then divided by the economy's median market capitalization over the past one year.

One of the remaining two firm characteristics is the market mis-valuation/future growth opportunities characteristic. This measure is taken as the "relative" market–to–book asset ratio (M/B) in the way of Individual firm's M/B divided by Economy M/B median at the same day that the individual M/B is calculated. In the CRI implementation, market–to–book asset ratio (M/B) is measured as a ratio of market capitalization and total liabilities to total assets. One can see whether the market mis-valuation effect or the future growth opportunities effect dominates this measure by looking at whether the parameter for this variable is positive or negative. This will be further discussed in the empirical analysis of Section 4.

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

Finally, the vector $U_i(n)$ contains 12 elements, consisting of:

1. Level of DTD.
2. Trend of DTD.
3. Level of log[(Cash + Short–term investments) / Total assets] for financial firms, abbreviated as CASH/TA.
4. Trend of CASH/TA for financial firms.
5. Level of log(Current assets / Current liabilities) for non–financial firms, abbreviated as CA/CL.
6. Trend of CA/CL for non–financial firms
7. Level of Net income / Total assets, abbreviated as NI/TA.
8. Trend of NI/TA.
9. Level of log (Firm market capitalization / Economy's median market capitalization over the past one year), abbreviated as SIZE.

10. Trend of SIZE.
11. Current value of Relative M/B defined as Individual firm's M/B divided by Economy M/B median, abbreviated as M/B.
12. Current value of SIGMA.

Note that every firm should belong to either a financial sector or a non–financial sector. Natually, this classification determines which liquidity ratio between CASH/TA and CA/CL is used. When it comes to one financial firm, for example, we cannot use CA/CL level and trend among the 12 elements. Therefore, default prediction of each firm should depend on the rest of the 10 firm–specific variables. The data fields that are needed to compute DTD and short-term investments are described in Subsection 2.3. The remaining data fields required are straightforward and standard. The computation for DTD is explained in Section 3.

2.2 Data Sources

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

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

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

The firm coverage of the Back Office Product is of sufficient quality that over 34,000 firms can be updated on a daily basis in the 128 economies under the CRI's coverage. While the current coverage is quite comprehensive, historical data from the Back Office Product can be sparse for certain economies. For this reason, various other databases are merged in order to fill out the historical data. The other databases used for historical data are: a database from the Taiwan Economics Journal (TEJ) for Taiwanese firms; a database provided by Korea University for South Korean firms; data from Prowess for Indian firms; and the Compustat for United States.

With all of the databases merged together and for the 128 economies under CRI's coverage, around 68,000 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 128 economies, 88 economies inclusive of Qatar as a new economy have their own stock exchange (see Table A.2). For the other 40 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 (see Table A.3).

2.3 Constructing Input Variables

The chosen stock indices and short-term interest rates for the 88 economies with their own stock exchanges under the CRI's current coverage are listed in Tables A.5 and A.6, respectively. All economies are listed by their three letter ISO code given in Table A.4.

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

The calculation for DTD is explained in section 3. In the calculation, several variables are required. One variable is a proxy for a one-year risk-free interest rate, and the choices for each of the 88 economies are listed in Table A.7. Total assets, long-term borrowing and total liabilities are also required, but can be obtained from standard FS fields easily.

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

The liquidity measure requires different fields for financial and non-financial firms. For non–financial firms, the two elements of "CA/CL" come from BS_CUR_ASSET_REPORT and BS_CUR_LIAB, respectively: log(Current assets / Current liabilities). For financial firms, the numerator of "CASH/TA", (Cash + Short-term investments), is taken as the sum of BS_CASH_NEAR_CASH_ITEM, 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 the last three fields are missing, zero is inserted for those fields, but at least one field is required. The "ARD" prefix indicates that these are "as reported" numbers directly from the FSes. As such, for some firms these fields may need to be adjusted to the same units before adding them to other fields.

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

2.4 Data for Corporate Events

The CRI database contains 6,065 default events and 42,204 other exits events from 1990 to the end of October 2019. The corporate events come from numerous sources, including Bloomberg, Compustat, CRSP, Moodys reports, TEJ, exchange websites and news sources. Moreover, in order to enhance default coverage, the CRI team has started to use "defaults" reported by major credit rating agencies and CIBIL for Indian defaults as additional data 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. Especially, if a firm has stale stock price for more than a year but has no record on experiencing any credit events, we will assume that it has been suspended and exited from its stock exchange. If two credit events of the same type happen in a row or a default event happens followed by another event of either type, we only keep the first event assuming that the series of events arise from the same source of financial distress. However, if firms are delisted from an exchange and then experience a default event within 180 calendar days of the delisting, we will only keep the default event, and any information between the two dates won't be used. Technical defaults such as covenant violations are not included in our definition of default. The exit events that are not considered as defaults in the CRI system are listed in Table A.10.

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

Complete statistics of the total number of firms, number of defaults, and number of other exits in each of the 88 economies from 1990 to 2019 are listed in Table A.11.

3 Implementation Details

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

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

3.1 Data Treatment for Calibration

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

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

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

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

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

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

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

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

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

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

A check on the trading volume of shares is used to remove stale prices. Specifically, if there are more than two consecutive days of identical market capitalization prices, the subsequent identical prices are removed only if the trading volume is equal to zero. Any firms with zero volume more than 10 consecutive working days, the firms will be labelled as *non-trading* firm and its PD shall not be provided. This is to avoid, for example, cases where the shares of a company are under a trading suspension[4] but the market capitalization data is incorrectly carried forward.

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

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

Currency conversion: Currency conversions are required if the market capitalization or any of the FS variables are reported in a currency different than the currency of the economy. If a currency conversion is required, the foreign exchange rate used is the one reported at the relevant market close. For firms traded in most of the Asian economies and Asia-Pacific, the Tokyo closing rate is used; for firms traded in Europe, Africa, 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.

As of December 2017, we proceed with the unified currency treatment about stock index return for each calibration group of economies: China (CNY), India (INR), Asia-Pacific Developed (USD), Emerging Market (USD), Europe (EUR), and North America (USD). This attempt is made to prevent currency distortion in assessing default prediction. Similarly, we apply the currency adjustment to market capitalization, total liabilities, and total assets, all of which are used to compute the M/B ratio.

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

[4]Note that, the information of trading suspension is not fully available in many exchange markets. If the information is publicly available, the firm status will be labelled as suspended firm accordingly.

restructure of the acquirer. However, its FSes do not usually immediately reflect the new situation due to the fact that they are only released on a periodic basis. As a result, the DTD and market-to-book ratio, which are important inputs for the PD computation, will be distorted due to a mismatch in the market capitalization and the FS variables. In order to ensure the accuracy and reliability of our PD estimates, some special treatments are taken for PD calculations to companies whose financials are presumably significantly affected by the M&A events. The treatments are only applied to the acquirers.

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

1. Upon the deal's completion, the acquirer owns 20% or more of the target company.
2. The size of the deal is material to the acquirer. This is measured in terms of total assets. If α is the percentage of the target that is being acquired, the size is considered material if the product of α and the total assets of the target is greater than or equal to 20% of the total assets of the acquirer.
3. The change in market capitalization is material, with the largest absolute daily market capitalization return, within 20 days of the M&A completion day, larger than or equal to 5%.

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

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

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

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

Treatment for missing values and outliers: Missing values and outliers are dealt with by a three-step procedure. In the first step, the 10 firm-specific input variables are computed for all firms and all months. In this step, the extreme values will be calculated, and the missing values will be determined. In the second step, outliers are eliminated by winsorization. In the final step, missing values are replaced under certain conditions.

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

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

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

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

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

With a winsorization level of 0.1 and 99.9 percentile, the boundary values still may not be reasonable. For example, NI/TA levels of nearly -25, meaning an annual net income -25 times larger than the total assets of a firm, has been observed at this stage. In these cases, a more aggressive winsorization level is applied, until the boundary values are reasonable. Thus, the winsorization level is economy- and variable-specific, and will depend on the data quality for that economy and variable. Winsorization levels different from the default of 0.1 percentile and 99.9 percentile are indicated in Table A.8. As for log variables log(x) such as CASH/TA and CA/CL, we should check first whether x is well defined with positive values. Otherwise, we assign the upper and lower bounds of the economy- and variable-specific winsorization level to these firms.

In addition to the special winsorization of the firm–specific variables, we also implement a winsorization of 5 and 95 percentiles for stock index return used as one of the common variables to the 3 groups of economies: Asia-Pacific Developed, Emerging Market, and Europe.

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

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

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

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

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

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

3.2 Distance-to-Default Computation

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

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

$$dV_t = \mu V_t dt + \sigma V_t dB_t. \tag{34}$$

Here, B_t is the standard Brownian motion, μ is the drift of the asset value in the physical measure, and σ is the volatility of the asset value. Following the Merton [1974] model, the probability of the company's default at time T evaluated at time t is $\Pr_t(V_T \leq L)$, from Eq. (34), we can derive $\Pr_t(V_T \leq L) = N(-\text{DTD}_t)$, where DTD at time t is defined as:

$$\text{DTD}_t = \frac{\log\left(\frac{V_t}{L}\right) + \left(\mu - \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}. \tag{35}$$

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

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

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

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

$$E_t = V_t N(d_+) - e^{-r(T-t)} L N(d_-), \tag{36}$$

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

$$d_\pm = \frac{\log\left(\frac{V_t}{L}\right) + \left(r \pm \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}, \tag{37}$$

and $L \equiv L(\delta) =$ Current Liabilities $+ 1/2 \cdot$ Long-term Debt $+ \delta \cdot$ Other Liabilities as mentioned before. Then we can express the likelihood function of the observed equity values by viewing the equity values as the transformed data from pricing formula in Eq. (36). It should be noted that the transformation involves the unknown asset volatility. By standard transformation theory, the likelihood of observed equity values must equal the product of the likelihood of the asset values (implied by equity values) and the Jacobian of the inverse transformation (from the equity value back to the asset value). Moreover, following Duan et al. [2012], the firm's market value of assets is standardized by its book value A_t, so that the scaling effect from a major investment or financing by the firm will not distort the time series from which the parameter values are estimated. Thus, the log-likelihood function based on equity prices is:

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

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. (36), $\hat{d}_+$ is computed with Eq. (37) 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. (36). If there are fewer than 50 days of valid observations for the DTD input variables (market capitalization, FS variables, and interest rate), the DTD value is set to be missing. An observation is valid if there is positive trading volume that day. If the trading volume is not available, the observation is assumed to be valid if the value for the market capitalization changes often enough. The precise criterion is as follows: if the market capitalization does not change for three days or more in a row, the first day is taken as a valid observation, and the remaining days with the same value are set to be missing.

A straightforward idea for the DTD computation is to first estimate the three variables μ, σ and δ via maximizing the log-likelihood function (38) over $\sigma \geq 0$ and $0 \leq \delta \leq 1$, and then to calculate the DTD from Eq. (35). 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

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

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

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

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

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

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

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

It was found that after applying the two-stage procedure described above, the estimate of μ was frequently unstable and could lower the explanatory power of DTD. For example, suppose a firm has a large drop in its implied asset value in January 2011, so that the estimated μ is negative for the DTD calculation at the end of December 2011. If there is little change in the company in January 2012, then the drop in implied asset value in January 2011 is no longer within the observation window for the DTD calculation at the end of January 2012. There will be a large increase in the estimated μ, resulting in a substantial improvement of the DTD just because of the moving observation window. To avoid this problem, we now set μ to be equal to $\sigma^2/2$. So in calculating DTD, the second term in the numerator of Eq. (35) is eliminated.

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

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

3.3 Calibration

Implementation: As shown in Section 1, the calibration of the forward intensity model involves multiple maximum pseudo-likelihood estimations, where the pseudo-likelihood functions are given in Eq. (15). 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, CA/CL, 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, CA/CL level and trend, and NI/TA level and trend, 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 88 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. The other emerging economies of Asia-Pacific, Latin America, Middle-East, and Africa form the "emerging markets" calibration group, which now includes 9 African economies: Botswana, Ghana, Kenya, Malawi, Mauritius, Namibia, Rwanda, Tanzania, and Uganda. Detailed grouping can be found in Table A.4.

All economies in the same calibration group share the same coefficients for all common variables except for the 3-month interest rate variable. In particular, we apply standardization to each economy's interest rate time series, except for China and India. First, we subtract the historical month-end mean from the 3-month interest rate variable in order to reflect the contemporary change relative to the historical average. We then scale the demeaned values so that the standard deviation equals one. Doing so allows to put all economies on the same scale so that the same interest rate parameter can be reasonably used on firms from different countries/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 standardized interests. For the Eurozone economies, all of them use the standardized Germany's 3-month Bubill rate after the Eurozone was launched on January 1st, 1999. This aims to reflect more of the monetary rather than the sovereign credit conditions in those economies. Before joining the Eurozone, each of those economies except Germany uses own standardized interest rates, 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 the same 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 firm's 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. Our research also reveals that debt–ridden countries (e.g., Venezuela) are usually susceptible to hyperinflation so that the market value of the firms under the severe economic turmoil is not trustworthy.

To avoid this problem, we use the economy's median market cap over the past one year as the divisor in the Relative Size variable:

1. We collect the whole market cap data of individual firms in a specific economy over the past one year.
2. We calculate the ratio of individual firm's market cap to the economy's median market cap calculated above.
3. We take a natural logarithm to reduce its variability.

3.4 Daily Output

Individual firms' PD: In computing the pseudo-log-likelihood functions in Eq. (15), only the end of month data is needed. The data needs to be extended to daily values in order to produce daily PDs.

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

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

Aggregating PDs: The CRI provides term structures of the probability distributions for the number of defaults as well as the expected number of defaults for different groups of firms. The companies are grouped by their domicile country (using the location of a firm's headquarter), by sector (using the firm's Bloomberg industrial sector code) and sectors within economies. However, the dual-listed companies (for example, Rio Tinto) exist as a single corporation, but retain two different legal identities. They may have two different sets of PDs, due to two exchange listings for separate entities, but sharing the same domicile. In such cases, we will override the entity's default domicile country to follow its stock exchange's location.

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

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

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

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

4 Empirical Analysis

This section presents an empirical analysis of the CRI outputs for the 88 economies with their own exchange that are currently being covered. In Subsection 4.1, an overview is given of the default parameter estimates. Subsection 4.2 explains and provides the accuracy ratios for the different countries under the CRI coverage.

4.1 Parameter Estimates

With 60 months of forecast horizons, 17 variables (16 variables plus an intercept), 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 2020 (December calibration) using data until the end of December 2019. 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 forward 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 the different relationships 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.

Aggregate DTD can measure the overall degree of the volatility-adjusted leverage in an economy. As mentioned in Subsection 2.1, we use two kinds of sector–specific aggregate DTDs: one for financial firms, and the other for non–financial firms. In each economy, the default parameters for the two aggregate DTDs usually display different patterns. Such patterns may reflect different credit risk profiles of the economy–wide business environments.

The log ratio of the sum of cash and short-term investments to total assets (CASH/TA) measures liquidity of a financial firm. Likewise, the log ratio of current assets to current liabilities (CA/CL) stands for liquidity of a non–financial firm. These two ratios indicate the availability of a firm's funds and its ability to make interest and principal payments. On the whole, almost all economies have negative default parameters for such liquidity ratios, although the short–term and long–term effects differ across each calibration group.

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 over the past one year 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. The lack of similarity may reflect the different business environments in such respective economies.

The default parameters associated with DTD Trend, CASH/TA Trend, CA/CL 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 individual firm's M/B to the economy M/B median (M/B) can either indicate the market mis-valuation effect or the future growth effect. This default parameter is negative for the US in the shorter term, indicating that higher M/B implies lower PD, and the future growth effect dominates during this period. On the other hand, in China and in the Developed Asia-Pacific calibration group, the default parameter for M/B is positive, indicating that for these economies, the market mis-valuation effect dominates.

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

4.2 Prediction Accuracy

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

A single calibration is conducted for the in-sample tests, using data until 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 measures 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 indicates a completely random rating system and 1 stands for a perfect rating system. The range of possible AUROC values is in [0.5, 1]. AUROC and AR values are related by: AR = 2×AUROC - 1.

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

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

The AR in some emerging market economies such as China, India, Indonesia, and the Philippines are noticeably weaker than the results in the developed economies. This can be due to a number of issues. The quality of data is worse in emerging markets, in terms of availability and data errors. This may be due to lower reporting and auditing standards. Also, variable selection is likely to play a more important role in emerging markets. The variables are 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 to B.8. For India in particular, these figures show that there is room for improvement in the predictive power of the model.

5 Corporate Vulnerability Index

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

1. Value-weighted CVI (CVI_{vw}) RMI-CRI PDs are aggregated with each firm weighted by its market capitalization so that the size of each firm is taken into account.
2. Equally-weighted CVI (CVI_{ew}) RMI-CRI PDs are aggregated with each firm equally weighted. This captures the prevalence of credit risk by focusing on the number of firms at risk.

3. Tail CVI (CVI_{tail}) In taking the 5th percentile of the highest RMI-CRI PDs, the most vulnerable firms in a group are measured.

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

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

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

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

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

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

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

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

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

6 Actuarial Spread

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

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

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

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

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

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

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

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

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

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

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

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 17 variables in general, including an intercept term, 4 common covariates and 12 firm-specific covariates, in the form of

$$f_t(u) = \exp\{\alpha_0(u) + \alpha_1(u)x_{1,t} + \ldots + \alpha_{16}(u)x_{16,t}\},$$

and

$$h_t(u) = \exp\{\beta_0(u) + \beta_1(u)x_{1,t} + \ldots + \beta_{16}(u)x_{16,t}\}.$$

In this similar manner, 15 variables for China apply to the two intensities (see Subsection 2.1). 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

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

for $i = 0, 1, 2, \ldots, 16$. 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 $i = 1, 2, \ldots, 16$. With $f_t(u)$ and $h_t(u)$ in place, we are ready to define $\psi_t(s,q) = \frac{\sum_{u=s}^{q}[f_t(u)+h_t(u)]}{q-(s-1)}$, for $q \geq s \geq 1$, which is a standardized forward termination intensity covering the days $t+s, \ldots, t+q$.

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

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

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

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

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

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

$$E_t^p\left[e^{-r_t(1,\tau-t)(\tau-t)/365} \cdot \mathbb{1}_{\left\{t<\tau\leq t_k^{'}\right\}}\right]$$

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

;and

$$E_t^p\left[A(t_{i-1} \vee (t+1), \tau)\right] \cdot e^{-r_t(1,\tau-t)(\tau-t)/365} \cdot \mathbb{1}_{\{t_{i-1}'<\tau\leq t_i'\}}$$

$$\begin{aligned} = & \sum_{q=t_{i-1}\vee(t+1)}^{t_i'} A(t_{i-1} \vee (t+1), q) \cdot e^{-[r_t(1,q-t)+\psi_t(1,q-t)]\cdot(q-t)/365} \cdot f_t(q-t) \cdot \Delta t \\ + & \sum_{q=t_{i-1}\vee(t+1)}^{t_i'} A(t_{i-1} \vee (t+1), q) \cdot e^{-[r_t(1,q-t)+\psi_t(1,q-t)]\cdot(q-t)/365} \cdot h_t(q-t) \\ & \cdot P_t(q-t, t_i' - t; r_t(1,v), q-t \leq v \leq t_i' - t) \cdot \Delta t \end{aligned}$$

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

7 CriSIFI

In August 2017, the CRI launched the CRI Systemically Important Financial Institution (CriSIFI) on its website (`http://rmicri.org`). The CriSIFI aims to identify systemic risks of those banks and insurers by capturing their tendency to default together (i.e., too connected to fail) along with their respective asset sizes (i.e., too big to fail). For example, a financial institution with a higher ranking (e.g., 10 is a higher ranking than 20) is likely to pose a higher risk to the financial system and thus has greater systemic importance than does a lower ranked firm. In short, the CriSIFI relies on a novel way to construct a proper financial network which combines nodes and edges of a network.

- Node: firm characteristics captured by the ratio of individual financial institution's assets over the network's total assets
- Edge: network configuration reflected through partial default correlations of financial institutions

The CriSIFI data panel is monthly updated and starts from January 2000. The CriSIFI is updated monthly on the CRI website where all exchanged-traded banks (banks and investment banks) and insurers globally are included. For details, see Table A.1 for the CRI coverage. The CriSIFI can be used to track and monitor systemic risk of each financial institution in the global financial system. Apart from the CriSIFI, the CRI reports "the CRI Systemically Important Bank (CriSIB)" and "the CRI Systemically Important Insurer (CriSII)" globally, or within a local community such as region (e.g., North America and Asia-Pacific Developed economies) and economy (e.g., U.S. and Singapore). All three systemic importance indicators can help identify potential systemic risk via financial institutions' connectedness in the global financial network. Next, we explain how to construct the CriSIFI.

7.1 Constructing the forward-looking PD partial correlation matrix

A primary input to the CriSIFI is the forward–looking PD (probability of default) partial correlation matrix, which is used to measure connectedness between financial institutions in the network. This partial correlation matrix is generated from the forward–looking PD total correlation matrix using the model of Duan and Miao [2016], which is a factor model along with sparsely correlated residuals for PDs and POEs (probabilities of other exist) of all firms considered. It is worth noting that POE is a crucial element for properly estimating multiple–period default probabilities, because suitable survival probability of a firm in a multiperiod context cannot be determined without POE (see Duan et al. [2012]). Omitting POE is particularly troublesome when knowing that POEs are empirically many folds larger than PDs. First, we briefly explain how to obtain the forward–looking PD total correlation matrix. It is important to note that our methodology follows that of Chan-Lau et al. [2016], which is largely based on Duan and Miao [2016] except for deploying a logit transformation instead of a double–log transformation.

(a) Define one pair of predetermined global factors, ten pairs of predetermined industry factors, and one pair of predetermined economy factors for each economy of domicile (one–month, logit–transformed, median PD and POE). The logit transformation, denoted by a hat, has the following form:

$$\widehat{PD} = \log \frac{PD}{1 - PD} \text{ and } \widehat{POE} = \log \frac{POE}{1 - POE}.$$

The logit transformation is valid because PDs and POEs all fall in (0,1). A dynamic model is then constructed on these 24 $\widehat{PD}$ and $\widehat{POE}$ factors. Later, the inverse transformation will be applied to recover simulated model PD and/or POE factors:

$$PD = \frac{\exp(\widehat{PD})}{1 + \exp(\widehat{PD})} \text{ and } POE = \frac{\exp(\widehat{POE})}{1 + \exp(\widehat{POE})}.$$

(b) In particular, the predetermined economy pair should have at least 30 observations available in the domicile economy. Otherwise, we use the median PD/POE pair of aggregation groups as a substitution: Asia Pacific (Developed), Asia Pacific (Emerging), Europe, Latin America & Caribbean, Sub–Saharan Africa, or Middle East, North Africa & Central Asia. In case an economy has sufficient observations (equal or more than 30) in the history but not later on, we continue to use the economy median. If the economy has fewer observations earlier but sufficiently large later on, we allow the switch from the group median to the economy median to happen but for only once.

(c) The global pair of $\widehat{PD}$ and $\widehat{POE}$ are normalized to have mean 0 and variance 1. For each industry factor, regress $\widehat{PD}$ (or $\widehat{POE}$ factor) on the pair of the global factors to remove any shared information arising from the global factors (i.e., orthogonalization). Henceforth, the industry factors refer to the "orthogonalized regression residuals" uncorrelated with the global factors. We then normalize the 10 industry pairs of $\widehat{PD}$ and $\widehat{POE}$ residuals and the 1 predetermined pair of $\widehat{PD}$ and $\widehat{POE}$ to have a standard deviation of 1 (i.e., normalization).

(d) Model the factors with a bivariate vector autoregressive process of order one without intercept terms, i.e., VAR(1), for each of the 12 pairs of $\widehat{PD}$ and $\widehat{POE}$ factors by deploying entire historical data series up to the point of analysis. Doing so ensures that the factor dynamics are estimated with data covering different phases of a credit cycle and over several credit cycles. Note that the intercept terms are set to zero because normalization has removed the mean.

(e) Estimate the "best" factor model by regressing individual firm $\widehat{PD}$ on 12 global, industry, and economy $\widehat{PD}$ factors using a 60–month moving data window. Likewise, regress individual firm $\widehat{POE}$ on 12 global, industrial, economy $\widehat{POE}$ factors. Deploy the adaptive lasso technique of Zou [2006] with cross–validation in these regressions to avoid overfitting.

(f) Individual firm's factor model residuals (60 data points at most) are treated as an AR(1) process, and the AR residuals are then used to compute cross–firm correlations. Note that some individual firm's $\widehat{PD}$ and $\widehat{POE}$ are missing due to bankruptcies and/or mergers/acquisitions. We thus construct the AR residual correlation matrix by first computing pairwise correlations, and then apply thresholding coupled with cross–validation to identify a legitimate "sparse" AR residual total correlation matrix.

(g) Use the estimated factor model along with sparse residual correlations to simulate future PDs and POEs for all financial institutions under consideration, and with which we can apply the survival/default formula on the simulated PDs and POEs to obtain PD over any prediction horizon of interest via Monte Carlo averaging of the stochastic PD term structure for each financial institution. This theoretical PD term structure under a particular parameter value serves as the basis to recalibrate factor loadings for every financial institution via a single firm–specific scaling factor and the parameters of its residual AR(1) model. Our recalibration is implemented to fit the 5–year PD term structure provided by the CRI system. This recalibration step ensures that default correlations are obtained not at the expense of poorly matching the available PD term structure individually.

(h) Use the recalibrated model to simulate PDs and POEs for a specific horizon of interest (e.g., one year) at any future time point (e.g., one month later), and estimate the forward–looking total default correlation matrix using the simulated sample.

Importantly, we focus on the forward–looking default correlation via simulation, not on the historical average available from the time series of PDs in the CRI database. The reason is that this average measure represents backward-looking comovements, which does not represent the future when one goes through different phases of a credit cycle. In contrast, the forward-looking correlations reflect the currently available information and should better gauge the potential riskiness going forward. Readers who are interested in comparing the forward-looking and backward-looking results are referred to Chan-Lau et al. [2016]. Other practical considerations also favor forward-looking default correlations over historical default correlations. For example, considering 1–year PD correlations over a period of six months instead of one month would see a dramatic reduction in usable sample size by a factor of six.

Apart from the use of the forward–looking PDs, we focus on "partial" not "total" correlations. Partial correlation is the residual correlation after removing any indirect connections through other parties in the network. Conceptually, partial correlation rightfully captures the direct default connection between any two financial institutions. Of course, indirect connections are also of interest for network analysis, but they are already reflected through the network configuration represented by many direct bilateral linkages. We obtain the partial default correlation matrix through a regularization technique.

We use the CONCORD (CONvex CORrelation selection methoD) algorithm of Khare et al. [2015] and Oh et al. [2014]. Conceptually, it amounts to imposing zero partial correlations on pairs with weak ties. The CONCORD algorithm also ensures convergence because it preserves convexity through an appropriate selection of weights and a particular design of the penalty term on the concentration matrix rather than on the partial correlation matrix. In addition, the high dimensional data calls for regularization, simply because high dimensionality left un-regularized may deliver a highly unstable partial correlation matrix. As a result, the globally connected and regularized network will be more stable and does not generate an overwhelmingly large number of systemic firms.

Specifically, the CONCORD objective is to minimize

$$Q_{con}(\Omega) = \frac{N}{2}\left[-\ln\left[\det(\Omega_D^2)\right] + \mathrm{tr}(S_N\Omega^2) + \lambda||\Omega_X||_1\right],$$

where $\det(\cdot)$ denotes the determinant operator; $\mathrm{tr}(\cdot)$ denotes the trace operator; S_N is the sample correlation matrix computed with a sample size of N; $\Omega = \Omega_D + \Omega_X$ is the concentration matrix (i.e., the inverse of the correlation matrix); $\lambda > 0$ is the tuning parameter used to determine the shrinkage rate or how aggressively one penalizes the non–zero entries in Ω_X; $\lambda||\Omega_X||_1 = \lambda\sum_{i\neq j}|\omega_{ij}|$ is the L_1–penalty term; and ω_{ij} is the off–diagonal element in Ω_X. Here, we select a λ below which totally isolated firms in the network begin to emerge. The tolerance error for finding the optimal λ and the partial correlation precision are respectively set to 10^{-3} and 10^{-4}. For technical details, see Chan-Lau et al. [2016].

7.2 Computing the CriSIFI

The CriSIFI is a network centrality indicator used to assess the relative importance of a financial institution in the network, and is the appropriate entry in the non-negative eigenvector of $Q|\bar{P}_{X,t}|Q$ that corresponds to the largest eigenvalue. $|\bar{P}_{X,t}|$ is the absolute value of $\bar{P}_{X,t}$ and $\bar{P}_{X,t}$ denotes the 12–month moving average of $P_{X,t}$, the regularized partial correlation matrix at time t after setting its diagonal elements to 0. Deploying the 12-month moving average is to remove the excessive noise. Q is a diagonal matrix with q_i as its i–th diagonal element where q_i is the size of a financial institution over the total size of the network, measured in USD;

Technically, $Q|\bar{P}_{X,t}|Q$ is a non–negative matrix, and the Perron–Frobenius theorem ensures the existence of such a non–negative eigenvector.

The CriSIFI captures both the node (the firm's asset size) and edge (the strength of connectedness reflected in the partial correlation) characteristics in the financial network. We contend that our forward-looking systematic risk ranking, combining both the edge and node characteristics, is much more comprehensive than the alternatives: (1) a backward-looking ranking measure, and (2) any measure that only factors in one of the two characteristics. Therefore, under the CriSIFI small financial institutions being connected to large ones may present significant systemic risks simply due to the feedback effect from their connected larger counter–parties. Chan-Lau et al. [2016] also compare the performance of the CriSIFI with those of other measures such as Global Systemically Important Banks (G-SIBs) released by the Financial Stability Board (FSB). They find that the G-SIBs are likely to be biased toward singling out large financial institutions in the system, and overall connectivity only plays a rather minor role.

8 Probability of Default implied Rating (PDiR)

The CRI team has developed a generic technique that can translate the CRI-PD or any granular PD system into a credit rating/scoring system. The need for such reverse engineering is rather obvious in terms of business applications. The long tradition of credit rating practice has developed a deeply entrenched management infrastructure (business conventions, regulatory regimes and reference knowledge) around it. A credit rating of, say, S&P BBB- and above is known as an investment-grade obligor meeting certain regulatory and/or fiduciary requirements. Merely providing a PD value, regardless of its granularity and scientific quality, simply will not meet usage requirements under many circumstances. In short, a PD system critically needs a rating-equivalent interpretation for its outputs in order to facilitate its business and regulatory adoption.

First introduced by the CRI in 2011, the Probability of Default Implied Rating (PDiR) complements the CRI-PD system by mapping its one-year PD to letter grades used by major rating agencies. Early methods for PDiR aim to match the expected default rates predicted by the CRI-PD and the average historical default rates of the S&P or Moody's global corporate rating pool. However, due to the lack of realized defaults for top categories like AAA and AA+ for the S&P rating pool, proxy values from a linear extrapolation are adopted which are arguably arbitrary. Moreover, a recent effort to tally the proportion of the firms in the CRI sample falling into each of the rating categories suggests that there have been too many firms in the AAA category as compared to the experience of the S&P or Moody's global corporate rating pool. These two considerations have led to the revision effort to roll out PDiR2.0 based on the work of Duan and Li [2020]. PDiR2.0 has been implemented by the CRI starting April 13, 2020. It enhances the PD mapping by targeting the average realized credit rating migration experienced by the S&P or Moody's global corporate rating pool instead of relying solely on the reported default rates of the pool.

PDiR2.0 determines the suitable boundary CRI-PD levels for each of the rating categories used by rating agencies, and defines the migration rule with buffer zones built in to reflect rating stickiness. Currently, we provide the mapping tables of 1-year PD to PDiR calibrated to the realized credit rating migration history of the S&P and Moody's global rating pool. See Tables C.1 and C.2 for the results as of April 13, 2020. We assign the initial ratings for any firms by mapping its 10-business day moving average PD against the upper and lower bounds in the first 2 columns of the tables. The upper and lower bounds for upgrade/downgrade to a specific cohort are defined in the last 4 columns. The design with migration buffer zones creates latency in rating changes, intending to mimic the commercial credit rating practice. For example, a firm is upgraded from A+ to AA only if its moving average PD is smaller than AA's lower bound defined in the initial assignment. The methodology to estimate the boundary PD values is briefly sketched below.

Step 1: Obtain target rating migration matrix

We obtain the S&P average realized one-year migration matrix over the 18-year sample period (from 2000 to 2017). [5] We consolidate 21 rating categories inclusive of those with a plus/minus modifier into 9 combined categories in a natural way, i.e., putting those with a modifier into the same category as those without. We then construct rating migration matrix of dimension 9 by 10 with the last column holding the default rates corresponding to the 9 rating cohorts. To account for the substantially different other-exit rates facing S&P and CRI, we gross up each row of the migration matrix with the one minus other-exit rate unique to each rating cohort so that each row of the adjusted migration matrix has a row sum equal to 1. The grossed-up average realized rating migration matrix is our target matrix denoted by $\hat{M}$

Step 2: Obtain PD implied migration matrix

The upper PD bound for a rating category simultaneously serves as the lower bound of the adjacent category of less credit quality. Therefore, 8 cutoff values along with two natural PD bounds of 0 and 1 define the 9 consolidated rating categories. These 8 PD upper bounds are denoted by $\theta = (U_{AAA}, U_{AA}, U_A, U_{BBB}, U_{BB}, U_B, U_{CCC}, U_{CC})$, and they must be increasing in values. We divide each PD segment defined by θ into four subsegments. The top (bottom) 25% subsegment is reserved for the rating with a minus (plus) modifier, which also help define the migration buffer zones. After the initial rating assignment of a firm, migration to another category only occurs if its 10-day moving average PD crosses beyond a complete finer rating category. That is, an A obligor is downgraded to BBB+ only if its PD moves into the interval defined by BBB. Likewise, to upgrade a BBB+ obligor to A, its PD must move into the interval defined by A+. Category AAA, CC and C do not carry a rating modifier, but they still need buffer zones for migration assignments. To upgrade a firm to AAA (or CC), the 10-day moving average PD must be lower than the PD level corresponding to 75% of the AAA (or CC) interval. To downgrade a firm to CC (or C), the same logic applies, but is instead at the 25% level of the relevant segment.

After assigning firms into the 21 finer rating categories for the CRI sample over the 18-year sample period, we group all firms into the 9 consolidated rating categories, tally the results, and gross up by the other-exit rates to generate the model's implied 9 by 10 average realized migration matrix. Denote the model's final implied rating migration matrix by $M(\theta)$.

Step 3: Calibrate PD boundaries defining PDiR classes

The calibration objective is to find the value of θ that minimizes the sum of squared differences between the S&P observed and PD-implied rating migration matrices, i.e., $\hat{M}$ and $M(\theta)$. However, we include only three components in the calibration target. They are the diagonal, two immediate off-diagonal terms (one in each direction) and the 10th column holding default rates. Other elements of the 9 by 10 matrix are ignored because their values are small and prone to sampling errors. In addition to the constraint of increasing values placed on the elements of θ, we require the proportion of AAA firms in the CRI sample to be no less than 1.5%, a level comparable to that of the S&P global corporate rating pool. Without it, we would have substantially fewer AAA firms. Mathematically, we are solving the following

[5] Our data source is European Securities and Markets Authority (ESMA)'s central repository (CEREP).

minimization problem,

$$\min_{\theta} \sum_{i=1}^{9} \sum_{j \in A_i} (M_{i,j}(\theta) - \hat{M}_{i,j})^2$$
$$subject\ to \begin{cases} \theta\ satisfies\ \ 0 < U_{AAA} < U_{AA} < \cdots < U_{CC} < 1 \\ P_{AAA}(\theta) \geq P_{AAA}(S\&P) = 1.5\% \end{cases}$$

where

$$A_i = \begin{cases} 1, 2, 10 & i = 1 \\ i-1, i, i+1, 10 & 2 \leq i \leq 8 \\ 8, 9, 10 & i = 9 \end{cases}$$

defines the element/column indices included in the objective function. $P_{AAA}(\theta)$ is the percentage of firms classified as AAA according to the PD cutoff values while $P_{AAA}(S\&P)$ is the observed percentage of AAA firms under the S&P global rating pool. The minimization is executed by adopting the density-tempered sequential Monte Carlo (SMC) technique of Duan and Fulop [2015], which is detailed in Duan and Li [2020].

9 Ongoing Developments

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

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

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

Acknowledgements

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

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

A APPENDIX: DATA

Table A.1: All economies under the CRI coverage

Region	Economy
Asia Pacific (Developed) (7)	Australia, Hong Kong, Japan, New Zealand, Singapore, South Korea, Taiwan.
Asia Pacific (Emerging) (17)	Bangladesh, Cambodia, China, India, Indonesia, Kazakhstan, Laos, Macau, Malaysia, Mongolia, Myanmar, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand, Vietnam.
North America (4)	Bermuda, Canada, Greenland, United States.
Western Europe (28)	Austria, Belgium, Cyprus, Denmark, Faeroe Islands, Finland, France, Germany, Gibraltar, Greece, Guernsey, Iceland, Ireland, Italy, Isle of Man, Jersey, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, Reunion, Spain, Sweden, Switzerland, United Kingdom.
Eastern Europe (20)	Azerbaijan, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Latvia, Lithuania, Macedonia, Montenegro, Poland, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Turkey, Ukraine.
Latin America & Caribbean (19)	Argentina, Bahamas, Belize, Brazil, British Virgin Islands, Cayman Islands, Chile, Colombia, Curacao, Dominican Republic, Falkland Islands, Jamaica, Mexico, Peru, Panama, Puerto Rico, Uruguay, U.S. Virgin Islands, Venezuela.
Middle East & Africa (33)	Angola, Bahrain, Botswana, Cameroon, Egypt, Gabon, Ghana, Iraq, Israel, Jordan, Kenya, Kuwait, Madagascar, Malawi, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Niger Republic, Oman, Qatar, Rwanda, Saudi Arabia, Sierra Leone, South Africa, Sudan, Tanzania, Togo, Tunisia, Uganda, United Arab Emirates, Zambia.

Table A.2: The 88 economies 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 (22)	Bahrain, Botswana, Egypt, Ghana, Israel, Jordan, Kenya, Kuwait, Malawi, Mauritius, Morocco, Namibia, Nigeria, Oman, Qatar, Rwanda, Saudi Arabia, South Africa, Tunisia, Uganda, United Arab Emirates, United Republic of Tanzania.

Table A.3: The 40 economies under the CRI coverage for which we cover companies domiciled in the economy but listed on a foreign exchange included in Table A.2. The gray boxes indicate that these economies also have their own local stock exchange.

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

Table A.4: The ISO codes of 88 economies covered by the CRI and the corresponding calibration groups and stock exchanges.

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

Continued on next page

Table A.4 – *Continued from previous page*

ISO Code	Economy	Calibration Group	Stock Exchange
			London Stock Exchange
			Professional Liability Underwriting Society Market Group
GHA	Ghana	Emerging	GSE Composite Index
GRC	Greece	Europe	Alternative Market of Athens Exchange
			Athens Stock Exchange
HKG	Hong Kong	Developed Asia-Pacific	Hong Kong Exchanges and Clearing Limited
HRV	Croatia	Europe	Zagreb Stock Exchange
HUN	Hungary	Europe	Budapest Stock Exchange
IDN	Indonesia	Emerging	Indonesian Stock Exchange
IND	India	India	Bombay Stock Exchange
			MCX Stock Exchange Limited
			National Stock Exchange of India Limited
IRL	Ireland	Europe	Irish Stock Exchange
ISL	Iceland	Europe	Iceland Stock Exchange
ISR	Israel	Europe	Tel Aviv Stock Exchange
ITA	Italy	Europe	Borsa Italiana S.p.A
			Hi-Multilateral Trading Facilities Sim S.p.A
JAM	Jamaica	Emerging	Jamaica Stock Exchange
JOR	Jordan	Emerging	Amman Stock Exchange
JPN	Japan	Developed Asia-Pacific	Fukuoka Stock Exchange
			JASDAQ Securities Exchange
			Nagoya Stock Exchange
			Osaka Securities Exchange
			Sapporo Stock Exchange
			Tokyo Stock Exchange
KAZ	Kazakhstan	Emerging	Kazakhstan Stock Exchange JSC
KEN	Kenya	Emerging	Kenya Nairobi Stock Exchange Index
KOR	South Korea	Developed Asia-Pacific	Korea New Exchange
			Korea Stock Exchange
			Korean Securities Dealers Automated Quotations
KWT	Kuwait	Emerging	Kuwait Stock Exchange
			Bloomberg Kuwait Premier Market Total Return Index
LKA	Sri Lanka	Emerging	Colombo Stock Exchange
LTU	Lithuania	Europe	OMX Vilnius Stock Exchange
LUX	Luxembourg	Europe	Luxembourg Stock Exchange
LVA	Latvia	Europe	OMX Riga Stock Exchange
MAR	Morocco	Emerging	Casablanca Stock Exchange
MEX	Mexico	Emerging	Mexican Stock Exchange
MKD	Macedonia	Europe	Macedonian Stock Exchange Inc.
MLT	Malta	Europe	Malta Stock Exchange
MNE	Montenegro	Europe	Montenegro Stock Exchange
MUS	Mauritius	Emerging	Mauritius Stock Exchange SEMDEX Index

Continued on next page

Table A.4 – *Continued from previous page*

ISO Code	Economy	Calibration Group	Stock Exchange
MWI	Malawi	Emerging	Malawi All Share Index
MYS	Malaysia	Emerging	Kuala Lumpur Stock Exchange
NAM	Namibia	Emerging	Namibia Overal Index
NGA	Nigeria	Emerging	Nigerian Stock Exchange
NLD	Netherlands	Europe	Euronext Amsterdam Stock Exchange
NOR	Norway	Europe	Oslo Stock Exchange
NZL	New Zealand	Developed Asia-Pacific	New Zealand Exchange
OMN	Oman	Emerging	Muscat Securities Market
PAK	Pakistan	Emerging	Karachi Stock Exchange Pakistan Stock Exchange
PER	Peru	Emerging	Lima Stock Exchange
PHL	Philippines	Emerging	Philippine Stock Exchange
POL	Poland	Europe	Warsaw Stock Exchange
PRT	Portugal	Europe	Euronext Lisbon Stock Exchange
QAT	Qatar	Emerging	Qatar Exchange (QE) Index
ROM	Romania	Europe	Bucharest Stock Exchange Sibiu Stock Exchange
RUS	Russian Federation	Europe	Moscow Exchange Moscow Interbank Currency Exchange Russian Trading System
RWA	Rwanda	Emerging	Rwanda Stock Exchange All Share Index
SAU	Saudi Arabia	Emerging	Saudi Stock Exchange
SGP	Singapore	Developed Asia-Pacific	Singapore Exchange
SRB	Serbia	Europe	Belgrade Stock Exchange
SVK	Slovakia	Europe	Bratislava Stock Exchange
SVN	Slovenia	Europe	Ljubljana Stock Exchange
SWE	Sweden	Europe	AktieTorget Stock Exchange First North Stockholm Nordic Growth Market Stockholm Stock Exchange
THA	Thailand	Emerging	Stock Exchange of Thailand
TUN	Tunisia	Emerging	Tunis Stock Exchange
TUR	Turkey	Europe	Istanbul Stock Exchange
TWN	Taiwan	Developed Asia-Pacific	Taiwan Stock Exchange
TZA	United Republic of Tanzania	Emerging	Tanzania Share (TSI) Index
UGA	Uganda	Emerging	Uganda SE All Share Index
UKR	Ukraine	Europe	First Stock Trading System Russian Trading System Ukraine
USA	United States	North America	NASDAQ Capital Market NASDAQ Global Market NASDAQ Global Select Market New York Stock Exchange NYSE Arca NYSE MKT LLC Bats Stock Exchange
VEN	Venezuela	Emerging	Caracas Stock Exchange
VNM	Vietnam	Emerging	Hanoi Stock Exchange Ho Chi Minh City Stock Exchange
ZAF	South Africa	Emerging	Johannesburg Stock Exchange

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

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

Economy	Stock Index	Period Used*
ARE	FTSE NASDAQ DUB UAE 20	06/28/2006 - Present
ARG	Buenos Aires Stock Exchange Merval Index	
AUS	All Ordinaries Index	
AUT	Austrian Traded ATX Index	
BEL	Belgian Stk Mkt Ret Index	
BGD	DSEX Index	01/28/2013 - Present
	Dhaka Stock Exchange General I	- 01/27/2013
BGR	Bulgaria Stock Exchange Sofix Index	10/24/2000 - Present
BHR	BB All Share Index	07/08/2004 - Present
BIH	SASE Free Market 10 Index	12/31/2004 - Present
BRA	Brazil Bovespa Stock Index	
BWA	Botswana Domestic Companies Index	06/30/1989 - Present
CAN	S&PTSX Composite Index	
CHE	SPI Swiss Performance Index	
CHL	Santiago Stock Exchange IPSA Index	
CHN	Shanghai SE Composite Index	12/19/1990 - Present
COL	FTSE All World Series Colombia Local	01/01/1999 - Present
CYP	Cyprus Stock Exchange General Index	09/03/2004 - Present
	Cyprus Stock Exchange General	04/02/1996 - 09/02/2004
CZE	Prague Stock Exchange Index	04/05/1994 - Present
DEU	CDAX Performance Index	
DNK	OMX Copenhagen 20 Index	
EGY	EGX 100EW Index	10/05/2020 - Present
	EGX 100 Index	05/01/2006 - 09/05/2020
ESP	IBEX 35 Index	
EST	OMX Tallinn OMXT	06/03/1996 - Present
FIN	OMX Helsinki Index	
FRA	CAC 40 Index	
GBR	FTSE 100 Index	
GHA	GSE Composite Index	12/31/2010 - Present
GRC	Athex Composite Share Price Index	
HKG	Hang Seng Index	
HRV	Croatia Zagreb CROBEX	06/14/2002 - Present
HUN	Budapest Stock Exchange Index	01/02/1991 - Present
IDN	Jakarta Composite Index	
IND	BSE Sensex 30 Index	
IRL	ISEQ Overall Index	
ISL	OMX Iceland All-Share PR	12/31/1992 - Present
ISR	Tel Aviv 100 Index	12/31/1991 - Present
ITA	FTSE Italia All-share Index	11/02/2020 - Present
	Italy Stock Market BCI Comit Globale	- 10/02/2020
JAM	Jamaica Stock Exchange Market Index	
JOR	MSCI Jordan Index	
JPN	Nikkei 500	
KAZ	Kazakhstan Stock Exchange Index KASE	07/12/2000 - Present
KEN	Keyna Nairobi Stock Exchange Index	01/11/1990 - Present
KOR	KOSPI Index	
KWT	Bloomberg Kuwait Premier Market Total Return Index	04/01/2018 - Present
	Kuwait SE Weighted Index	01/02/2012 - 03/31/2018

Continued on next page

Table A.5 – *Continued from previous page*

Economy	Stock Index	Period Used*
	Kuwait Global General Index	- 01/01/2012
LKA	Sri Lanka Colombo Stock Exchange All-Share Index	
LTU	OMX Vilnius OMXV	01/04/2000 - Present
LUX	Luxembourg Stock Exchange Luxx Index	01/04/1999 - 01/04/1999
	Luxembourg Stock Exchange 13 'Dead'	01/02/1998 - 01/03/1999
LVA	OMX Riga OMXR	01/03/2000 - Present
MAR	MASI Free Float All Shares Index	03/31/1995 - Present
	CFG 25 CFG 25	12/31/1993 - 03/30/1995
MEX	Mexico Bolsa Index	01/19/1994 - Present
MKD	Macedonian Stock Exchange MBI 10	12/30/2004 - Present
MLT	Malta Stock Exchange	12/27/1995 - Present
MNE	Montenegro Stock Exchange Index	01/04/2015 - Present
	Montenegro Stock Exchange 20	03/03/2003 - 03/31/2015
MUS	Mauritius Stock Exchange SEMDEX Index	07/05/1989 - Present
MWI	Malawi All Share Index	11/15/1996 - Present
MYS	FTSE Bursa Malaysia KLCI	
NAM	Namibia Overall Index	12/19/2003 - Present
NGA	Nigeria Stock Exchange All Share	01/30/1998 - Present
NLD	AEX-Index	
NOR	OBX Price Index	
NZL	NZX All Index	03/30/1992 - Present
OMN	MSM30 Index	03/31/1992 - Present
PAK	Karachi All Share Index	03/11/1998 - Present
PER	S&PBVL Peru General Index TR PEN	01/05/2015 - Present
	Bolsa de Valores de Lima General Sector Index	01/02/1990 - 04/30/2015
PHL	Philippine Stock Exchange Index	
POL	WSE WIG Index	04/16/1991 - Present
PRT	PSI General Index	
QAT	Qatar Exchange (QE) Index	08/10/1998 - Present
ROM	Bucharest BET Plus Index	06/23/2014 - Present
	BSE Composite Index	04/17/1998 - 06/22/2014
RUS	MICEX Index	09/22/1997 - Present
RWA	Rwanda Stock Exchange All Share Index	01/10/2013 - Present
SAU	Tadawul All Share Index	01/31/1994 - Present
SGP	Straits Times Index	1/10/2008 - Present
	Straits Times Old Index	01/04/1985 - 01/09/2008
SRB	BELEXline Index	10/01/2004 - Present
SVK	Slovak Share Index	09/14/1993 - Present
SVN	HSBC Slovenia Dollar	12/29/1995 - Present
SWE	OMX Stockholm All-Share	
THA	Stock Exchange Of Thai Index	
TUN	Tunis SE TUNINDEX	04/30/1999 - Present
TUR	Istanbul Stock Exchange National 100 Index	
TWN	Taiwan Stock Exchange Weighted Index	
TZA	Tanzania Share (TSI) Index	04/03/2009 - Present
UGA	Uganda SE All Share Index	10/28/2003 - Present
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

Continued on next page

Table A.5 – *Continued from previous page*

Economy	Stock Index	Period Used*
ZAF	MSCI South Africa Index	12/31/1992 - Present

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

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

Economy	Short-Term Interest Rate	Period Used*
ARE	UAE Ibor 3 Month	05/15/2000 - Present
ARG	Argentina Deposit Tate 90 Day	04/01/1991 - Present
AUS	Australia Dealer Bill 90 Day	
AUT	Germany 3 Month Bubill	01/01/1999 - Present
	AUSTRIA VIBOR 3 MONTH	06/10/1991 - 12/31/1998
BEL	Germany 3 Month Bubill	01/01/1999 - Present
	BELGIUM TREASURY BILL 3 MONTH	01/30/1991 - 12/31/1998
BGD	Bangladesh 3 Month Bill Auction Cut Off Yield	
BGR	Bulgaria Interbank 3 Month	02/17/2003 - Present
BHR	Bahrain Ibor 3 Month	12/14/2006 - Present
BIH	-	
BRA	Andima Brazil Govt Bond Fixed Rate 3 Months	04/03/2000 - Present
	Brazil CDB (Up To 30 Days)	10/10/1994 - 04/02/2000
BWA	Botswana, Treasury Bills, Nominal Yield, 3 Month Average	11/01/2004 - Present
CAN	Canada Treasury Bill 3 Month	01/02/1990 - Present
CHE	Swiss Interbank 3m (ZRC:SNB)	
CHL	Chile Overnight Interbank Interest Rate	05/29/1995 - Present
	Chile TAB UF Interbank Rate 90 Days	11/02/1992 - 05/28/1995
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
	Cyprus, TREASURY BILL RATE - 13 WEEK	01/15/1993 - 12/31/2007
CZE	Czech Republic Interbank 3 Month	04/22/1992 - Present
DEU	Germany 3 Month Bubill	05/25/1993 - Present
	Germany Interbank 3 Month	01/02/1986 - 05/24/1993
DNK	Denmark Interbank 3 Month	
EGY	Egypt 91 Day T-Bill	07/06/2004 - Present
ESP	Germany 3 Month Bubill	01/01/1999 - Present
	Spain 3 Month Treasury Bill Yield	11/30/1992 - 12/31/1998
	SPAIN INTERBANK 3 MONTH	12/19/1991 - 11/29/1992
EST	Germany 3 Month Bubill	01/01/2011 - Present
	Estonia, Interest Rates, Prices, Production, & Labour, Interest Rates, DEPOSIT RATE	02/15/1993 - 12/31/2010
FIN	Germany 3 Month Bubill	01/01/1999 - Present
	FINLAND INTERBANK CLOSE 3 MONT	04/01/1992 - 12/31/1998
FRA	Germany 3 Month Bubill	01/01/1999 - Present
	France Treasury Bills 3 Month Intraday	12/29/1995 - 12/31/1998
GBR	UK Treasury Bill Tender 3 Month	01/04/1995 - Present
GHA	Ghana 12 Month T-Bill Auction Average Yield	11/02/2020 - Present
	Ghana 3 Month Bill Auction Average Yield	11/02/2007 - 10/02/2020

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Table A.6 – *Continued from previous page*

Economy	Short-Term Interest Rate	Period Used*
GRC	Germany 3 Month Bubill	01/01/2000 - Present
	GREECE TREASURY BILL 3 MONTH	01/02/1990 - 12/31/1999
HKG	Hong Kong Exchange Fund Bill 3 Month	06/10/1991 - Present
HRV	Croatia Zibor Rate 3 Month	06/02/1997 - Present
HUN	Hungary Interbank 3 Month	09/07/1995 - Present
IDN	Indonesia Interbank 3 Months	07/10/2003 - Present
	Indonesia SBI/DISC 90 Day'dead'	- 07/09/2003
IND	India Treasury Bill 3 Month	05/20/2013 - Present
	India T-Bill Secondary 91 Day	01/15/1993 - 05/19/2013
IRL	Germany 3 Month Bubill	01/01/1999 - Present
	IRELAND INTERBANK 3 MONTH	01/20/1984 - 12/31/1998
ISL	Iceland Interbank 3 - Month	08/04/1998 - Present
	Iceland 90 - Day Cb Notes	- 08/03/1998
ISR	Israel T-Bill Secondary 3 Mnth	05/30/1995 - Present
ITA	Germany 3 Month Bubill	01/01/1999 - Present
	Italy Bots Treasury Bill 3 Month Intraday Gross Yields	09/05/1994 - 12/31/1998
	ITALY T-BILL AUCT. GROSS 3 MONTH	01/15/1988 - 09/04/1994
JAM	Bloomberg Bank of Jamaica 3 Month Treasury Bill Yield	11/30/2010 - Present
	Jamaica 3 Months Repo Rate	07/17/2008 - 11/29/2010
JOR	Jordanian Dinar Interbank Offered Rate 3 Months	09/20/2006 - Present
	Jordan Re-discount rate	03/12/2001 - 09/19/2006
JPN	Japan Treasury Discount Bills 3 Month	07/10/1992 - Present
	Japan Government Bond Interest Rate - 1 Year	- 07/09/1992
KAZ	Kazakhstan KIBOR/KIBID 90 Days Interbank	09/29/2001 - Present
KEN	Thomson Reuters Kenya GVT BMK Bid Yield 3 Months	05/26/2009 - Present
KOR	Korea Commercial Paper 91d	06/14/1993 - Present
KWT	Kuwait Interbank 3 Month	
LKA	Sri Lanka Treasury Bill 3 Month	
LTU	Germany 3 Month Bubill	01/01/2015 - Present
	VILNIUS INTERBANK THREE MONTH	01/06/1999 - 12/31/2014
LUX	Germany 3 Month Bubill	01/01/1999 - Present
	LONG TERM GOVERNMENT BOND YIELDS - MAASTRICHT DEFINITION (AVG.)	01/15/1985 - 12/31/1998
LVA	Germany 3 Month Bubill	01/01/2014 - Present
	TREASURY BILL RATE 3 MONTH	05/11/1994 - 12/31/2013
MAR	Morocco Deposit Rate 3 Month	06/06/2003 - Present
MEX	Mexico Cetes 2nd Mkt. 90 Day	06/26/1996 - Present
	Mexico CETES 91 Day Avg.Ret.At Auc.	- 06/25/1996
MKD	Macedonia Skibor 3 Months	07/02/2007 - Present
MLT	Germany 3 Month Bubill	01/01/2008 - Present
	LONG TERM GOVERNMENT BOND YIELDS - MAASTRICHT DEFINITION (AVG.)	01/15/1985 - 12/31/2007
MNE	-	
MUS	Thomson Reuters Mauritius GVT BMK Bid Yield 1 Year	05/26/2010 - Present
MWI	Malawi 3 Month T-Bill Auction Average Yield	01/02/2009 - Present
MYS	Malaysia Deposit 3 Month	
NAM	Namibia, Treasury Bills, Effective Yield, 3 Month	05/01/1991 - Present
NGA	Nigeria Interbank Offered Rate 3 Month	01/30/2004 - Present
NLD	Germany 3 Month Bubill	01/01/1999 - Present
	Netherlands Interbank 3 Month	01/02/1979 - 12/31/1998

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Table A.6 – *Continued from previous page*

Economy	Short-Term Interest Rate	Period Used*
NOR	Norway Govt Treasury Bills 3 Month	06/27/1995 - Present
	Norway Interbank 3 Month (Effective)	- 06/26/1995
NZL	-	
OMN	OMR 3 Month Deposit	07/16/2002 - Present
PAK	Reuters Pakistan Repo 3 Month Rate	01/02/2002 - Present
	PKR 3 Month Repo	10/29/1999 - 01/01/2002
PER	Bloomberg Asbanc Peru 3 Months Nominal Rate	09/30/2002 - Present
	Peru Savings Rate	07/01/1991 - 09/29/2002
PHL	Philippine Treasury Bill 91d	
POL	Poland Interbank 3 Month (EOD)	06/04/1993 - Present
PRT	Germany 3 Month Bubill	01/01/1999 - Present
	Portugal 1–year - LISBOB - Act/365 Day convention	- 12/31/1998
QAT	Qatar 3 Month T–Bill Auction Average Yield	05/08/2012 - Present
ROM	Romanian Interbank 3 Month	08/01/1995 - Present
RUS	MosPime 3 Months Rate	04/18/2005 - Present
	Russia Moscow Interbank Non Co	08/14/2000 - 04/17/2005
	Russia Interbank 31 To 90 Day	09/01/1994 - 08/13/2000
RWA	Rwanda 3 Month Bill Auction Average Yield	04/22/2009 - Present
SAU	Saudi Interbank 3 Month	
SGP	Monetary Authority of Singapore Benchmark Govt Bill Yield 3 Month	09/20/2013 - Present
	Singapore T-Bill 3 Month	- 09/19/2013
SRB	National Bank of Serbia Belibor 3M Rate (Interbank Rate)	01/28/2005 - Present
SVK	Germany 3 Month Bubill	01/01/2009 - Present
	SLOVAK REP. INTERBANK 3 MTH	06/23/1994 - 12/31/2008
SVN	Germany 3 Month Bubill	01/01/2007 - Present
	SLOVENIA TREASURY BILL 3 MONTH'DEAD'	10/29/1998 - 12/31/2006
SWE	Sweden T Bill 3 Month	05/25/1993 - Present
	Sweden Treasury Bill 90 Day	- 05/24/1993
THA	Thailand Bibor Fixings 3 Month	05/30/2002 - Present
	Thailand Repo 3 Month (BOT)'Dead'	03/11/1994 - 05/29/2002
TUN	Tu Policy Rates: TMM (Avg.)	12/15/1994 - Present
TUR	Turkish Interbank 3 Month	08/01/2002 - Present
TWN	Taiwan Money Market 90 Day	
TZA	Tanzania 3 Month Bill Auction Average Yield	01/02/2003 - Present
UGA	Uganda 3 Month Bill Auction Average Yield	01/05/2005 - Present
UKR	Ukraine Interbank 3 Months	03/01/2001 - Present
USA	US Generic Govt 3 Month Yield	
VEN	Venezuela 90 Day Deposit Rate	01/10/1997 - Present
	Venezuela Overnight	11/28/1994 - 01/09/1997
VNM	Vietnam Interbank 3 Month	12/11/1998 - Present
ZAF	SA T-Bill 91 Days (Tender Rates)	

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

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

Economy	Interest Rate Name	Period Used*
ARE	UAE IBOR 1 Year	05/15/2000 - Present
ARG	Argentina Deposit 90 Day (PA.)	04/01/1991 - Present
AUS	Australia Govt Bonds Generic Mid Yield 1 Year	
AUT	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Austria VIBOR 12 Month	06/10/1991 - 12/31/1998
BEL	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Belgium Treasury Bill 1 Year	04/02/1991 - 12/31/1998
BGD	Bangladesh 12 Month Bill Auction Cut Off Yield	
BGR	Bulgaria Interbank 3 Month	02/17/2003 - Present
BHR	Bahrain IBOR 1 Year	12/14/2006 - Present
BIH	Reuters Bosnia and Herzegovina, Interest Rates, Deposite Rate	09/14/1998 - Present
	BP Real Interest Rate (%) NADJ	06/30/1998 - 09/13/1998
BRA	Andima Brazil Govt Bond Fixed Rate 1 Year	04/03/2000 - Present
	Brazil CDB (Up To 30 Days)	10/10/1994 - 04/02/2000
BWA	Thomson Reuters Botswana Pula 1 Year Deposit	07/27/2010 - Present
CAN	Canada Treasury Bill 1 Year	01/02/1990 - Present
CHE	Swiss Interbank 1 Year (ZRC:SNB)	
CHL	Chile Overnight Interbank Interest Rate	05/29/1995 - Present
	Chile Tab UF Interbank Rates 90 Days	11/02/1992 - 05/28/1995
CHN	China Household Savings Deposits 1 Year Rate	01/02/1992 - Present
COL	Colombia Government Generic Bond 1 Year Yield	01/03/2001 - Present
	Colombia CD Rate 360-Day	07/12/1993 - 01/02/2001
CYP	German Government Bonds 1 Year BKO	01/01/2008 - Present
	Cyprus, Treasury Bill Rate - 13 Week	01/15/1993 - 12/31/2007
CZE	Czech Republic Interbank 3 Month	04/22/1992 - Present
DEU	German Government Bonds 1 Year BKO	01/10/1995 - Present
	Germany Interbank 12 Month	11/02/1990 - 01/09/1995
DNK	Denmark Government Bonds 1 Year Note Generic Bid Yield	06/19/2008 - Present
	Denmark Euro-Krone 1 Year (FT/ICAP/TR)	06/14/1985 - 06/18/2008
EGY	Egypt 364 Day T-Bill	07/06/2004 - Present
ESP	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Spain 12 Month Treasury Bill Yield	11/30/1992 - 12/31/1998
	Spain Interbank 12 Month	12/19/1991 - 11/29/1992
EST	German Government Bonds 1 Year BKO	01/01/2011 - Present
	Estonia, Interest Rates, Prices, Production, & LABOUR, Interest Rates, Deposit Rate	02/15/1993 - 12/31/2010
FIN	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Finland Interbank Close 12 Month	04/02/1992 - 12/31/1998
FRA	German Government Bonds 1 Year BKO	01/01/1999 - Present
	France Treasury Bill 1 Year Intraday	- 12/31/1998
GBR	UK Govt Bonds 1 Year Note Gene	09/12/2001 - Present
	UK Govt. Liab. Nom. Spot Curve 12 Month	- 09/11/2001
GHA	Ghana 1YR Note Auction Average Yield	11/02/2007 - Present
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

Continued on next page

Table A.7 – *Continued from previous page*

Economy	Interest Rate Name	Period Used*
	INDONESIA SBI/DISC 90 DAY'DEAD'	01/01/1985 - 07/09/2003
IND	India Treasury Bill 1 Year	05/20/2013 - Present
	INDIA T-BILL SECONDARY 1 YEAR	01/01/1993 - 05/19/2013
IRL	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Dublin Interbank Offered Rates	04/10/1991 - 12/31/1998
ISL	Iceland Interbank 12 - Month	02/01/2000 - Present
	Iceland Interbank 3 - Month	08/04/1998 - 01/31/2000
	Iceland 90 - Day CD Notes	- 08/03/1998
ISR	Israel T-Bill Secondary 1 Year	11/15/1994 - Present
ITA	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Italy Bots Treasury Bill 12 Month Gross Yields	09/05/1994 - 12/31/1998
	Italy T-Bill Auct. Gross 12 Month	- 09/04/1994
JAM	Bloomberg Bank of Jamaica 6 Month Treasury Bill Yield	03/13/2017 - Present
	Jamaica 12 Months Repo Rate	07/17/2008 - 03/12/2017
JOR	Bllomberg Jordanian Dinar Interbank Offered Rate 1 Year	09/20/2006 - Present
	Jordan Re-Discount Rate	03/12/2001 - 09/19/2006
JPN	Japan Treasury Bills 12 Month	12/14/1999 - Present
KAZ	Kazakhstan KIBOR/KIBID 90 Days Interbank	09/29/2001 - Present
KEN	Thomson Reuters Kenya GVT BMK Bid Yield 1 Year	05/26/2009 - Present
KOR	Korea Monetary Stab. Bonds 1 Year	01/03/1992 - Present
KWT	Kuwait Interbank 1 Year	
LKA	Sri Lanka Fixed Deposit 1 Year	
LTU	German Government Bonds 1 Year BKO	01/01/2015 - Present
	Vilnius Interbank 12 Month	03/29/2000 - 12/31/2014
LUX	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Long Term Government Bond Yields - Maastricht Definition (Avg.)	- 12/31/1998
LVA	German Government Bonds 1 Year BKO	01/01/2014 - Present
	Treasury Bill Rate 1 Year	04/03/1996 - 12/31/2013
MAR	Morocco Deposit Rate 1 Year	06/06/2003 - Present
MEX	Mexico Cetes 2nd Mkt. 360 Day	06/26/1996 - Present
	Mexico Cetes 91 Day Avg.Ret.At Auc.	- 06/25/1996
MKD	Macedonia SKIBOR 3 Months	07/02/2007 - Present
MLT	German Government Bonds 1 Year BKO	01/01/2008 - Present
	Long Term Government Bond Yields - Maastricht Definition (Avg.)	01/15/1985 - 12/31/2007
MNE	Treasury Bill Rate - 182-Day (EP)	07/16/2004 - Present
MUS	Thomson Reuters Mauritius GVT BMK Bid Yield 1 Year	05/26/2010 - Present
MWI	MALAWI 12 Month Bill Auction Average Accepted Yield	03/06/2012 - Present
MYS	Bank Negara Malaysia 1 Year Govt Securities Indicative YTM	06/21/2005 - Present
	Malaysia Deposit 1 Year	- 06/20/2005
NAM	Namibia 12 Month Bill Auction Average Yield	03/13/2002 - Present
NGA	Nigeria Interbank Offered Rate 12 Month	09/29/2011 - Present
	Nigeria Interbank Offered Rate 3 Month	01/30/2004 - 09/28/2011
NLD	German Government Bonds 1 Year BKO	01/01/1999 - Present
	Netherland Interbank 1 Year	- 12/31/1998
NOR	Norway Govt Treasury Bills 12 Month	07/01/1997 - Present
	Norway Interbank 1 Year	- 06/30/1997
NZL	New Zealand Dollar Deposit 1 Year	
OMN	OMR 12 Month Deposit	07/16/2002 - Present

Continued on next page

Table A.7 – *Continued from previous page*

Economy	**Interest Rate Name**	**Period Used***
PAK	Bloomberg State Bank of Pakistan KIBOR Fixing 12 Month Rate	04/19/2004 - Present
	PKR 12 Month Repo	10/29/2004 - 04/18/2004
PER	Bloomberg Asbanc Peru 1 Year Nominal Rate	09/30/2002 - Present
	Peru Savings Rate	07/01/1991 - 09/29/2002
PHL	Philippine Treasury Bill 364d	
POL	Poland Interbank 1 Year (EOD)	10/11/1995 - Present
PRT	German Government Bonds 1 Year BKO	01/01/1999 - Present
QAT	Qatar 3 Month T–Bill Auction Average Yield	05/08/2012 - Present
ROM	Romanian Interbank 12 Month	08/01/1995 - Present
RUS	Mospime 3 Months Rate	04/18/2005 - Present
	Russia Moscow Interbank Non Co	08/14/2000 - 04/17/2005
	Russia Interbank 31 To 90 Day	09/01/1994 - 08/13/2000
RWA	Rwanda 12 Month Bill Auction Average Yield	05/12/2010 - Present
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	- 09/19/2013
SRB	Bloomberg National Bank of Serbia BELIBOR 6M Rate	01/28/2005 - Present
	Serbia Treasury Bill Auction Results 12 Months Average Accepted Yield	08/26/2009 - 01/27/2005
SVK	German Government Bonds 1 Year BKO	01/01/2009 - Present
	Slovak Rep. Interbank 1 Year	08/09/1994 - 12/31/2008
SVN	German Government Bonds 1 Year BKO	01/01/2007 - Present
	Slovenia Treasury Bill 3 Month'dead'	10/29/1998 - 12/31/2006
SWE	Sweden T Bill 3 Month	05/25/1993 - Present
	Sweden Treasury Bill 90 Day	- 05/24/1993
THA	Thailand Govt Bond 1 Year Note	08/07/2000 - Present
	Thailand Deposit 12 Month (KT)	01/02/1991 - 08/06/2000
TUN	TU BCT Key Interest Rate	12/15/1994 - Present
TUR	Turkish Interbank 12 Month	08/01/2002 - Present
TWN	Taiwan Deposit 12 Month	
TZA	Tanzania 12 Month Bill Auction Average Yield	01/02/2003 - Present
UGA	Uganda 12 Month Bill Auction Average Yield	01/05/2005 - Present
UKR	Ukraine Interbank 3 Months	03/01/2001 - Present
USA	US Treasury Constant Maturities 1 Year	
VEN	Venezuela Savings Deposit Rate	01/03/2000 - Present
	Venezuela Overnight	11/28/1994 - 01/02/2000
VNM	Vietnam Interbank 3 Month	12/11/1998 - Present
ZAF	South African Prime Overdraft 1 Year Rate	

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

Table A.8: Summary Statistics of input variables (based on data from January 1990 to December 2019).

DTD Level								
Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	-1.84	1.05	2.36	3.89	36.1	2.73	2.47	17936
Australia	-1.34	1.77	3.02	4.6	30.42	3.5	2.55	386176
Austria	-3.34	2.07	3.6	5.76	42.08	4.92	6.17	25555
Bahrain	-0.85	1.89	3.51	6.95	24.31	4.94	4.37	2789
Bangladesh	-2.28	2.07	3.33	5.01	27.09	3.84	2.71	25515
Belgium	-3.34	2.74	4.75	7.48	42.08	5.61	4.72	38496
Bosnia and Herzegovina	-3.34	1.56	2.7	5.01	41.25	3.73	3.6	4172
Botswana	0.06	7.43	11.09	17.11	36.1	13.17	8.14	1664
Brazil	-2.34	0.66	2.21	4.17	36.1	2.72	3.03	65009
Bulgaria	-1.93	1.24	2.39	4.19	42.08	3.19	3.29	11322
Canada	-1.14	1.88	3.35	5.3	28.77	3.91	2.94	285201
Chile	-1.54	3.43	5.6	8.33	36.1	6.52	4.83	32104
China	0.05	3.21	4.37	5.97	17.25	4.83	2.33	466423
Colombia	-2.34	2.29	4.19	6.42	36.1	4.63	3.27	7161
Croatia	-2.9	1.14	2.58	4.73	23.5	3.17	2.81	14950
Cyprus	-1.4	0.91	1.76	3.06	42.08	2.47	2.77	16190
Czech Republic	-3.34	1.4	2.85	4.94	42.08	3.34	2.94	6370
Denmark	-3.34	1.93	3.49	5.51	42.08	4.18	3.71	51732
Egypt	-2.34	1.61	2.74	4.12	16.95	3.11	2.28	29608
Estonia	-1.57	1.86	3.63	6.6	24.0	4.58	3.75	3660
Finland	-3.34	2.52	3.91	5.66	42.08	4.24	2.59	38190
France	-3.34	1.99	3.44	5.31	42.08	4.01	3.37	204172
Germany	-3.34	1.72	3.21	5.07	42.08	3.76	3.2	230630
Ghana	0.2	1.12	1.74	2.56	7.65	2.39	2.03	147
Greece	-3.34	1.18	2.32	3.79	42.08	2.69	2.6	67622
Hong Kong	-1.34	1.8	2.95	4.54	30.42	3.52	2.65	333193
Hungary	-3.34	1.42	2.77	4.52	27.56	3.27	2.73	9422
Iceland	-3.34	1.75	3.29	5.06	18.02	3.51	2.8	4783
India	-3.37	0.88	1.94	3.38	28.33	2.52	2.78	657635
Indonesia	-2.34	0.99	2.18	3.88	36.1	2.92	3.39	93467
Ireland	-1.28	1.97	3.6	5.44	35.26	4.01	2.96	10260
Israel	-3.34	1.37	2.7	4.36	42.08	3.14	2.66	98182
Italy	-3.34	1.78	3.16	4.9	42.08	3.63	3.4	81860
Jamaica	-2.34	1.3	2.39	3.57	18.25	2.63	2.04	7945
Japan	-1.34	2.33	3.53	5.16	30.42	4.04	2.58	1059016
Jordan	-1.08	2.59	3.95	5.93	24.81	4.59	2.91	32389
Kazakhstan	-2.14	0.21	1.96	4.09	36.1	3.04	4.66	1310
Kenya	-1.41	1.68	2.78	4.26	36.1	3.34	2.74	6545
Kuwait	-1.98	2.27	3.4	5.0	22.21	3.92	2.44	31512
Latvia	-1.14	1.15	2.7	4.58	37.29	3.28	3.07	3045
Lithuania	-1.3	1.59	3.6	5.99	20.72	4.26	3.61	6079
Luxembourg	-3.34	2.87	4.96	8.86	35.53	6.63	5.32	3186
Macedonia	-1.61	1.57	2.59	5.07	24.9	3.99	3.86	3088
Malawi	-1.16	0.79	2.33	4.27	36.1	3.18	3.6	510
Malaysia	-2.34	1.75	3.12	5.19	36.1	3.98	3.4	251056
Malta	-0.41	3.05	4.68	7.48	23.07	5.77	3.86	2344
Mauritius	0.24	4.29	6.66	10.96	36.1	8.93	7.21	3608
Mexico	-2.34	2.17	4.21	6.8	36.1	4.86	3.93	25381
Montenegro	-1.0	1.22	2.5	3.61	42.08	2.82	2.92	1948
Morocco	-1.04	2.52	3.74	5.57	24.85	4.27	2.79	11729
Namibia	0.75	6.25	8.17	11.82	36.1	10.07	6.38	577
Netherlands	-3.34	2.54	4.25	6.36	42.08	4.73	3.37	43115
New Zealand	-1.07	3.0	5.4	8.13	30.42	6.0	4.1	25303
Nigeria	-2.34	0.75	2.07	3.55	36.1	2.73	3.68	22011
Norway	-2.83	1.34	2.66	4.28	31.35	2.99	2.41	55026
Oman	-1.33	3.17	4.77	8.19	36.1	6.12	4.49	6182
Pakistan	-2.34	0.8	2.41	4.16	36.1	2.72	2.64	39789
Peru	-2.34	1.93	3.51	5.43	36.1	4.15	3.32	12638
Philippines	-2.34	1.51	2.96	4.94	36.1	3.61	3.24	53811
Poland	-2.86	1.4	2.56	3.88	42.08	2.84	2.14	92039
Portugal	-3.34	0.86	2.33	4.24	42.08	2.75	2.97	16088
Qatar	1.16	3.8	5.63	8.36	23.81	6.76	4.13	3889
Romania	-3.34	1.0	2.25	3.95	31.53	2.72	2.6	13581
Russian Federation	-3.34	0.57	1.77	3.38	42.08	2.27	2.79	29516
Rwanda	-0.7	4.42	5.28	18.89	36.1	11.01	10.15	192
Saudi Arabia	-1.08	4.03	5.92	8.76	36.1	6.81	3.95	27257
Serbia	-2.77	0.73	1.72	3.03	42.08	2.43	3.19	8714
Singapore	-1.34	1.57	2.88	4.8	29.54	3.56	2.88	158303
Slovakia	-2.75	1.18	2.32	3.79	42.08	4.75	8.54	1633
Slovenia	-2.43	1.79	3.78	6.39	42.08	4.6	4.78	6892
South Africa	-2.34	1.32	2.96	5.2	36.1	3.68	3.56	94815
South Korea	-1.34	1.52	2.61	4.06	30.42	3.19	3.12	437895
Spain	-3.34	2.03	3.67	5.63	42.08	4.43	4.45	44977
Sri Lanka	-2.34	1.56	2.77	4.44	36.1	3.36	2.83	35668
Sweden	-3.34	1.9	3.41	5.27	42.08	3.89	2.94	124198
Switzerland	-3.34	2.78	4.56	6.8	40.7	5.11	3.46	68342
Taiwan	-1.23	3.08	4.34	6.05	30.42	4.99	3.25	205240
Tanzania	0.13	2.44	6.09	11.72	36.1	8.06	7.11	999
Thailand	-1.75	2.1	3.55	5.59	36.1	4.36	3.86	143604
Tunisia	-2.34	2.2	3.62	5.8	23.62	4.31	3.15	11343
Turkey	-3.34	1.54	2.82	4.69	42.08	3.52	3.16	70664
UK	-3.34	2.31	3.99	6.37	42.08	4.85	4.05	465134
US	-1.14	1.96	3.34	5.17	28.77	3.88	2.88	1785180
Uganda	0.02	1.56	2.64	4.3	36.1	4.82	6.82	658
Ukraine	-3.26	0.38	1.38	2.56	28.11	1.64	2.15	4696
United Arab Emirates	-0.85	1.96	3.05	4.5	28.43	3.63	2.61	10522
Venezuela	-2.34	0.17	1.26	2.67	36.1	2.02	3.83	3669
Vietnam	-1.85	1.3	2.21	3.56	33.26	2.73	2.23	78239

DTD Trend

Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	-10.71	-0.55	-0.03	0.42	9.61	-0.09	1.13	17936
Australia	-7.59	-0.55	-0.03	0.44	6.49	-0.07	1.08	386176
Austria	-13.8	-0.69	-0.05	0.54	9.43	-0.19	2.29	25555
Bahrain	-7.01	-0.52	0.0	0.56	9.61	0.01	1.41	2789
Bangladesh	-10.71	-0.45	-0.02	0.39	9.61	-0.02	0.97	25515
Belgium	-13.8	-0.72	-0.02	0.65	9.43	-0.07	1.75	38496
Bosnia and Herzegovina	-13.8	-0.54	-0.02	0.36	9.43	-0.07	1.34	4172
Botswana	-10.71	-2.44	0.0	1.95	9.61	0.01	4.51	1664
Brazil	-10.71	-0.42	0.0	0.43	9.61	-0.01	1.07	65009
Bulgaria	-13.8	-0.51	0.0	0.42	9.43	-0.07	1.34	11322
Canada	-7.73	-0.6	-0.04	0.47	5.8	-0.08	1.19	285201
Chile	-10.71	-0.86	0.0	0.79	9.61	-0.03	2.13	32104
China	-6.05	-0.65	-0.04	0.52	5.83	-0.08	1.16	466423
Colombia	-10.71	-0.66	0.0	0.7	9.61	-0.01	1.5	7161
Croatia	-7.88	-0.57	-0.04	0.41	9.43	-0.06	1.05	14950
Cyprus	-13.8	-0.41	-0.05	0.27	9.43	-0.13	1.04	16190
Czech Republic	-13.8	-0.57	-0.05	0.4	9.43	-0.13	1.29	6370
Denmark	-13.8	-0.61	-0.01	0.53	9.43	-0.05	1.48	51732
Egypt	-10.71	-0.5	-0.01	0.47	9.61	-0.01	1.06	29608
Estonia	-8.76	-0.67	0.02	0.67	9.43	-0.01	1.41	3660
Finland	-13.8	-0.55	0.02	0.59	9.38	0.0	1.14	38190
France	-13.8	-0.57	-0.01	0.51	9.43	-0.05	1.34	204172
Germany	-13.8	-0.57	-0.03	0.47	9.43	-0.06	1.29	230630
Ghana	-2.31	-0.32	-0.06	0.06	1.12	-0.16	0.5	147
Greece	-13.8	-0.51	-0.05	0.36	9.43	-0.07	1.06	67622
Hong Kong	-7.59	-0.58	-0.03	0.47	6.49	-0.07	1.11	333193
Hungary	-13.8	-0.43	0.02	0.46	9.43	-0.02	1.1	9422
Iceland	-9.73	-0.71	-0.01	0.5	9.43	-0.1	1.33	4783
India	-9.88	-0.39	-0.02	0.36	6.79	-0.04	1.0	657635
Indonesia	-10.71	-0.44	0.0	0.41	9.61	-0.05	1.33	93467
Ireland	-13.8	-0.61	-0.01	0.52	8.73	-0.1	1.27	10260
Israel	-13.8	-0.5	0.0	0.49	9.43	-0.01	1.16	98182
Italy	-13.8	-0.58	-0.03	0.48	9.43	-0.08	1.22	81860
Jamaica	-10.16	-0.41	0.0	0.42	9.61	0.03	1.01	7945
Japan	-7.59	-0.51	-0.0	0.5	6.49	-0.01	1.01	1059016
Jordan	-10.71	-0.55	-0.02	0.48	9.61	-0.04	1.22	32389
Kazakhstan	-10.71	-0.49	-0.0	0.44	9.61	-0.09	1.78	1310
Kenya	-10.71	-0.51	-0.06	0.34	7.08	-0.09	1.0	6545
Kuwait	-10.71	-0.54	-0.02	0.46	9.61	-0.06	1.13	31512
Latvia	-13.8	-0.5	0.0	0.45	6.82	-0.07	1.26	3045
Lithuania	-10.51	-0.65	0.0	0.62	9.43	-0.0	1.54	6079
Luxembourg	-11.05	-0.79	0.0	0.67	9.43	-0.07	1.77	3186
Macedonia	-12.69	-0.5	-0.02	0.5	6.93	-0.01	1.28	3088
Malawi	-10.71	-0.43	0.1	0.78	9.61	0.17	2.13	510
Malaysia	-10.71	-0.54	-0.02	0.47	9.61	-0.05	1.23	251056
Malta	-11.01	-0.84	-0.02	0.69	9.43	-0.06	1.82	2344
Mauritius	-10.71	-0.98	-0.07	0.81	9.61	-0.11	2.81	3608
Mexico	-10.71	-0.65	0.0	0.61	9.61	-0.06	1.5	25381
Montenegro	-4.27	-0.33	0.0	0.26	9.43	-0.01	0.83	1948
Morocco	-10.71	-0.53	-0.02	0.43	9.61	-0.09	1.11	11729
Namibia	-10.71	-1.54	-0.12	1.4	9.61	0.04	3.82	577
Netherlands	-13.8	-0.71	-0.03	0.6	9.43	-0.06	1.34	43115
New Zealand	-7.59	-0.76	-0.0	0.7	6.49	-0.04	1.61	25303
Nigeria	-10.71	-0.5	-0.03	0.39	9.61	-0.08	1.61	22011
Norway	-13.8	-0.54	-0.02	0.45	9.43	-0.06	1.04	55026
Oman	-10.71	-0.7	-0.01	0.67	9.61	-0.05	1.99	6182
Pakistan	-10.71	-0.4	0.0	0.38	9.61	-0.02	0.87	39789
Peru	-10.71	-0.58	0.0	0.6	9.61	0.01	1.51	12638
Philippines	-10.71	-0.49	0.0	0.47	9.61	-0.01	1.33	53811
Poland	-13.8	-0.5	-0.04	0.38	9.43	-0.08	0.91	92039
Portugal	-13.8	-0.49	-0.01	0.43	9.43	-0.04	1.07	16088
Qatar	-6.77	-0.83	-0.1	0.45	9.61	-0.23	1.36	3889
Romania	-13.8	-0.41	0.01	0.44	9.43	0.02	0.99	13581
Russian Federation	-13.8	-0.44	0.0	0.44	9.43	-0.07	1.24	29516
Rwanda	-10.71	-1.14	-0.0	0.77	9.61	-0.47	4.03	192
Saudi Arabia	-10.71	-0.9	0.01	0.91	9.61	-0.04	1.85	27257
Serbia	-13.8	-0.4	0.0	0.3	9.43	-0.1	1.09	8714
Singapore	-7.59	-0.53	-0.03	0.44	6.49	-0.06	1.1	158303
Slovakia	-13.8	-0.43	0.01	0.44	9.43	-0.31	2.8	1633
Slovenia	-13.8	-0.74	-0.09	0.44	9.43	-0.26	1.86	6892
South Africa	-10.71	-0.59	-0.05	0.43	9.61	-0.12	1.33	94815
South Korea	-7.59	-0.46	-0.0	0.44	6.49	-0.03	1.06	437895
Spain	-13.8	-0.57	0.0	0.58	9.43	-0.04	1.69	44977
Sri Lanka	-10.71	-0.45	-0.02	0.43	9.61	-0.01	1.18	35668
Sweden	-13.8	-0.56	-0.03	0.47	9.43	-0.05	1.16	124198
Switzerland	-13.8	-0.69	0.0	0.69	9.43	-0.01	1.44	68342
Taiwan	-7.59	-0.6	0.0	0.62	6.49	0.01	1.22	205240
Tanzania	-10.71	-1.47	-0.26	0.49	9.61	-0.6	3.19	999
Thailand	-10.71	-0.6	-0.0	0.56	9.61	-0.03	1.3	143604
Tunisia	-10.71	-0.68	-0.11	0.44	9.61	-0.12	1.26	11343
Turkey	-13.8	-0.6	-0.01	0.56	9.43	-0.03	1.33	70664
UK	-13.8	-0.81	-0.06	0.58	9.43	-0.19	1.82	465134
US	-7.73	-0.54	-0.01	0.48	5.8	-0.04	1.07	1785180
Uganda	-10.71	-0.51	0.0	0.55	9.61	-0.21	3.09	658
Ukraine	-13.8	-0.53	-0.02	0.37	9.43	-0.13	1.1	4696
United Arab Emirates	-10.71	-0.54	-0.04	0.36	9.19	-0.12	1.02	10522
Venezuela	-10.71	-0.43	-0.0	0.46	9.61	0.03	1.56	3669
Vietnam	-10.71	-0.41	-0.02	0.35	9.61	-0.04	0.86	78239

CA/CL Level

Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	-3.89	-0.16	0.23	0.59	3.49	0.22	0.69	17360
Australia	-3.34	0.18	0.79	1.86	6.76	1.02	1.36	378286
Austria	-3.46	-0.01	0.25	0.54	3.52	0.26	0.59	19049
Bahrain	-1.7	0.42	0.74	1.32	5.09	0.94	0.8	2203
Bangladesh	-3.09	-0.01	0.36	0.82	4.27	0.44	0.84	18448
Belgium	-3.46	0.02	0.31	0.68	5.33	0.39	0.77	30177
Bosnia and Herzegovina	-2.7	-0.09	0.56	1.41	5.33	0.65	1.18	11163
Botswana	-0.98	0.14	0.49	0.87	4.28	0.56	0.63	2267
Brazil	-4.69	-0.14	0.28	0.69	5.09	0.18	0.98	68490
Bulgaria	-3.46	0.1	0.46	1.05	4.56	0.53	0.9	13080
Canada	-3.64	0.01	0.55	1.25	4.67	0.65	1.25	261572
Chile	-4.69	0.07	0.41	0.83	5.09	0.48	0.71	32233
China	-2.84	0.08	0.45	0.97	4.01	0.56	0.81	434066
Colombia	-4.27	-0.05	0.27	0.69	3.09	0.3	0.65	6755
Croatia	-3.46	-0.36	0.19	0.67	5.33	0.16	1.16	19900
Cyprus	-3.46	-0.33	0.25	0.78	5.23	0.23	0.93	13604
Czech Republic	-2.23	-0.1	0.17	0.65	5.33	0.34	0.79	7739
Denmark	-3.46	0.14	0.45	0.79	5.33	0.5	0.76	36309
Egypt	-3.12	0.04	0.39	0.87	4.32	0.48	0.81	21145
Estonia	-2.61	0.04	0.47	0.82	2.9	0.49	0.64	3039
Finland	-1.9	0.13	0.39	0.71	3.59	0.43	0.55	35455
France	-3.46	0.08	0.34	0.68	5.33	0.42	0.62	175467
Germany	-3.46	0.09	0.44	0.88	5.33	0.52	0.81	183985
Ghana	-2.49	-0.25	0.04	0.51	1.89	0.1	0.69	1628
Greece	-3.46	0.06	0.38	0.74	5.33	0.41	0.66	63195
Hong Kong	-3.34	0.17	0.54	1.07	6.76	0.64	0.85	252303
Hungary	-3.23	-0.07	0.33	0.8	4.1	0.42	0.76	8176
Iceland	-1.11	0.01	0.28	0.5	2.25	0.27	0.42	5004
India	-4.75	0.16	0.6	1.26	6.66	0.74	1.2	805560
Indonesia	-4.69	0.01	0.38	0.86	5.09	0.4	0.95	79895
Ireland	-3.46	0.15	0.43	0.82	4.4	0.5	0.75	8902
Israel	-3.46	0.1	0.45	0.96	5.33	0.58	1.07	69092
Italy	-2.84	-0.0	0.29	0.61	5.33	0.33	0.68	62847
Jamaica	-1.85	0.36	0.74	1.13	3.76	0.77	0.71	6408
Japan	-3.34	0.09	0.43	0.86	5.2	0.5	0.66	976874
Jordan	-4.69	0.03	0.54	1.05	5.09	0.55	0.93	22382
Kazakhstan	-1.61	0.37	0.91	1.37	5.09	0.89	0.92	1196
Kenya	-3.21	0.07	0.39	0.79	4.07	0.44	0.7	7738
Kuwait	-3.44	0.1	0.58	1.28	5.04	0.67	0.98	15146
Latvia	-2.7	0.29	0.76	1.52	5.33	0.94	0.99	5354
Lithuania	-2.71	-0.12	0.29	0.68	2.61	0.28	0.7	5753
Luxembourg	-2.27	-0.12	0.19	0.67	4.33	0.28	1.03	1444
Macedonia	-2.97	-0.03	0.62	0.98	3.9	0.58	0.94	3722
Malawi	-1.13	-0.34	0.0	0.39	0.87	-0.02	0.52	520
Malaysia	-4.69	0.13	0.55	1.08	5.09	0.64	0.87	211114
Malta	-1.19	0.01	0.29	0.53	1.23	0.22	0.51	1301
Mauritius	-4.15	-0.31	0.04	0.4	2.6	0.05	0.72	4894
Mexico	-3.96	0.09	0.46	0.91	5.09	0.49	0.78	26302
Montenegro	-3.46	-0.61	0.19	1.11	5.33	0.19	1.28	4293
Morocco	-1.07	0.14	0.46	0.75	2.46	0.45	0.49	10962
Namibia	-0.49	0.4	0.56	0.97	1.28	0.6	0.41	372
Netherlands	-3.46	0.08	0.34	0.6	5.33	0.36	0.6	36194
New Zealand	-3.34	-0.02	0.44	0.89	6.32	0.45	0.92	22976
Nigeria	-4.69	-0.31	0.12	0.48	3.99	-0.01	0.96	18697
Norway	-3.46	0.14	0.5	0.94	5.33	0.61	0.86	49183
Oman	-4.06	0.02	0.31	0.81	4.52	0.42	0.78	13952
Pakistan	-4.69	-0.09	0.16	0.53	5.09	0.2	0.68	35524
Peru	-2.9	-0.05	0.34	0.73	3.39	0.34	0.71	17006
Philippines	-4.69	-0.1	0.4	1.06	5.09	0.53	1.43	38698
Poland	-3.46	0.11	0.4	0.83	5.33	0.48	0.78	78385
Portugal	-3.46	-0.41	-0.03	0.32	5.33	-0.05	0.68	15848
Qatar	-1.14	0.23	0.62	1.11	5.09	0.77	0.91	3634
Romania	-2.1	0.02	0.4	0.93	5.33	0.48	0.83	16486
Russian Federation	-3.46	0.0	0.33	0.8	5.33	0.48	0.91	39523
Rwanda	-0.65	-0.56	-0.45	-0.37	-0.29	-0.46	0.12	68
Saudi Arabia	-3.94	0.15	0.51	0.99	4.68	0.57	0.75	18581
Serbia	-3.46	-0.05	0.36	0.87	3.55	0.38	0.94	19382
Singapore	-3.34	0.2	0.54	1.0	6.59	0.62	0.75	135526
Slovakia	-1.18	-0.08	0.3	0.73	4.74	0.5	0.93	2915
Slovenia	-2.27	-0.09	0.23	0.64	3.07	0.3	0.72	7772
South Africa	-4.69	0.13	0.41	0.74	5.09	0.46	0.73	80401
South Korea	-3.34	0.03	0.43	0.98	6.76	0.59	0.94	408102
Spain	-3.46	-0.04	0.2	0.51	3.47	0.23	0.58	38420
Sri Lanka	-4.37	-0.1	0.31	0.79	5.09	0.35	0.87	25268
Sweden	-3.46	0.14	0.55	0.98	5.33	0.62	0.81	110176
Switzerland	-3.46	0.31	0.59	0.94	5.33	0.65	0.64	52479
Taiwan	-3.34	0.23	0.53	0.92	5.93	0.6	0.65	180008
Tanzania	-2.12	-0.11	0.56	0.98	1.75	0.39	0.73	819
Thailand	-4.69	-0.06	0.34	0.88	5.09	0.41	0.86	118393
Tunisia	-1.57	0.07	0.45	0.81	2.73	0.45	0.64	7198
Turkey	-3.46	0.05	0.38	0.77	5.33	0.42	0.76	69414
UK	-3.46	0.01	0.37	0.86	5.33	0.5	0.94	413257
US	-3.64	0.31	0.75	1.26	4.67	0.82	0.81	1413275
Uganda	-0.72	-0.12	0.06	1.27	2.31	0.44	0.82	398
Ukraine	-3.46	-0.16	0.2	0.63	5.33	0.26	0.76	8891
United Arab Emirates	-2.49	0.17	0.58	1.12	5.09	0.7	0.92	6158
Venezuela	-1.92	0.12	0.34	0.55	1.96	0.32	0.53	2626
Vietnam	-2.98	0.12	0.39	0.84	4.64	0.53	0.66	73046

CA/CL Trend

Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	-2.21	-0.09	0.0	0.07	2.25	-0.01	0.25	17360
Australia	-2.61	-0.24	-0.0	0.13	2.58	-0.04	0.61	378286
Austria	-2.5	-0.06	0.0	0.04	2.49	-0.01	0.2	19049
Bahrain	-2.21	-0.11	0.0	0.1	1.76	-0.03	0.29	2203
Bangladesh	-2.21	-0.04	0.0	0.04	2.25	-0.0	0.2	18448
Belgium	-2.52	-0.05	0.0	0.04	2.49	-0.01	0.24	30177
Bosnia and Herzegovina	-2.52	-0.06	0.0	0.06	2.49	-0.0	0.29	11163
Botswana	-2.21	-0.07	0.0	0.07	2.25	-0.01	0.26	2267
Brazil	-2.21	-0.09	-0.0	0.08	2.25	-0.01	0.28	68490
Bulgaria	-2.52	-0.06	0.0	0.06	2.49	-0.0	0.25	13080
Canada	-2.38	-0.18	-0.0	0.11	2.38	-0.03	0.52	261572
Chile	-2.21	-0.09	-0.0	0.08	2.25	-0.0	0.3	32233
China	-1.51	-0.09	-0.01	0.05	1.52	-0.02	0.22	434066
Colombia	-2.21	-0.09	0.0	0.08	2.25	-0.0	0.29	6755
Croatia	-2.43	-0.13	-0.0	0.09	2.49	-0.01	0.36	19900
Cyprus	-2.52	-0.08	0.0	0.03	2.49	-0.02	0.27	13604
Czech Republic	-2.52	-0.06	0.0	0.04	2.49	-0.0	0.27	7739
Denmark	-2.52	-0.08	0.0	0.05	2.49	-0.01	0.3	36309
Egypt	-2.21	-0.09	0.0	0.07	2.25	-0.0	0.26	21145
Estonia	-1.65	-0.08	0.0	0.07	2.49	0.01	0.23	3039
Finland	-2.52	-0.07	-0.0	0.05	2.49	-0.01	0.19	35455
France	-2.52	-0.04	0.0	0.03	2.49	-0.01	0.19	175467
Germany	-2.52	-0.07	0.0	0.05	2.49	-0.01	0.29	183985
Ghana	-1.7	-0.09	-0.0	0.06	1.28	-0.02	0.21	1628
Greece	-2.52	-0.1	-0.01	0.05	2.49	-0.02	0.26	63195
Hong Kong	-2.61	-0.09	0.0	0.07	2.58	-0.01	0.33	252303
Hungary	-2.52	-0.08	-0.0	0.07	2.49	-0.0	0.33	8176
Iceland	-1.01	-0.07	0.0	0.05	0.97	-0.01	0.17	5004
India	-3.14	-0.09	0.0	0.05	2.92	-0.02	0.4	805560
Indonesia	-2.21	-0.1	-0.0	0.07	2.25	-0.01	0.32	79895
Ireland	-2.52	-0.08	0.0	0.06	2.49	-0.02	0.33	8902
Israel	-2.52	-0.09	-0.0	0.07	2.49	-0.01	0.4	69092
Italy	-2.52	-0.07	-0.0	0.05	2.49	-0.01	0.25	62847
Jamaica	-2.07	-0.07	0.0	0.08	2.25	0.0	0.23	6408
Japan	-2.61	-0.04	0.0	0.05	2.58	0.0	0.14	976874
Jordan	-2.21	-0.09	-0.0	0.07	2.25	-0.01	0.3	22382
Kazakhstan	-1.47	-0.11	0.0	0.15	1.41	0.01	0.31	1196
Kenya	-2.21	-0.07	0.0	0.04	2.25	-0.01	0.24	7738
Kuwait	-2.21	-0.1	0.0	0.1	2.25	-0.01	0.35	15146
Latvia	-2.52	-0.12	-0.0	0.09	2.49	-0.02	0.3	5354
Lithuania	-1.86	-0.11	0.0	0.09	1.44	-0.01	0.25	5753
Luxembourg	-2.52	-0.08	0.0	0.05	2.49	-0.01	0.38	1444
Macedonia	-2.52	-0.05	0.0	0.04	2.05	-0.01	0.28	3722
Malawi	-0.43	-0.03	0.0	0.06	0.35	0.01	0.11	520
Malaysia	-2.21	-0.08	0.0	0.07	2.25	-0.01	0.26	211114
Malta	-0.74	-0.06	0.0	0.04	1.63	-0.01	0.17	1301
Mauritius	-2.21	-0.06	0.0	0.06	2.25	0.0	0.3	4894
Mexico	-2.21	-0.1	-0.0	0.07	2.25	-0.01	0.24	26302
Montenegro	-2.52	-0.04	0.0	0.07	2.49	0.02	0.36	4293
Morocco	-2.14	-0.06	-0.0	0.05	1.19	-0.01	0.16	10962
Namibia	-0.35	-0.04	0.0	0.06	0.23	-0.0	0.1	372
Netherlands	-2.52	-0.05	0.0	0.04	2.49	-0.01	0.23	36194
New Zealand	-2.61	-0.11	0.0	0.1	2.58	-0.01	0.38	22976
Nigeria	-2.21	-0.09	0.0	0.06	2.25	-0.01	0.34	18697
Norway	-2.52	-0.12	-0.0	0.08	2.49	-0.03	0.38	49183
Oman	-2.21	-0.08	0.0	0.08	2.25	0.0	0.26	13952
Pakistan	-2.21	-0.04	0.0	0.04	2.25	-0.0	0.18	35524
Peru	-2.21	-0.09	0.0	0.08	2.25	-0.0	0.25	17006
Philippines	-2.21	-0.12	-0.0	0.08	2.25	-0.01	0.45	38698
Poland	-2.52	-0.1	-0.0	0.05	2.49	-0.03	0.3	78385
Portugal	-2.52	-0.08	0.0	0.06	2.22	-0.0	0.25	15848
Qatar	-2.21	-0.17	-0.01	0.11	2.25	-0.05	0.42	3634
Romania	-2.52	-0.08	0.0	0.07	2.49	0.0	0.29	16486
Russian Federation	-2.52	-0.11	0.0	0.11	2.49	0.0	0.46	39523
Rwanda	-0.26	-0.04	0.0	0.05	0.11	-0.01	0.09	68
Saudi Arabia	-2.21	-0.1	-0.0	0.08	2.25	-0.01	0.27	18581
Serbia	-2.52	-0.03	0.0	0.02	2.49	-0.0	0.24	19382
Singapore	-2.61	-0.08	0.0	0.07	2.58	-0.01	0.28	135526
Slovakia	-2.08	-0.06	0.0	0.04	2.49	-0.0	0.31	2915
Slovenia	-1.97	-0.06	0.0	0.06	2.05	-0.0	0.22	7772
South Africa	-2.21	-0.06	0.0	0.05	2.25	-0.01	0.3	80401
South Korea	-2.61	-0.1	0.0	0.08	2.58	-0.01	0.32	408102
Spain	-2.52	-0.06	0.0	0.05	2.49	-0.01	0.22	38420
Sri Lanka	-2.21	-0.1	-0.0	0.08	2.25	-0.01	0.31	25268
Sweden	-2.52	-0.12	-0.0	0.07	2.49	-0.03	0.37	110176
Switzerland	-2.52	-0.06	0.0	0.06	2.49	-0.01	0.22	52479
Taiwan	-2.61	-0.08	0.0	0.08	2.58	-0.0	0.21	180008
Tanzania	-1.39	-0.09	0.0	0.08	2.25	0.01	0.31	819
Thailand	-2.21	-0.09	0.0	0.08	2.25	-0.01	0.27	118393
Tunisia	-1.83	-0.07	-0.0	0.03	1.34	-0.02	0.16	7198
Turkey	-2.52	-0.11	-0.01	0.08	2.49	-0.01	0.29	69414
UK	-2.52	-0.09	0.0	0.06	2.49	-0.02	0.36	413257
US	-2.38	-0.11	-0.0	0.08	2.38	-0.02	0.3	1413275
Uganda	-0.97	-0.03	0.0	0.05	1.02	0.01	0.19	398
Ukraine	-2.52	-0.06	0.0	0.05	2.49	-0.0	0.28	8891
United Arab Emirates	-2.21	-0.12	-0.01	0.06	2.25	-0.04	0.31	6158
Venezuela	-2.21	-0.06	0.0	0.04	1.46	-0.01	0.22	2626
Vietnam	-2.21	-0.08	-0.0	0.07	2.25	-0.0	0.25	73046

NI/TA Level

Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	-0.04	-0.0	0.0	0.01	0.03	0.0	0.01	20199
Australia	-0.74	-0.03	-0.01	0.0	0.12	-0.03	0.08	426986
Austria	-0.64	0.0	0.0	0.0	0.1	-0.0	0.02	28053
Bahrain	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	6150
Bangladesh	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	29745
Belgium	-0.96	0.0	0.0	0.01	0.1	0.0	0.03	43100
Bosnia and Herzegovina	-0.13	-0.0	0.0	0.0	0.09	0.0	0.01	12654
Botswana	-0.04	0.0	0.01	0.01	0.03	0.01	0.01	4798
Brazil	-0.04	-0.0	0.0	0.01	0.03	0.0	0.01	81829
Bulgaria	-0.32	-0.0	0.0	0.01	0.1	0.0	0.02	17814
Canada	-0.78	-0.01	0.0	0.0	0.2	-0.02	0.08	298717
Chile	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	44975
China	-0.07	0.0	0.0	0.01	0.1	0.0	0.01	475620
Colombia	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	10137
Croatia	-0.27	-0.0	0.0	0.0	0.1	0.0	0.01	23009
Cyprus	-0.96	-0.0	0.0	0.0	0.1	-0.01	0.04	21404
Czech Republic	-0.29	0.0	0.0	0.0	0.04	0.0	0.01	8758
Denmark	-0.96	-0.0	0.0	0.0	0.1	-0.0	0.04	58323
Egypt	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	31664
Estonia	-0.09	-0.0	0.0	0.01	0.05	0.0	0.01	3779
Finland	-0.48	0.0	0.0	0.01	0.1	0.0	0.02	40414
France	-0.96	-0.0	0.0	0.0	0.1	-0.0	0.03	216477
Germany	-0.96	-0.0	0.0	0.0	0.1	-0.0	0.03	244145
Ghana	-0.03	0.0	0.0	0.01	0.03	0.0	0.01	2584
Greece	-0.96	-0.0	0.0	0.0	0.1	0.0	0.02	70934
Hong Kong	-0.74	-0.0	0.0	0.01	0.12	-0.0	0.03	341851
Hungary	-0.96	-0.0	0.0	0.01	0.04	-0.0	0.08	10599
Iceland	-0.07	0.0	0.0	0.01	0.05	0.0	0.01	6272
India	-0.05	-0.0	0.0	0.01	0.03	0.0	0.01	942206
Indonesia	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	109160
Ireland	-0.81	-0.0	0.0	0.01	0.1	-0.0	0.03	11438
Israel	-0.96	-0.0	0.0	0.0	0.1	-0.01	0.09	105184
Italy	-0.24	-0.0	0.0	0.0	0.1	0.0	0.01	85072
Jamaica	-0.04	0.0	0.01	0.01	0.03	0.01	0.01	9454
Japan	-0.74	0.0	0.0	0.0	0.12	0.0	0.01	1079426
Jordan	-0.04	-0.0	0.0	0.0	0.03	0.0	0.01	43551
Kazakhstan	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	2578
Kenya	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	11711
Kuwait	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	37210
Latvia	-0.12	-0.0	0.0	0.01	0.1	0.0	0.01	5670
Lithuania	-0.04	0.0	0.0	0.01	0.04	0.0	0.01	6578
Luxembourg	-0.04	0.0	0.0	0.01	0.1	0.0	0.01	4271
Macedonia	-0.5	0.0	0.0	0.0	0.04	-0.0	0.03	4899
Malawi	-0.02	0.0	0.0	0.01	0.03	0.01	0.01	1407
Malaysia	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	257731
Malta	-0.02	0.0	0.0	0.0	0.04	0.0	0.0	3078
Mauritius	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	8235
Mexico	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	32245
Montenegro	-0.07	-0.0	0.0	0.0	0.02	-0.0	0.01	4771
Morocco	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	16449
Namibia	-0.0	0.0	0.0	0.01	0.03	0.01	0.01	1075
Netherlands	-0.96	0.0	0.0	0.01	0.1	-0.0	0.05	44332
New Zealand	-0.74	-0.0	0.0	0.01	0.12	-0.01	0.06	27953
Nigeria	-0.04	-0.0	0.0	0.01	0.03	0.0	0.01	27842
Norway	-0.96	-0.0	0.0	0.0	0.1	-0.0	0.03	61307
Oman	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	21134
Pakistan	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	45293
Peru	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	20228
Philippines	-0.04	-0.0	0.0	0.01	0.03	0.0	0.01	62456
Poland	-0.96	-0.0	0.0	0.01	0.1	-0.0	0.04	95859
Portugal	-0.22	-0.0	0.0	0.0	0.1	0.0	0.01	19555
Qatar	-0.01	0.0	0.0	0.01	0.03	0.01	0.01	7601
Romania	-0.96	-0.0	0.0	0.01	0.1	0.0	0.04	18419
Russian Federation	-0.23	0.0	0.0	0.01	0.1	0.0	0.01	43116
Rwanda	-0.01	0.0	0.0	0.0	0.01	0.0	0.0	213
Saudi Arabia	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	28058
Serbia	-0.12	-0.0	0.0	0.01	0.07	0.0	0.01	21521
Singapore	-0.74	-0.0	0.0	0.01	0.12	-0.0	0.03	169035
Slovakia	-0.03	-0.0	0.0	0.0	0.05	0.0	0.01	4061
Slovenia	-0.07	-0.0	0.0	0.0	0.04	0.0	0.01	10215
South Africa	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	102763
South Korea	-0.74	-0.0	0.0	0.01	0.12	-0.0	0.02	446735
Spain	-0.96	0.0	0.0	0.0	0.1	0.0	0.02	54328
Sri Lanka	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	37406
Sweden	-0.96	-0.01	0.0	0.01	0.1	-0.01	0.04	130821
Switzerland	-0.96	0.0	0.0	0.01	0.1	0.0	0.02	73049
Taiwan	-0.37	0.0	0.0	0.01	0.06	0.0	0.01	206954
Tanzania	-0.04	0.0	0.01	0.02	0.03	0.01	0.01	1224
Thailand	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	150753
Tunisia	-0.04	0.0	0.0	0.0	0.02	0.0	0.01	12365
Turkey	-0.96	-0.0	0.0	0.01	0.1	0.0	0.03	91079
UK	-0.96	-0.01	0.0	0.01	0.1	-0.01	0.06	507239
US	-0.78	-0.0	0.0	0.01	0.2	-0.0	0.03	1880960
Uganda	-0.01	0.0	0.0	0.0	0.02	0.0	0.0	871
Ukraine	-0.1	-0.0	0.0	0.01	0.1	0.0	0.01	9838
United Arab Emirates	-0.04	0.0	0.0	0.0	0.03	0.0	0.01	14909
Venezuela	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	5199
Vietnam	-0.04	0.0	0.0	0.01	0.03	0.0	0.01	83827

NI/TA Trend

Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	20199
Australia	-0.55	-0.0	0.0	0.0	0.44	-0.0	0.07	426986
Austria	-0.5	-0.0	0.0	0.0	0.45	-0.0	0.02	28053
Bahrain	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.0	6150
Bangladesh	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.0	29745
Belgium	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.02	43100
Bosnia and Herzegovina	-0.19	-0.0	0.0	0.0	0.13	-0.0	0.01	12654
Botswana	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.0	4798
Brazil	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	81829
Bulgaria	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.02	17814
Canada	-0.43	-0.0	0.0	0.0	0.4	0.0	0.05	298717
Chile	-0.03	-0.0	-0.0	0.0	0.03	-0.0	0.01	44975
China	-0.11	-0.0	-0.0	0.0	0.08	-0.0	0.01	475620
Colombia	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.0	10137
Croatia	-0.46	-0.0	0.0	0.0	0.48	-0.0	0.02	23009
Cyprus	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.03	21404
Czech Republic	-0.27	-0.0	0.0	0.0	0.26	0.0	0.01	8758
Denmark	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.03	58323
Egypt	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	31664
Estonia	-0.31	-0.0	0.0	0.0	0.11	0.0	0.01	3779
Finland	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.02	40414
France	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.02	216477
Germany	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.02	244145
Ghana	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	2584
Greece	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.02	70934
Hong Kong	-0.55	-0.0	0.0	0.0	0.44	-0.0	0.03	341851
Hungary	-0.5	-0.0	0.0	0.0	0.48	0.0	0.04	10599
Iceland	-0.08	-0.0	0.0	0.0	0.13	-0.0	0.01	6272
India	-0.19	-0.0	0.0	0.0	0.17	-0.0	0.01	942206
Indonesia	-0.03	-0.0	-0.0	0.0	0.03	-0.0	0.01	109160
Ireland	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.03	11438
Israel	-0.5	-0.0	-0.0	0.0	0.48	0.0	0.06	105184
Italy	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.01	85072
Jamaica	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	9454
Japan	-0.55	-0.0	0.0	0.0	0.44	-0.0	0.01	1079426
Jordan	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	43551
Kazakhstan	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	2578
Kenya	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.0	11711
Kuwait	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	37210
Latvia	-0.29	-0.0	0.0	0.0	0.47	-0.0	0.02	5670
Lithuania	-0.12	-0.0	0.0	0.0	0.12	-0.0	0.01	6578
Luxembourg	-0.12	-0.0	0.0	0.0	0.15	0.0	0.01	4271
Macedonia	-0.43	-0.0	0.0	0.0	0.34	-0.0	0.02	4899
Malawi	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.0	1407
Malaysia	-0.03	-0.0	-0.0	0.0	0.03	-0.0	0.01	257731
Malta	-0.05	-0.0	0.0	0.0	0.03	-0.0	0.0	3078
Mauritius	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	8235
Mexico	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	32245
Montenegro	-0.09	-0.0	0.0	0.0	0.06	0.0	0.0	4771
Morocco	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.0	16449
Namibia	-0.01	-0.0	0.0	0.0	0.01	0.0	0.0	1075
Netherlands	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.04	44332
New Zealand	-0.55	-0.0	0.0	0.0	0.44	0.0	0.05	27953
Nigeria	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	27842
Norway	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.03	61307
Oman	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	21134
Pakistan	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.0	45293
Peru	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	20228
Philippines	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	62456
Poland	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.03	95859
Portugal	-0.5	-0.0	0.0	0.0	0.22	-0.0	0.01	19555
Qatar	-0.03	-0.0	-0.0	0.0	0.03	-0.0	0.0	7601
Romania	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.03	18419
Russian Federation	-0.5	-0.0	0.0	0.0	0.23	-0.0	0.01	43116
Rwanda	-0.01	-0.0	-0.0	0.0	0.01	-0.0	0.0	213
Saudi Arabia	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	28058
Serbia	-0.13	-0.0	0.0	0.0	0.16	-0.0	0.01	21521
Singapore	-0.55	-0.0	-0.0	0.0	0.44	-0.0	0.03	169035
Slovakia	-0.06	-0.0	0.0	0.0	0.07	-0.0	0.01	4061
Slovenia	-0.07	-0.0	0.0	0.0	0.11	-0.0	0.01	10215
South Africa	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	102763
South Korea	-0.55	-0.0	0.0	0.0	0.44	-0.0	0.02	446735
Spain	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.02	54328
Sri Lanka	-0.03	-0.0	-0.0	0.0	0.03	-0.0	0.01	37406
Sweden	-0.5	-0.0	0.0	0.0	0.48	-0.0	0.03	130821
Switzerland	-0.5	-0.0	0.0	0.0	0.48	0.0	0.02	73049
Taiwan	-0.55	-0.0	-0.0	0.0	0.37	-0.0	0.01	206954
Tanzania	-0.03	-0.0	-0.0	0.0	0.03	0.0	0.01	1224
Thailand	-0.03	-0.0	-0.0	0.0	0.03	-0.0	0.01	150753
Tunisia	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.0	12365
Turkey	-0.5	-0.0	-0.0	0.0	0.48	-0.0	0.02	91079
UK	-0.5	-0.0	0.0	0.0	0.48	0.0	0.04	507239
US	-0.43	-0.0	0.0	0.0	0.4	-0.0	0.02	1880960
Uganda	-0.02	-0.0	0.0	0.0	0.02	0.0	0.0	871
Ukraine	-0.2	-0.0	0.0	0.0	0.16	-0.0	0.01	9838
United Arab Emirates	-0.03	-0.0	0.0	0.0	0.03	-0.0	0.01	14909
Venezuela	-0.03	-0.0	0.0	0.0	0.03	0.0	0.0	5199
Vietnam	-0.03	-0.0	-0.0	0.0	0.03	-0.0	0.01	83827

SIZE Level

Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	-6.11	-1.56	-0.03	1.38	6.1	-0.06	2.0	20317
Australia	-4.22	-1.17	-0.03	1.61	7.15	0.38	2.09	447741
Austria	-7.06	-1.3	-0.0	1.47	4.83	0.01	2.04	30674
Bahrain	-3.09	-0.8	0.03	1.31	3.42	0.2	1.38	5254
Bangladesh	-4.37	-0.91	0.05	1.4	6.31	0.22	1.66	34441
Belgium	-7.06	-1.46	0.01	1.64	7.55	0.04	2.3	51294
Bosnia and Herzegovina	-7.06	-1.15	-0.03	1.07	5.65	0.05	1.84	15441
Botswana	-6.11	-0.92	0.03	1.11	5.61	0.1	1.46	4455
Brazil	-6.11	-1.7	0.01	1.4	6.31	-0.14	2.38	83024
Bulgaria	-7.06	-1.39	-0.0	1.2	7.55	-0.09	1.85	26618
Canada	-5.95	-1.44	-0.03	1.54	6.63	0.06	2.25	333943
Chile	-6.11	-1.17	-0.01	1.24	6.22	-0.03	1.8	43361
China	-2.05	-0.45	0.0	0.59	4.34	0.15	0.87	505232
Colombia	-6.11	-1.39	0.03	1.11	4.45	-0.21	1.7	9894
Croatia	-7.06	-1.17	-0.03	1.16	5.74	0.04	1.8	22007
Cyprus	-7.0	-1.04	-0.08	0.96	6.58	-0.01	1.55	23149
Czech Republic	-6.53	-1.24	-0.09	1.16	5.43	-0.02	1.88	9432
Denmark	-7.06	-1.15	-0.01	1.36	7.55	0.23	2.0	60501
Egypt	-5.54	-1.25	-0.08	1.44	5.74	0.11	1.87	33385
Estonia	-3.72	-0.92	0.01	1.17	4.79	0.1	1.67	3953
Finland	-6.22	-1.34	-0.04	1.44	7.43	0.07	1.97	42045
France	-7.06	-1.44	-0.05	1.72	7.55	0.23	2.36	252665
Germany	-7.06	-1.59	-0.04	1.55	7.55	0.02	2.56	294632
Ghana	-6.11	-1.43	0.0	1.26	3.24	-0.28	1.99	2476
Greece	-7.06	-0.93	-0.02	1.2	6.73	0.25	1.74	73186
Hong Kong	-4.22	-1.02	-0.02	1.36	7.15	0.3	1.83	375532
Hungary	-7.06	-1.65	-0.01	1.47	6.2	0.08	2.32	11239
Iceland	-6.41	-0.69	0.06	0.79	3.64	0.02	1.29	6702
India	-5.04	-1.43	0.01	1.88	8.38	0.36	2.38	793030
Indonesia	-6.11	-1.24	0.0	1.31	6.31	0.1	1.87	107562
Ireland	-5.87	-1.17	0.0	1.57	5.5	0.18	2.01	12453
Israel	-7.06	-1.08	-0.04	1.23	7.55	0.14	1.82	123331
Italy	-7.06	-1.18	-0.03	1.49	6.47	0.19	1.97	90981
Jamaica	-6.11	-1.24	-0.01	1.08	4.67	-0.1	1.76	10104
Japan	-4.22	-1.04	-0.05	1.22	7.15	0.21	1.71	1127708
Jordan	-3.81	-0.87	-0.01	1.12	6.31	0.23	1.54	43038
Kazakhstan	-4.46	-1.61	0.02	1.3	4.16	-0.12	1.84	2361
Kenya	-6.11	-1.23	0.0	1.16	5.56	-0.08	1.8	12716
Kuwait	-6.11	-0.81	-0.04	0.84	5.55	0.13	1.38	36566
Latvia	-6.25	-1.16	-0.05	2.31	6.21	0.49	2.22	5697
Lithuania	-4.88	-1.11	0.04	1.07	3.97	-0.01	1.57	7901
Luxembourg	-7.06	-1.51	0.01	0.71	5.62	-0.26	1.91	4877
Macedonia	-6.67	-1.37	-0.02	1.07	4.88	-0.11	1.8	7225
Malawi	-5.75	-1.52	-0.11	0.99	5.69	-0.25	1.81	1446
Malaysia	-5.48	-0.88	-0.02	1.08	6.31	0.22	1.56	272356
Malta	-4.2	-0.98	-0.05	0.96	2.49	-0.07	1.34	3413
Mauritius	-6.11	-0.74	0.06	0.82	3.54	0.02	1.28	8716
Mexico	-6.11	-1.27	-0.03	1.22	5.01	-0.06	1.88	31470
Montenegro	-7.06	-1.44	-0.06	1.07	4.92	-0.15	1.9	5091
Morocco	-6.11	-1.32	-0.02	1.53	5.16	0.06	1.88	16633
Namibia	-6.11	-1.23	0.01	0.76	1.94	-0.52	1.79	1000
Netherlands	-7.06	-1.6	0.04	1.58	6.56	0.07	2.3	47236
New Zealand	-4.22	-1.43	0.02	1.24	5.15	-0.07	1.92	29225
Nigeria	-6.11	-1.1	-0.03	1.77	6.31	0.29	2.1	29850
Norway	-7.06	-1.15	-0.01	1.26	6.75	0.11	1.78	64341
Oman	-5.5	-0.96	0.02	1.12	5.07	0.05	1.56	18864
Pakistan	-6.11	-1.49	-0.04	1.71	6.31	0.1	2.27	80126
Peru	-6.11	-1.3	-0.02	1.59	5.01	0.06	1.93	18934
Philippines	-6.11	-1.18	0.01	1.52	5.68	0.24	1.87	61821
Poland	-6.84	-1.33	-0.09	1.43	7.55	0.15	2.07	128497
Portugal	-7.06	-1.55	0.03	1.8	5.32	0.0	2.47	20357
Qatar	-6.11	-1.55	0.05	1.01	3.82	-0.2	1.65	7971
Romania	-7.06	-1.22	-0.05	1.18	7.55	0.08	2.01	27152
Russian Federation	-7.06	-1.65	-0.03	1.68	7.55	0.05	2.44	40478
Rwanda	-2.76	-1.91	-0.12	0.26	1.92	-0.61	1.13	244
Saudi Arabia	-4.58	-0.89	-0.03	1.34	6.31	0.3	1.58	29765
Serbia	-6.51	-1.29	-0.07	1.22	6.31	0.04	1.85	21776
Singapore	-4.22	-0.95	-0.02	1.2	6.82	0.27	1.72	175266
Slovakia	-6.22	-1.33	-0.0	2.2	6.28	0.47	2.49	4615
Slovenia	-7.06	-1.15	-0.01	1.6	7.55	0.35	2.37	12847
South Africa	-6.11	-1.63	-0.01	1.66	6.31	0.02	2.27	110408
South Korea	-4.22	-0.72	0.01	0.98	7.15	0.24	1.51	504577
Spain	-7.06	-1.45	-0.01	1.55	6.06	0.03	2.17	54756
Sri Lanka	-6.11	-0.99	-0.06	1.0	4.86	0.07	1.54	40056
Sweden	-7.06	-1.52	-0.08	1.66	7.55	0.19	2.32	140024
Switzerland	-7.06	-1.28	0.02	1.26	7.55	0.08	1.97	75799
Taiwan	-4.22	-0.79	-0.0	0.89	7.04	0.14	1.4	221641
Tanzania	-4.03	-1.83	-0.0	0.94	3.65	-0.3	1.8	1331
Thailand	-5.26	-0.94	-0.0	1.15	6.31	0.22	1.6	157856
Tunisia	-4.67	-0.97	-0.05	1.16	3.94	0.08	1.36	13174
Turkey	-5.27	-1.21	-0.02	1.36	6.47	0.15	1.89	95648
UK	-7.06	-1.43	-0.05	1.61	7.55	0.2	2.25	541082
US	-5.95	-1.29	0.02	1.45	6.63	0.14	1.99	1961320
Uganda	-3.49	-1.4	0.03	0.76	3.06	-0.29	1.56	944
Ukraine	-7.06	-1.01	-0.01	0.83	3.87	-0.11	1.52	9022
United Arab Emirates	-4.26	-1.04	-0.03	1.11	4.81	0.11	1.6	13474
Venezuela	-6.11	-1.34	-0.11	1.14	6.31	-0.19	2.36	6287
Vietnam	-4.53	-0.93	0.01	1.2	6.31	0.23	1.72	85875

SIZE Trend

Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	-1.81	-0.19	-0.01	0.18	2.04	0.0	0.39	20317
Australia	-1.61	-0.21	-0.01	0.2	1.86	0.01	0.42	447741
Austria	-2.09	-0.14	-0.02	0.11	2.21	-0.02	0.3	30674
Bahrain	-1.24	-0.1	-0.01	0.07	2.04	-0.02	0.18	5254
Bangladesh	-1.81	-0.16	-0.03	0.09	1.84	-0.03	0.27	34441
Belgium	-2.09	-0.11	-0.01	0.09	2.21	-0.02	0.28	51294
Bosnia and Herzegovina	-2.09	-0.12	-0.0	0.12	2.21	0.01	0.3	15441
Botswana	-1.81	-0.12	-0.01	0.09	2.04	-0.01	0.26	4455
Brazil	-1.81	-0.2	-0.02	0.18	2.04	-0.0	0.38	83024
Bulgaria	-2.09	-0.15	-0.02	0.13	2.21	-0.01	0.39	26618
Canada	-1.91	-0.18	0.01	0.2	1.88	0.01	0.4	333943
Chile	-1.81	-0.12	-0.0	0.12	2.04	0.01	0.26	43361
China	-0.93	-0.13	-0.0	0.13	1.2	0.01	0.24	505232
Colombia	-1.81	-0.13	-0.0	0.12	2.04	0.0	0.26	9894
Croatia	-2.09	-0.14	0.0	0.16	2.21	0.01	0.33	22007
Cyprus	-2.09	-0.17	0.0	0.16	2.21	-0.01	0.34	23149
Czech Republic	-2.09	-0.13	0.03	0.2	2.21	0.04	0.3	9432
Denmark	-2.09	-0.11	0.0	0.12	2.21	0.01	0.28	60501
Egypt	-1.81	-0.15	0.0	0.17	2.04	0.02	0.31	33385
Estonia	-1.99	-0.17	-0.02	0.11	2.21	-0.02	0.32	3953
Finland	-2.09	-0.12	0.01	0.15	2.21	0.02	0.28	42045
France	-2.09	-0.11	0.02	0.15	2.21	0.02	0.3	252665
Germany	-2.09	-0.14	0.0	0.16	2.21	-0.01	0.37	294632
Ghana	-1.47	-0.26	-0.01	0.18	2.03	-0.04	0.33	2476
Greece	-2.09	-0.19	-0.01	0.18	2.21	-0.01	0.35	73186
Hong Kong	-1.61	-0.18	-0.01	0.16	1.86	0.0	0.36	375532
Hungary	-2.09	-0.16	-0.01	0.16	2.21	0.0	0.34	11239
Iceland	-2.09	-0.17	-0.02	0.11	2.21	-0.03	0.31	6702
India	-1.71	-0.22	-0.02	0.19	2.01	-0.0	0.39	793030
Indonesia	-1.81	-0.19	-0.03	0.15	2.04	-0.01	0.39	107562
Ireland	-2.09	-0.15	0.0	0.16	2.21	-0.0	0.33	12453
Israel	-2.09	-0.15	0.0	0.17	2.21	0.02	0.35	123331
Italy	-2.09	-0.11	0.0	0.13	2.21	0.01	0.25	90981
Jamaica	-1.81	-0.14	0.01	0.2	2.04	0.04	0.35	10104
Japan	-1.61	-0.1	0.0	0.13	1.86	0.02	0.23	1127708
Jordan	-1.81	-0.11	-0.01	0.1	2.04	0.0	0.24	43038
Kazakhstan	-1.81	-0.27	0.01	0.26	2.04	-0.01	0.53	2361
Kenya	-1.81	-0.14	0.01	0.15	2.04	0.01	0.27	12716
Kuwait	-1.81	-0.11	0.01	0.13	2.04	0.01	0.26	36566
Latvia	-2.09	-0.18	0.0	0.22	2.21	0.03	0.36	5697
Lithuania	-2.09	-0.16	-0.02	0.14	2.21	-0.0	0.33	7901
Luxembourg	-2.09	-0.12	0.0	0.13	2.21	-0.01	0.32	4877
Macedonia	-2.09	-0.15	-0.01	0.13	2.07	0.02	0.32	7225
Malawi	-1.81	-0.15	0.05	0.27	2.04	0.02	0.54	1446
Malaysia	-1.81	-0.14	-0.01	0.14	2.04	0.01	0.3	272356
Malta	-1.49	-0.08	0.02	0.14	1.99	0.05	0.25	3413
Mauritius	-1.81	-0.11	-0.02	0.08	2.0	-0.01	0.2	8716
Mexico	-1.81	-0.12	0.0	0.13	2.04	0.0	0.28	31470
Montenegro	-2.09	-0.12	0.0	0.16	2.21	0.02	0.38	5091
Morocco	-1.81	-0.12	-0.01	0.11	2.04	0.01	0.23	16633
Namibia	-1.81	-0.05	0.03	0.13	2.04	0.09	0.37	1000
Netherlands	-2.09	-0.14	-0.01	0.11	2.21	-0.02	0.28	47236
New Zealand	-1.61	-0.13	-0.01	0.12	1.86	-0.0	0.29	29225
Nigeria	-1.81	-0.16	-0.01	0.16	2.04	0.01	0.35	29850
Norway	-2.09	-0.16	-0.0	0.16	2.21	0.01	0.37	64341
Oman	-1.81	-0.11	-0.0	0.12	2.04	0.0	0.27	18864
Pakistan	-1.81	-0.19	-0.02	0.19	2.04	0.03	0.39	80126
Peru	-1.81	-0.15	-0.0	0.15	2.04	0.01	0.32	18934
Philippines	-1.81	-0.16	-0.02	0.14	2.04	0.0	0.34	61821
Poland	-2.09	-0.17	0.0	0.19	2.21	0.02	0.38	128497
Portugal	-2.09	-0.16	-0.02	0.11	2.21	-0.02	0.27	20357
Qatar	-1.81	-0.13	-0.02	0.1	2.04	-0.02	0.24	7971
Romania	-2.09	-0.14	0.02	0.21	2.21	0.05	0.39	27152
Russian Federation	-2.09	-0.18	-0.0	0.17	2.21	-0.0	0.39	40478
Rwanda	-0.36	-0.07	0.04	0.27	1.91	0.19	0.45	244
Saudi Arabia	-1.81	-0.1	0.02	0.15	2.04	0.02	0.24	29765
Serbia	-2.09	-0.11	0.01	0.16	2.21	0.03	0.32	21776
Singapore	-1.61	-0.15	-0.01	0.14	1.86	0.0	0.31	175266
Slovakia	-2.09	-0.16	0.03	0.25	2.21	0.04	0.44	4615
Slovenia	-2.09	-0.13	0.03	0.17	2.21	0.0	0.33	12847
South Africa	-1.81	-0.18	-0.02	0.15	2.04	-0.01	0.36	110408
South Korea	-1.61	-0.18	-0.03	0.14	1.86	-0.01	0.35	504577
Spain	-2.09	-0.11	0.01	0.14	2.21	0.02	0.29	54756
Sri Lanka	-1.81	-0.12	0.01	0.16	2.04	0.03	0.27	40056
Sweden	-2.09	-0.12	0.03	0.2	2.21	0.04	0.36	140024
Switzerland	-2.09	-0.1	-0.0	0.11	2.21	-0.0	0.24	75799
Taiwan	-1.61	-0.12	-0.0	0.12	1.86	0.0	0.24	221641
Tanzania	-1.12	-0.05	0.04	0.2	1.11	0.07	0.2	1331
Thailand	-1.81	-0.15	-0.01	0.13	2.04	0.0	0.3	157856
Tunisia	-1.81	-0.1	-0.0	0.1	1.82	0.01	0.2	13174
Turkey	-2.09	-0.19	-0.01	0.18	2.21	0.0	0.35	95648
UK	-2.09	-0.16	0.01	0.17	2.21	0.01	0.37	541082
US	-1.91	-0.16	-0.0	0.14	1.88	-0.02	0.33	1961320
Uganda	-1.08	-0.17	-0.05	0.08	1.46	-0.03	0.31	944
Ukraine	-2.09	-0.25	0.0	0.27	2.21	-0.0	0.53	9022
United Arab Emirates	-1.81	-0.1	0.0	0.12	2.04	0.01	0.25	13474
Venezuela	-1.81	-0.23	0.03	0.3	2.04	0.05	0.71	6287
Vietnam	-1.81	-0.17	-0.03	0.12	2.04	-0.02	0.27	85875

M/B

Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	0.18	0.83	1.0	1.26	15.09	1.4	1.86	19116
Australia	0.15	0.68	1.0	1.76	14.47	1.77	2.34	415381
Austria	0.11	0.88	1.0	1.27	17.97	1.22	0.98	27378
Bahrain	0.36	0.88	1.0	1.13	5.52	1.08	0.38	4948
Bangladesh	0.18	0.82	1.0	1.45	15.09	1.49	1.61	29549
Belgium	0.11	0.85	1.0	1.31	17.97	1.33	1.38	41805
Bosnia and Herzegovina	0.13	0.68	1.0	1.46	17.97	1.17	1.04	8250
Botswana	0.29	0.83	1.0	1.35	15.09	1.36	1.36	4101
Brazil	0.18	0.79	1.0	1.38	15.09	1.64	2.44	75241
Bulgaria	0.11	0.72	1.0	1.36	17.97	1.26	1.34	16173
Canada	0.16	0.74	1.0	1.59	67.14	2.03	5.3	295202
Chile	0.18	0.77	1.0	1.38	15.09	1.29	1.41	40344
China	0.26	0.74	1.0	1.45	21.01	1.29	1.24	464025
Colombia	0.18	0.83	1.0	1.22	6.0	1.1	0.56	8866
Croatia	0.15	0.78	1.0	1.22	17.97	1.11	0.87	19828
Cyprus	0.11	0.77	1.0	1.29	17.97	1.22	1.33	19199
Czech Republic	0.2	0.78	1.0	1.26	17.97	1.13	0.7	7552
Denmark	0.11	0.89	1.0	1.38	17.97	1.54	1.93	56497
Egypt	0.2	0.82	1.0	1.37	15.09	1.27	1.07	30593
Estonia	0.22	0.85	1.0	1.3	17.97	1.27	1.33	3741
Finland	0.14	0.81	1.0	1.37	17.97	1.32	1.33	39880
France	0.11	0.83	1.0	1.36	17.97	1.37	1.49	210563
Germany	0.11	0.81	1.0	1.41	17.97	1.43	1.67	239331
Ghana	0.39	0.87	1.0	1.37	7.73	1.35	1.03	2266
Greece	0.11	0.82	1.0	1.29	17.97	1.2	0.92	69399
Hong Kong	0.15	0.74	1.0	1.55	14.47	1.53	1.86	337961
Hungary	0.11	0.76	1.0	1.34	17.97	1.35	1.67	10276
Iceland	0.11	0.87	1.0	1.21	4.69	1.09	0.4	5781
India	0.18	0.76	1.0	1.48	14.08	1.53	1.88	710959
Indonesia	0.18	0.81	1.0	1.42	15.09	1.42	1.55	101957
Ireland	0.16	0.8	1.0	1.37	17.97	1.31	1.3	11195
Israel	0.11	0.87	1.0	1.31	17.97	1.57	2.25	102551
Italy	0.18	0.87	1.0	1.26	17.97	1.22	0.93	84224
Jamaica	0.18	0.79	1.0	1.39	15.09	1.37	1.4	9039
Japan	0.16	0.85	1.0	1.23	14.47	1.25	1.13	1077014
Jordan	0.18	0.78	1.0	1.24	15.09	1.15	0.79	39537
Kazakhstan	0.24	0.89	1.0	1.11	15.09	1.35	1.6	1935
Kenya	0.19	0.79	1.0	1.24	15.09	1.25	1.06	11312
Kuwait	0.18	0.82	1.0	1.26	15.09	1.13	0.64	34743
Latvia	0.15	0.73	1.0	1.25	12.91	1.12	0.82	4818
Lithuania	0.28	0.83	1.0	1.22	6.11	1.1	0.51	6451
Luxembourg	0.32	0.8	1.0	1.23	17.97	1.74	3.33	3938
Macedonia	0.11	0.76	1.0	1.18	17.97	1.2	1.7	4219
Malawi	0.18	0.84	1.0	1.25	15.09	1.31	1.49	1221
Malaysia	0.18	0.8	1.0	1.32	15.09	1.27	1.14	255873
Malta	0.33	0.88	1.0	1.43	14.41	1.39	1.18	2928
Mauritius	0.18	0.78	1.0	1.24	15.09	1.17	0.9	7934
Mexico	0.18	0.81	1.0	1.32	14.97	1.15	0.58	29596
Montenegro	0.11	0.65	1.0	1.58	17.97	1.39	1.69	3239
Morocco	0.22	0.86	1.0	1.46	11.73	1.27	0.69	15704
Namibia	0.57	0.88	1.0	1.12	4.08	1.22	0.69	900
Netherlands	0.11	0.82	1.0	1.37	17.97	1.39	1.68	44011
New Zealand	0.15	0.77	1.0	1.55	14.47	1.59	2.03	27121
Nigeria	0.18	0.81	1.0	1.39	15.09	1.4	1.42	26302
Norway	0.11	0.84	1.0	1.44	17.97	1.5	1.73	59870
Oman	0.18	0.87	1.0	1.26	5.53	1.13	0.47	17439
Pakistan	0.18	0.81	1.0	1.3	15.09	1.3	1.25	44224
Peru	0.18	0.74	1.0	1.39	15.09	1.26	1.0	17073
Philippines	0.18	0.73	1.0	1.61	15.09	1.89	2.85	58581
Poland	0.11	0.78	1.0	1.39	17.97	1.43	1.77	94855
Portugal	0.11	0.86	1.0	1.21	17.97	1.11	0.61	18407
Qatar	0.18	0.84	1.0	1.31	11.22	1.16	0.56	7587
Romania	0.11	0.75	1.0	1.32	17.97	1.23	1.45	17095
Russian Federation	0.11	0.72	1.0	1.33	17.97	1.31	1.65	37005
Rwanda	0.35	0.68	1.0	1.58	2.07	1.09	0.47	212
Saudi Arabia	0.18	0.76	1.0	1.49	15.09	1.31	1.01	27831
Serbia	0.11	0.76	1.0	1.25	17.97	1.08	0.74	14517
Singapore	0.15	0.8	1.0	1.34	14.47	1.32	1.3	165816
Slovakia	0.16	0.79	1.0	1.14	4.64	1.0	0.38	2965
Slovenia	0.11	0.78	1.0	1.2	17.97	1.1	1.02	9114
South Africa	0.18	0.76	1.0	1.45	15.09	1.38	1.54	100811
South Korea	0.15	0.82	1.0	1.37	14.47	1.36	1.36	441875
Spain	0.11	0.84	1.0	1.28	17.97	1.22	0.93	50654
Sri Lanka	0.22	0.81	1.0	1.25	15.09	1.26	1.21	36880
Sweden	0.11	0.73	1.0	1.63	17.97	1.58	1.83	129521
Switzerland	0.14	0.83	1.0	1.41	17.97	1.36	1.23	71699
Taiwan	0.21	0.83	1.0	1.35	14.47	1.23	0.8	206696
Tanzania	0.44	0.73	1.0	1.59	15.09	1.79	2.41	1164
Thailand	0.18	0.8	1.0	1.34	15.09	1.23	0.91	147704
Tunisia	0.2	0.89	1.0	1.3	6.4	1.22	0.63	12072
Turkey	0.11	0.8	1.0	1.37	17.97	1.58	2.53	90393
UK	0.11	0.73	1.0	1.58	17.97	1.59	2.12	493620
US	0.16	0.78	1.0	1.58	67.14	1.6	2.7	1877222
Uganda	0.52	0.82	1.0	1.12	15.09	1.1	1.01	844
Ukraine	0.11	0.76	1.0	1.38	17.97	1.4	1.83	7494
United Arab Emirates	0.26	0.84	1.0	1.15	9.95	1.07	0.47	13070
Venezuela	0.18	0.68	1.0	1.27	15.09	2.29	4.13	4495
Vietnam	0.18	0.86	1.0	1.19	15.09	1.12	0.61	81937

SIGMA

Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	0.02	0.09	0.11	0.15	0.72	0.13	0.06	17157
Australia	0.03	0.13	0.23	0.34	1.04	0.25	0.16	371422
Austria	0.02	0.06	0.08	0.13	1.33	0.11	0.1	26113
Bahrain	0.02	0.06	0.09	0.13	0.4	0.1	0.05	2311
Bangladesh	0.02	0.09	0.11	0.14	0.67	0.12	0.05	33359
Belgium	0.02	0.06	0.08	0.12	1.41	0.1	0.08	41105
Bosnia and Herzegovina	0.02	0.1	0.15	0.21	0.77	0.17	0.1	4402
Botswana	0.02	0.03	0.05	0.07	0.42	0.06	0.05	1889
Brazil	0.02	0.09	0.13	0.2	1.07	0.17	0.13	61701
Bulgaria	0.02	0.11	0.16	0.25	1.11	0.2	0.13	11888
Canada	0.03	0.1	0.17	0.28	1.05	0.22	0.17	301165
Chile	0.02	0.06	0.08	0.11	0.83	0.09	0.06	28688
China	0.03	0.08	0.11	0.14	0.43	0.12	0.05	503675
Colombia	0.02	0.06	0.08	0.11	0.48	0.09	0.06	6430
Croatia	0.02	0.09	0.13	0.19	1.19	0.16	0.1	14576
Cyprus	0.02	0.14	0.2	0.28	1.41	0.24	0.18	16266
Czech Republic	0.03	0.08	0.12	0.16	0.66	0.12	0.06	6873
Denmark	0.02	0.07	0.1	0.15	1.23	0.13	0.1	48004
Egypt	0.02	0.08	0.11	0.15	0.64	0.13	0.07	30814
Estonia	0.02	0.06	0.11	0.18	0.68	0.13	0.09	3586
Finland	0.02	0.08	0.1	0.14	1.41	0.13	0.09	37564
France	0.02	0.07	0.1	0.16	1.41	0.13	0.09	213070
Germany	0.02	0.09	0.14	0.26	1.41	0.23	0.25	270195
Ghana	0.02	0.07	0.09	0.12	1.07	0.11	0.1	1233
Greece	0.02	0.1	0.14	0.19	0.9	0.16	0.09	69807
Hong Kong	0.03	0.1	0.15	0.22	1.04	0.17	0.1	365208
Hungary	0.02	0.08	0.12	0.2	0.75	0.16	0.11	9381
Iceland	0.03	0.06	0.08	0.13	0.61	0.1	0.07	4237
India	0.04	0.14	0.17	0.22	1.04	0.2	0.12	706595
Indonesia	0.02	0.11	0.16	0.25	1.07	0.2	0.13	89002
Ireland	0.03	0.08	0.11	0.18	1.41	0.16	0.14	9669
Israel	0.02	0.08	0.12	0.19	1.1	0.15	0.09	106793
Italy	0.02	0.07	0.09	0.12	0.68	0.11	0.05	87532
Jamaica	0.03	0.13	0.17	0.24	0.84	0.2	0.1	7265
Japan	0.03	0.08	0.1	0.15	1.04	0.12	0.07	1074135
Jordan	0.02	0.09	0.12	0.15	0.88	0.13	0.06	33801
Kazakhstan	0.02	0.08	0.11	0.18	0.95	0.15	0.13	1173
Kenya	0.04	0.09	0.12	0.16	0.52	0.13	0.05	10775
Kuwait	0.02	0.09	0.12	0.16	1.07	0.13	0.06	29497
Latvia	0.03	0.09	0.13	0.21	0.94	0.16	0.11	2723
Lithuania	0.02	0.07	0.11	0.16	1.02	0.13	0.09	6468
Luxembourg	0.02	0.08	0.1	0.13	0.52	0.11	0.05	2978
Macedonia	0.02	0.07	0.11	0.16	0.66	0.12	0.07	2781
Malawi	0.02	0.08	0.12	0.22	0.58	0.15	0.11	165
Malaysia	0.02	0.09	0.14	0.2	1.07	0.16	0.1	259303
Malta	0.02	0.05	0.07	0.09	0.59	0.08	0.07	1443
Mauritius	0.02	0.04	0.06	0.09	0.43	0.07	0.05	6085
Mexico	0.02	0.07	0.09	0.12	1.03	0.11	0.07	23209
Montenegro	0.05	0.13	0.2	0.38	1.41	0.31	0.29	1911
Morocco	0.02	0.08	0.1	0.12	0.47	0.1	0.04	13525
Namibia	0.02	0.03	0.05	0.06	0.22	0.05	0.03	294
Netherlands	0.02	0.06	0.09	0.13	1.41	0.11	0.09	44666
New Zealand	0.03	0.06	0.08	0.14	1.04	0.12	0.11	23944
Nigeria	0.02	0.1	0.13	0.16	0.6	0.13	0.06	23088
Norway	0.03	0.09	0.13	0.2	1.26	0.16	0.11	52813
Oman	0.02	0.06	0.08	0.11	0.98	0.09	0.06	12051
Pakistan	0.03	0.1	0.14	0.22	1.07	0.2	0.16	67144
Peru	0.02	0.07	0.11	0.16	0.53	0.13	0.07	10287
Philippines	0.02	0.1	0.15	0.23	0.97	0.18	0.11	50624
Poland	0.02	0.11	0.16	0.26	1.41	0.21	0.15	119894
Portugal	0.02	0.07	0.1	0.15	1.21	0.13	0.1	15377
Qatar	0.02	0.06	0.08	0.11	0.49	0.1	0.05	7644
Romania	0.03	0.11	0.17	0.24	1.41	0.2	0.13	16544
Russian Federation	0.02	0.09	0.13	0.21	1.25	0.17	0.12	28881
Rwanda	0.02	0.04	0.07	0.09	0.13	0.06	0.03	141
Saudi Arabia	0.02	0.06	0.08	0.11	0.64	0.1	0.05	28960
Serbia	0.02	0.12	0.19	0.27	1.41	0.2	0.11	7648
Singapore	0.03	0.09	0.14	0.23	1.04	0.19	0.16	154192
Slovakia	0.02	0.08	0.11	0.18	0.55	0.13	0.09	1365
Slovenia	0.02	0.07	0.1	0.16	1.27	0.14	0.13	7978
South Africa	0.02	0.09	0.13	0.22	1.07	0.19	0.17	96130
South Korea	0.03	0.11	0.14	0.2	1.04	0.16	0.08	494289
Spain	0.02	0.06	0.09	0.13	0.95	0.1	0.06	46098
Sri Lanka	0.02	0.09	0.13	0.18	1.07	0.15	0.09	37535
Sweden	0.02	0.09	0.14	0.25	1.41	0.2	0.15	130381
Switzerland	0.02	0.06	0.09	0.12	1.41	0.11	0.08	66527
Taiwan	0.03	0.07	0.1	0.12	0.62	0.1	0.04	218053
Tanzania	0.02	0.05	0.08	0.11	0.39	0.09	0.06	929
Thailand	0.02	0.08	0.12	0.17	1.07	0.14	0.09	146099
Tunisia	0.02	0.06	0.08	0.09	0.58	0.08	0.04	11407
Turkey	0.03	0.1	0.13	0.18	1.09	0.15	0.07	94358
UK	0.02	0.08	0.12	0.19	1.41	0.15	0.1	473494
US	0.03	0.09	0.14	0.22	1.05	0.17	0.12	1882684
Uganda	0.02	0.08	0.13	0.17	0.47	0.14	0.1	462
Ukraine	0.02	0.11	0.17	0.26	1.17	0.22	0.16	3907
United Arab Emirates	0.02	0.08	0.11	0.15	0.43	0.12	0.06	9232
Venezuela	0.02	0.14	0.21	0.32	1.07	0.25	0.15	4055
Vietnam	0.02	0.1	0.14	0.19	0.72	0.15	0.06	78376

CASH/TA Level

Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	-9.4	-3.06	-2.05	-1.68	-0.4	-2.36	1.02	2634
Australia	-9.69	-4.04	-2.83	-1.68	-0.0	-2.94	1.68	48167
Austria	-10.93	-4.21	-2.81	-1.88	-0.07	-3.25	1.86	8243
Bahrain	-7.12	-2.3	-1.83	-1.4	-0.09	-2.01	1.02	3841
Bangladesh	-9.24	-2.57	-1.94	-0.99	-0.2	-2.19	1.49	11264
Belgium	-12.74	-5.59	-4.36	-2.55	-0.04	-4.24	2.18	11300
Bosnia and Herzegovina	-8.33	-2.67	-1.58	-1.05	-0.39	-2.18	1.7	1431
Botswana	-9.34	-3.84	-2.44	-1.8	-0.02	-2.98	1.63	2473
Brazil	-12.0	-3.79	-2.21	-1.45	-0.0	-2.85	1.98	13042
Bulgaria	-9.82	-4.07	-2.73	-1.75	-0.08	-3.13	1.88	4674
Canada	-9.63	-4.36	-3.18	-1.92	-0.0	-3.22	1.76	33618
Chile	-12.0	-5.32	-3.6	-2.45	-0.0	-4.12	2.29	11591
China	-7.39	-2.59	-2.07	-1.57	-0.05	-2.14	0.97	41541
Colombia	-11.88	-2.91	-2.43	-2.13	-0.0	-2.84	1.68	3282
Croatia	-11.74	-3.87	-1.57	-1.37	-0.89	-2.57	1.8	3109
Cyprus	-11.53	-4.07	-2.67	-1.61	-0.09	-3.11	1.93	7426
Czech Republic	-11.54	-4.22	-2.06	-1.43	-0.66	-2.89	2.06	961
Denmark	-12.74	-3.41	-2.5	-1.93	-0.0	-2.82	1.4	20723
Egypt	-8.82	-3.29	-2.34	-1.6	-0.3	-2.65	1.41	9911
Estonia	-7.61	-4.23	-3.25	-1.92	-0.64	-3.25	1.53	734
Finland	-11.73	-4.19	-2.97	-2.07	-0.1	-3.34	1.88	4498
France	-12.74	-5.44	-3.65	-2.53	-0.03	-4.32	2.55	37728
Germany	-12.74	-4.75	-3.26	-1.98	0.05	-3.66	2.26	55139
Ghana	-4.99	-2.07	-1.43	-1.19	-0.59	-1.67	0.75	956
Greece	-10.97	-3.71	-2.45	-1.64	-0.19	-2.91	1.79	7530
Hong Kong	-9.69	-3.36	-2.41	-1.67	-0.0	-2.61	1.38	87096
Hungary	-11.86	-4.33	-3.07	-2.05	-0.0	-3.36	1.78	2430
Iceland	-7.06	-3.74	-2.99	-2.4	-0.99	-3.14	1.02	1256
India	-9.6	-4.82	-3.67	-2.6	-0.1	-3.78	1.62	127340
Indonesia	-10.67	-3.69	-2.45	-1.82	-0.0	-2.83	1.39	28751
Ireland	-8.12	-3.28	-2.43	-1.78	-0.24	-2.73	1.38	2506
Israel	-12.65	-3.84	-2.84	-1.98	0.05	-3.05	1.6	33726
Italy	-12.74	-4.4	-3.06	-2.0	-0.02	-3.83	2.69	21608
Jamaica	-11.32	-3.55	-2.23	-1.19	-0.0	-2.46	1.61	3005
Japan	-9.62	-3.22	-2.63	-1.97	-0.0	-2.63	1.0	101726
Jordan	-10.03	-4.45	-2.91	-1.48	-0.01	-3.18	1.97	20157
Kazakhstan	-4.45	-2.33	-1.98	-1.69	-1.11	-2.04	0.54	1375
Kenya	-7.93	-3.38	-2.27	-1.91	-0.89	-2.69	1.15	3849
Kuwait	-10.87	-4.21	-3.25	-2.41	-0.02	-3.4	1.46	21111
Latvia	-5.85	-3.69	-2.48	-1.47	-1.08	-2.77	1.42	316
Lithuania	-8.95	-4.2	-2.58	-1.56	-0.74	-2.86	1.57	825
Luxembourg	-9.97	-3.57	-2.44	-1.95	-0.41	-3.05	1.82	2661
Macedonia	-9.55	-1.59	-1.4	-1.08	-0.26	-1.92	1.72	1099
Malawi	-6.8	-3.38	-1.73	-1.29	-0.55	-2.36	1.43	887
Malaysia	-12.0	-4.46	-3.25	-2.13	-0.02	-3.42	1.67	46079
Malta	-7.89	-3.76	-2.61	-1.45	-0.69	-2.86	1.71	1703
Mauritius	-11.55	-5.16	-3.77	-2.85	-0.78	-4.39	2.23	2501
Mexico	-12.0	-4.14	-2.89	-2.15	-0.01	-3.44	2.06	5733
Montenegro	-3.96	-2.12	-1.75	-1.48	-0.87	-1.88	0.64	427
Morocco	-12.0	-5.77	-3.87	-2.47	-0.02	-4.49	2.79	5448
Namibia	-9.4	-5.47	-2.96	-2.12	-0.52	-3.69	2.16	717
Netherlands	-12.74	-4.97	-3.36	-2.31	0.05	-3.73	1.92	6997
New Zealand	-9.69	-5.92	-4.34	-2.28	-0.0	-4.17	2.14	4036
Nigeria	-12.0	-2.21	-1.5	-1.06	-0.0	-1.88	1.34	9133
Norway	-7.54	-3.88	-3.32	-2.71	-0.01	-3.26	1.04	11900
Oman	-10.19	-4.0	-2.73	-1.92	-0.02	-3.02	1.47	6787
Pakistan	-8.8	-2.64	-2.15	-1.65	-0.11	-2.3	1.15	9915
Peru	-8.74	-2.46	-1.74	-1.48	-0.0	-2.32	1.59	3174
Philippines	-12.0	-4.16	-2.52	-1.7	-0.0	-3.12	1.99	22778
Poland	-10.6	-3.91	-2.72	-1.9	0.05	-3.01	1.58	16658
Portugal	-12.74	-4.48	-2.79	-1.97	-0.08	-3.58	2.56	3695
Qatar	-6.68	-2.62	-1.92	-1.39	-0.0	-2.04	1.08	3918
Romania	-8.63	-4.1	-2.19	-1.36	-0.39	-2.89	1.89	1910
Russian Federation	-12.74	-2.13	-1.76	-1.27	-0.01	-1.89	1.47	3601
Rwanda	-6.22	-4.96	-1.91	-1.5	-1.14	-2.83	1.78	145
Saudi Arabia	-10.42	-2.38	-1.78	-0.84	-0.0	-1.89	1.37	8867
Serbia	-7.13	-1.55	-1.23	-0.83	-0.03	-1.48	1.21	1958
Singapore	-8.7	-3.66	-2.54	-1.71	-0.0	-2.79	1.43	33256
Slovakia	-4.87	-2.91	-2.3	-1.69	-1.1	-2.41	0.93	1146
Slovenia	-11.79	-5.48	-4.29	-3.21	-0.54	-4.46	1.85	2325
South Africa	-9.55	-4.0	-2.72	-1.84	-0.0	-3.04	1.62	21530
South Korea	-9.69	-4.41	-3.37	-2.58	-0.17	-3.68	1.56	29637
Spain	-10.42	-4.6	-3.21	-2.17	0.04	-3.52	1.86	15551
Sri Lanka	-10.17	-3.79	-2.84	-2.21	-0.0	-3.02	1.32	11830
Sweden	-11.42	-4.33	-3.18	-2.13	0.05	-3.32	1.68	19626
Switzerland	-9.27	-3.61	-2.59	-1.68	0.05	-2.74	1.46	20136
Taiwan	-9.38	-3.71	-2.74	-2.1	-0.0	-2.99	1.27	22366
Tanzania	-2.37	-1.78	-1.53	-1.03	-0.53	-1.4	0.48	440
Thailand	-10.56	-4.15	-3.07	-2.19	-0.0	-3.22	1.46	31979
Tunisia	-11.42	-4.0	-3.14	-2.36	-0.86	-3.29	1.26	5121
Turkey	-11.57	-4.06	-2.37	-1.59	-0.0	-3.04	2.07	20519
UK	-12.58	-3.57	-2.41	-1.43	0.05	-2.68	1.76	90918
US	-9.63	-3.89	-3.19	-2.52	-0.0	-3.26	1.27	388653
Uganda	-4.35	-1.97	-1.44	-1.18	-0.59	-1.91	1.15	468
Ukraine	-4.78	-2.2	-1.85	-1.48	-0.45	-2.01	0.88	972
United Arab Emirates	-5.67	-2.53	-1.89	-1.46	-0.0	-2.05	0.89	8589
Venezuela	-8.57	-3.16	-1.65	-1.34	-0.0	-2.22	1.31	2390
Vietnam	-7.83	-3.42	-2.1	-1.12	-0.0	-2.38	1.57	10660

CASH/TA Trend

Country	Min	25%	Median	75%	Max	Mean	StdDev	Observations
Argentina	-4.12	-0.12	0.0	0.17	4.22	0.03	0.51	2634
Australia	-3.61	-0.21	0.0	0.17	3.74	-0.02	0.66	48167
Austria	-4.5	-0.14	-0.0	0.09	4.82	-0.01	0.66	8243
Bahrain	-2.17	-0.14	-0.01	0.12	2.93	0.0	0.38	3841
Bangladesh	-4.13	-0.06	0.0	0.04	4.22	0.02	0.44	11264
Belgium	-4.5	-0.18	0.0	0.17	4.82	-0.0	0.65	11300
Bosnia and Herzegovina	-3.65	-0.05	0.0	0.06	3.22	0.02	0.46	1431
Botswana	-4.13	-0.15	0.0	0.14	4.22	0.01	0.66	2473
Brazil	-4.13	-0.18	0.0	0.15	4.22	-0.02	0.67	13042
Bulgaria	-4.5	-0.12	0.0	0.07	4.82	-0.03	0.65	4674
Canada	-3.3	-0.23	0.0	0.19	3.16	-0.02	0.67	33618
Chile	-4.13	-0.24	0.0	0.24	4.22	0.03	0.99	11591
China	-2.46	-0.16	0.0	0.14	2.67	-0.0	0.41	41541
Colombia	-4.13	-0.15	-0.0	0.14	4.22	0.02	0.67	3282
Croatia	-3.59	-0.08	0.0	0.07	3.06	-0.01	0.39	3109
Cyprus	-4.5	-0.18	0.0	0.07	4.82	-0.05	0.79	7426
Czech Republic	-4.5	-0.08	0.0	0.09	2.35	-0.05	0.51	961
Denmark	-4.5	-0.17	0.0	0.17	4.82	0.0	0.61	20723
Egypt	-4.13	-0.19	-0.0	0.16	4.09	-0.01	0.54	9911
Estonia	-2.29	-0.29	0.0	0.18	3.87	-0.01	0.67	734
Finland	-4.5	-0.24	0.0	0.17	4.82	-0.01	0.66	4498
France	-4.5	-0.15	0.0	0.15	4.82	0.01	0.72	37728
Germany	-4.5	-0.18	0.0	0.13	4.82	-0.01	0.76	55139
Ghana	-1.46	-0.12	0.0	0.15	1.56	0.02	0.28	956
Greece	-4.5	-0.17	0.0	0.13	4.82	0.01	0.78	7530
Hong Kong	-3.61	-0.18	0.0	0.15	3.74	-0.01	0.57	87096
Hungary	-3.58	-0.19	0.0	0.21	4.82	0.02	0.68	2430
Iceland	-2.3	-0.18	0.0	0.13	4.07	0.01	0.51	1256
India	-4.3	-0.16	0.0	0.13	4.46	-0.01	0.75	127340
Indonesia	-4.13	-0.17	0.0	0.15	4.22	0.0	0.49	28751
Ireland	-4.34	-0.11	0.0	0.1	3.35	0.0	0.48	2506
Israel	-4.5	-0.26	0.0	0.22	4.82	-0.01	0.76	33726
Italy	-4.5	-0.16	-0.0	0.12	4.82	0.01	0.67	21608
Jamaica	-3.18	-0.12	0.0	0.13	4.22	0.01	0.58	3005
Japan	-3.61	-0.13	0.0	0.13	3.74	-0.0	0.33	101726
Jordan	-4.13	-0.2	0.0	0.14	4.22	-0.03	0.73	20157
Kazakhstan	-3.23	-0.13	0.0	0.13	1.34	-0.01	0.33	1375
Kenya	-2.88	-0.13	0.0	0.1	3.86	-0.01	0.43	3849
Kuwait	-4.13	-0.22	0.0	0.22	4.22	0.01	0.67	21111
Latvia	-1.9	-0.17	-0.0	0.16	1.22	-0.03	0.4	316
Lithuania	-2.66	-0.15	0.0	0.15	4.82	0.04	0.6	825
Luxembourg	-4.5	-0.15	0.0	0.12	4.82	0.01	0.65	2661
Macedonia	-1.83	-0.08	0.0	0.04	1.5	-0.04	0.29	1099
Malawi	-4.13	-0.07	0.0	0.1	2.92	0.03	0.48	887
Malaysia	-4.13	-0.18	0.0	0.21	4.22	0.02	0.65	46079
Malta	-3.43	-0.11	0.0	0.1	2.37	-0.01	0.36	1703
Mauritius	-4.13	-0.15	0.0	0.1	4.22	-0.02	0.67	2501
Mexico	-4.13	-0.2	0.0	0.18	4.22	0.01	0.66	5733
Montenegro	-0.7	-0.01	0.0	0.06	0.54	0.0	0.15	427
Morocco	-4.13	-0.17	0.0	0.17	4.22	-0.01	0.74	5448
Namibia	-3.8	-0.12	0.0	0.11	3.8	-0.04	0.68	717
Netherlands	-4.5	-0.16	0.0	0.19	4.82	0.02	0.76	6997
New Zealand	-3.61	-0.25	0.0	0.2	3.74	-0.01	0.69	4036
Nigeria	-3.72	-0.13	0.0	0.09	4.22	-0.01	0.47	9133
Norway	-4.2	-0.22	0.0	0.2	4.82	-0.01	0.51	11900
Oman	-4.13	-0.24	0.0	0.2	4.22	-0.02	0.75	6787
Pakistan	-4.13	-0.12	0.0	0.09	4.22	-0.0	0.46	9915
Peru	-4.13	-0.1	0.0	0.07	3.19	-0.02	0.36	3174
Philippines	-4.13	-0.17	-0.0	0.13	4.22	-0.01	0.63	22778
Poland	-4.5	-0.24	0.0	0.18	4.82	-0.02	0.74	16658
Portugal	-4.5	-0.11	-0.0	0.06	4.82	-0.01	0.48	3695
Qatar	-2.48	-0.18	-0.01	0.13	3.33	-0.02	0.4	3918
Romania	-4.13	-0.14	-0.0	0.11	4.47	0.01	0.61	1910
Russian Federation	-4.5	-0.13	0.0	0.14	4.82	-0.02	0.61	3601
Rwanda	-0.78	-0.17	-0.03	0.12	1.66	-0.01	0.38	145
Saudi Arabia	-4.13	-0.15	-0.0	0.12	4.22	-0.01	0.63	8867
Serbia	-3.61	-0.09	0.0	0.04	2.45	-0.03	0.35	1958
Singapore	-3.61	-0.17	0.0	0.15	3.74	0.0	0.51	33256
Slovakia	-1.41	-0.13	-0.0	0.06	1.5	-0.01	0.29	1146
Slovenia	-4.5	-0.19	0.0	0.19	4.72	0.01	0.83	2325
South Africa	-4.13	-0.15	0.0	0.13	4.22	-0.0	0.62	21530
South Korea	-3.61	-0.24	0.0	0.24	3.74	-0.01	0.76	29637
Spain	-4.5	-0.18	0.0	0.13	4.82	-0.01	0.63	15551
Sri Lanka	-4.13	-0.18	0.0	0.19	4.22	0.0	0.61	11830
Sweden	-4.5	-0.26	0.0	0.21	4.82	-0.02	0.72	19626
Switzerland	-4.5	-0.1	0.0	0.09	4.82	-0.0	0.5	20136
Taiwan	-3.61	-0.17	0.0	0.15	3.74	-0.0	0.54	22366
Tanzania	-0.53	-0.1	0.0	0.06	0.65	-0.01	0.2	440
Thailand	-4.13	-0.22	0.0	0.19	4.22	0.0	0.6	31979
Tunisia	-4.13	-0.13	0.0	0.13	4.22	-0.0	0.53	5121
Turkey	-4.5	-0.23	0.0	0.2	4.82	0.0	0.93	20519
UK	-4.5	-0.19	0.0	0.13	4.82	-0.02	0.67	90918
US	-3.3	-0.21	-0.01	0.17	3.16	-0.02	0.51	388653
Uganda	-1.04	-0.07	0.0	0.11	0.78	-0.0	0.25	468
Ukraine	-2.51	-0.13	-0.0	0.07	1.8	-0.03	0.28	972
United Arab Emirates	-3.28	-0.13	-0.0	0.1	3.4	-0.01	0.36	8589
Venezuela	-3.78	-0.05	0.0	0.06	4.22	0.01	0.45	2390
Vietnam	-4.13	-0.23	-0.01	0.14	4.22	-0.06	0.62	10660

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

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

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

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

Table A.11: Number of defaults and other exits of 88 economics from 1990 to 2019.

Economy: Argentina

		Defaults		**Others**	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	1	0	0.0	0	0.0
1993	1	0	0.0	0	0.0
1994	25	0	0.0	1	4.0
1995	97	0	0.0	4	4.12
1996	100	0	0.0	5	5.0
1997	97	0	0.0	12	12.37
1998	89	1	1.12	8	8.99
1999	85	1	1.18	12	14.12
2000	79	1	1.27	5	6.33
2001	75	2	2.67	12	16.0
2002	79	7	8.86	3	3.8
2003	77	3	3.9	3	3.9
2004	74	2	2.7	1	1.35
2005	73	0	0.0	1	1.37
2006	75	0	0.0	0	0.0
2007	80	0	0.0	1	1.25
2008	80	0	0.0	5	6.25
2009	75	1	1.33	6	8.0
2010	73	1	1.37	0	0.0
2011	73	0	0.0	0	0.0
2012	74	0	0.0	1	1.35
2013	73	0	0.0	4	5.48
2014	70	0	0.0	4	5.71
2015	68	0	0.0	1	1.47
2016	72	1	1.39	0	0.0
2017	80	0	0.0	2	2.5
2018	81	0	0.0	3	3.7
2019	79	0	0.0	0	0.0

Economy: Australia

		Defaults		**Others**	
Year	Active	#	%	#	%
1990	762	0	0.0	39	5.12
1991	743	4	0.54	26	3.5
1992	767	0	0.0	20	2.61
1993	850	0	0.0	11	1.29
1994	953	0	0.0	12	1.26
1995	988	1	0.1	24	2.43
1996	1037	1	0.1	29	2.8
1997	1089	2	0.18	56	5.14
1998	1089	3	0.28	66	6.06
1999	1140	3	0.26	50	4.39
2000	1267	10	0.79	58	4.58
2001	1272	27	2.12	63	4.95
2002	1267	8	0.63	59	4.66
2003	1296	8	0.62	53	4.09
2004	1396	4	0.29	46	3.3
2005	1530	5	0.33	55	3.59
2006	1673	3	0.18	76	4.54
2007	1859	4	0.22	78	4.2
2008	1851	25	1.35	73	3.94
2009	1798	26	1.45	64	3.56
2010	1825	5	0.27	76	4.16
2011	1865	1	0.05	98	5.25
2012	1818	3	0.17	92	5.06
2013	1788	4	0.22	69	3.86
2014	1800	7	0.39	94	5.22
2015	1816	3	0.17	94	5.18
2016	1856	2	0.11	110	5.93
2017	1874	12	0.64	93	4.96
2018	1894	11	0.58	109	5.76
2019	1852	16	0.86	61	3.29

Economy: Austria

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	1	0	0.0	1	100.0
1991	78	0	0.0	0	0.0
1992	89	0	0.0	0	0.0
1993	100	0	0.0	0	0.0
1994	111	0	0.0	0	0.0
1995	118	0	0.0	1	0.85
1996	120	0	0.0	3	2.5
1997	123	0	0.0	4	3.25
1998	122	0	0.0	8	6.56
1999	119	0	0.0	10	8.4
2000	126	0	0.0	8	6.35
2001	127	2	1.57	6	4.72
2002	124	0	0.0	9	7.26
2003	123	0	0.0	13	10.57
2004	113	0	0.0	10	8.85
2005	111	0	0.0	8	7.21
2006	111	0	0.0	4	3.6
2007	115	0	0.0	5	4.35
2008	114	2	1.75	3	2.63
2009	111	1	0.9	3	2.7
2010	111	1	0.9	9	8.11
2011	103	0	0.0	9	8.74
2012	96	1	1.04	6	6.25
2013	92	0	0.0	4	4.35
2014	90	0	0.0	0	0.0
2015	92	0	0.0	11	11.96
2016	83	0	0.0	8	9.64
2017	80	0	0.0	8	10.0
2018	74	0	0.0	3	4.05
2019	83	0	0.0	1	1.2

Economy: Bahrain

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	32	0	0.0	0	0.0
2005	36	0	0.0	0	0.0
2006	39	0	0.0	0	0.0
2007	40	0	0.0	1	2.5
2008	41	1	2.44	2	4.88
2009	38	0	0.0	1	2.63
2010	39	0	0.0	1	2.56
2011	38	1	2.63	2	5.26
2012	35	0	0.0	3	8.57
2013	32	0	0.0	0	0.0
2014	34	0	0.0	0	0.0
2015	34	0	0.0	2	5.88
2016	34	0	0.0	3	8.82
2017	37	0	0.0	3	8.11
2018	36	0	0.0	1	2.78
2019	39	0	0.0	0	0.0

Economy: Bangladesh

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	161	0	0.0	0	0.0
2000	171	0	0.0	37	21.64
2001	144	0	0.0	35	24.31
2002	121	0	0.0	7	5.79
2003	125	0	0.0	22	17.6
2004	111	0	0.0	4	3.6
2005	208	0	0.0	1	0.48
2006	216	0	0.0	2	0.93
2007	226	0	0.0	2	0.88
2008	235	0	0.0	6	2.55
2009	237	0	0.0	42	17.72
2010	233	0	0.0	9	3.86
2011	232	1	0.43	3	1.29
2012	241	0	0.0	0	0.0
2013	256	0	0.0	1	0.39
2014	274	1	0.36	0	0.0
2015	285	0	0.0	0	0.0
2016	294	0	0.0	1	0.34
2017	301	0	0.0	0	0.0
2018	312	0	0.0	2	0.64
2019	318	0	0.0	0	0.0

Economy: Belgium

		Defaults		Others	
Year	Active	#	%	#	%
1990	115	0	0.0	1	0.87
1991	139	0	0.0	2	1.44
1992	140	0	0.0	0	0.0
1993	145	0	0.0	0	0.0
1994	151	0	0.0	1	0.66
1995	160	0	0.0	0	0.0
1996	173	0	0.0	5	2.89
1997	183	0	0.0	15	8.2
1998	194	0	0.0	16	8.25
1999	205	2	0.98	5	2.44
2000	206	0	0.0	6	2.91
2001	202	2	0.99	9	4.46
2002	192	3	1.56	11	5.73
2003	187	1	0.53	9	4.81
2004	182	1	0.55	10	5.49
2005	183	1	0.55	10	5.46
2006	193	2	1.04	6	3.11
2007	225	1	0.44	10	4.44
2008	227	0	0.0	10	4.41
2009	221	1	0.45	6	2.71
2010	219	0	0.0	11	5.02
2011	210	0	0.0	11	5.24
2012	201	1	0.5	3	1.49
2013	202	2	0.99	11	5.45
2014	191	1	0.52	16	8.38
2015	182	0	0.0	8	4.4
2016	179	1	0.56	10	5.59
2017	172	0	0.0	7	4.07
2018	171	0	0.0	12	7.02
2019	173	0	0.0	7	4.05

Economy: Bosnia and Herzegovina

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	0	0.0	NaN	0	NaN
1997	0	0.0	NaN	0	NaN
1998	0	0.0	NaN	0	NaN
1999	0	0.0	NaN	0	NaN
2000	0	0.0	NaN	0	NaN
2001	0	0.0	NaN	0	NaN
2002	0	0.0	NaN	0	NaN
2003	0	0.0	NaN	0	NaN
2004	0	0.0	NaN	0	NaN
2005	0	0.0	NaN	0	NaN
2006	286	0.0	0.0	0	0.0
2007	325	0.0	0.0	1	0.31
2008	338	0.0	0.0	27	7.99
2009	316	0.0	0.0	114	36.08
2010	211	0.0	0.0	39	18.48
2011	185	0.0	0.0	50	27.03
2012	148	0.0	0.0	20	13.51
2013	140	0.0	0.0	18	12.86
2014	130	0.0	0.0	16	12.31
2015	132	0.0	0.0	11	8.33
2016	128	0.0	0.0	15	11.72
2017	135	0.0	0.0	8	5.93
2018	156	0.0	0.0	19	12.18
2019	204	0.0	0.0	0	0.0

Economy: Botswana

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	8	0.0	0.0	0	0.0
1997	11	0.0	0.0	0	0.0
1998	12	0.0	0.0	0	0.0
1999	15	0.0	0.0	0	0.0
2000	16	0.0	0.0	0	0.0
2001	16	0.0	0.0	0	0.0
2002	18	0.0	0.0	0	0.0
2003	19	0.0	0.0	0	0.0
2004	19	0.0	0.0	2	10.53
2005	17	0.0	0.0	0	0.0
2006	17	0.0	0.0	0	0.0
2007	18	0.0	0.0	0	0.0
2008	21	0.0	0.0	1	4.76
2009	20	0.0	0.0	0	0.0
2010	22	0.0	0.0	1	4.55
2011	22	0.0	0.0	0	0.0
2012	23	0.0	0.0	0	0.0
2013	24	0.0	0.0	1	4.17
2014	23	0.0	0.0	1	4.35
2015	23	0.0	0.0	2	8.7
2016	23	0.0	0.0	0	0.0
2017	25	0.0	0.0	1	4.0
2018	26	0.0	0.0	2	7.69
2019	26	0.0	0.0	2	7.69

Economy: Brazil

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	266	0	0.0	0	0.0
1995	298	0	0.0	5	1.68
1996	310	0	0.0	6	1.94
1997	326	1	0.31	22	6.75
1998	362	1	0.28	33	9.12
1999	351	1	0.28	26	7.41
2000	338	2	0.59	29	8.58
2001	316	0	0.0	34	10.76
2002	298	2	0.67	23	7.72
2003	288	2	0.69	14	4.86
2004	287	0	0.0	14	4.88
2005	288	1	0.35	17	5.9
2006	302	0	0.0	14	4.64
2007	360	0	0.0	14	3.89
2008	360	1	0.28	21	5.83
2009	347	0	0.0	14	4.03
2010	347	0	0.0	19	5.48
2011	341	0	0.0	14	4.11
2012	338	6	1.78	22	6.51
2013	325	7	2.15	8	2.46
2014	317	6	1.89	11	3.47
2015	320	4	1.25	14	4.38
2016	322	8	2.48	18	5.59
2017	322	5	1.55	13	4.04
2018	315	0	0.0	6	1.9
2019	321	0	0.0	15	4.67

Economy: Bulgaria

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	14	0	0.0	0	0.0
2001	25	0	0.0	0	0.0
2002	32	0	0.0	0	0.0
2003	36	0	0.0	1	2.78
2004	39	0	0.0	0	0.0
2005	141	1	0.71	1	0.71
2006	218	0	0.0	0	0.0
2007	242	0	0.0	8	3.31
2008	256	0	0.0	16	6.25
2009	244	0	0.0	21	8.61
2010	228	1	0.44	25	10.96
2011	208	0	0.0	20	9.62
2012	197	0	0.0	18	9.14
2013	186	0	0.0	13	6.99
2014	178	2	1.12	15	8.43
2015	166	0	0.0	10	6.02
2016	163	0	0.0	10	6.13
2017	160	0	0.0	15	9.38
2018	154	0	0.0	4	2.6
2019	182	0	0.0	1	0.55

Economy: Canada

		Defaults		Others	
Year	Active	#	%	#	%
1990	988	0	0.0	67	6.78
1991	991	0	0.0	54	5.45
1992	1055	1	0.09	24	2.27
1993	1253	0	0.0	9	0.72
1994	1442	0	0.0	11	0.76
1995	1613	0	0.0	18	1.12
1996	1837	0	0.0	36	1.96
1997	2144	6	0.28	106	4.94
1998	2303	9	0.39	207	8.99
1999	2243	13	0.58	1053	46.95
2000	1364	8	0.59	180	13.2
2001	1264	20	1.58	240	18.99
2002	1070	6	0.56	98	9.16
2003	1061	13	1.23	85	8.01
2004	1095	6	0.55	78	7.12
2005	1132	2	0.18	83	7.33
2006	1199	3	0.25	91	7.59
2007	1250	3	0.24	109	8.72
2008	1235	12	0.97	97	7.85
2009	1187	13	1.1	113	9.52
2010	1175	3	0.26	81	6.89
2011	1190	5	0.42	88	7.39
2012	1168	6	0.51	90	7.71
2013	1151	3	0.26	83	7.21
2014	1159	7	0.6	89	7.68
2015	1178	7	0.59	94	7.98
2016	1153	11	0.95	91	7.89
2017	1152	5	0.43	86	7.47
2018	1218	0	0.0	66	5.42
2019	1294	0	0.0	50	3.86

Economy: Chile

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	145	0	0.0	0	0.0
1995	167	0	0.0	1	0.6
1996	177	0	0.0	0	0.0
1997	190	0	0.0	0	0.0
1998	193	0	0.0	4	2.07
1999	192	0	0.0	9	4.69
2000	184	0	0.0	6	3.26
2001	182	1	0.55	6	3.3
2002	180	1	0.56	5	2.78
2003	176	0	0.0	7	3.98
2004	181	1	0.55	2	1.1
2005	186	0	0.0	5	2.69
2006	187	0	0.0	7	3.74
2007	181	0	0.0	3	1.66
2008	181	0	0.0	5	2.76
2009	181	0	0.0	5	2.76
2010	182	0	0.0	8	4.4
2011	178	0	0.0	6	3.37
2012	182	0	0.0	7	3.85
2013	182	0	0.0	5	2.75
2014	180	1	0.56	2	1.11
2015	183	0	0.0	9	4.92
2016	183	0	0.0	12	6.56
2017	178	0	0.0	5	2.81
2018	180	0	0.0	10	5.56
2019	180	0	0.0	3	1.67

Economy: China

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	8	0	0.0	0	0.0
1991	10	0	0.0	0	0.0
1992	45	0	0.0	0	0.0
1993	159	0	0.0	0	0.0
1994	271	1	0.37	0	0.0
1995	308	6	1.95	0	0.0
1996	518	10	1.93	0	0.0
1997	729	15	2.06	1	0.14
1998	869	34	3.91	0	0.0
1999	948	23	2.43	0	0.0
2000	1093	27	2.47	0	0.0
2001	1191	49	4.11	2	0.17
2002	1252	51	4.07	5	0.4
2003	1305	43	3.3	4	0.31
2004	1458	106	7.27	9	0.62
2005	1446	93	6.43	13	0.9
2006	1464	62	4.23	28	1.91
2007	1538	51	3.32	20	1.3
2008	1584	39	2.46	7	0.44
2009	1687	38	2.25	11	0.65
2010	2012	39	1.94	15	0.75
2011	2264	14	0.62	11	0.49
2012	2417	16	0.66	9	0.37
2013	2431	14	0.58	7	0.29
2014	2542	5	0.2	11	0.43
2015	2761	3	0.11	10	0.36
2016	2986	7	0.23	12	0.4
2017	3422	20	0.58	13	0.38
2018	3536	38	1.07	9	0.25
2019	3726	36	0.97	9	0.24

Economy: Colombia

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	1	0	0.0	0	0.0
1995	48	0	0.0	0	0.0
1996	51	0	0.0	4	7.84
1997	52	0	0.0	6	11.54
1998	62	0	0.0	12	19.35
1999	53	0	0.0	4	7.55
2000	51	0	0.0	5	9.8
2001	54	0	0.0	6	11.11
2002	50	0	0.0	1	2.0
2003	53	0	0.0	2	3.77
2004	53	0	0.0	2	3.77
2005	60	0	0.0	7	11.67
2006	53	0	0.0	8	15.09
2007	53	0	0.0	4	7.55
2008	48	0	0.0	4	8.33
2009	49	0	0.0	3	6.12
2010	49	0	0.0	1	2.04
2011	49	0	0.0	1	2.04
2012	50	1	2.0	2	4.0
2013	48	0	0.0	1	2.08
2014	48	0	0.0	3	6.25
2015	45	0	0.0	1	2.22
2016	44	0	0.0	3	6.82
2017	42	0	0.0	2	4.76
2018	43	0	0.0	3	6.98
2019	46	0	0.0	0	0.0

Economy: Croatia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	30	0	0.0	0	0.0
2003	47	0	0.0	2	4.26
2004	56	0	0.0	2	3.57
2005	61	0	0.0	2	3.28
2006	202	0	0.0	3	1.49
2007	224	0	0.0	4	1.79
2008	221	0	0.0	30	13.57
2009	192	0	0.0	23	11.98
2010	173	1	0.58	13	7.51
2011	164	0	0.0	10	6.1
2012	157	1	0.64	14	8.92
2013	145	0	0.0	14	9.66
2014	146	1	0.68	14	9.59
2015	137	0	0.0	11	8.03
2016	135	0	0.0	13	9.63
2017	124	0	0.0	9	7.26
2018	117	0	0.0	25	21.37
2019	103	1	0.97	4	3.88

Economy: Cyprus

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	37	0	0.0	1	2.7
1997	43	0	0.0	0	0.0
1998	50	0	0.0	2	4.0
1999	59	0	0.0	1	1.69
2000	120	0	0.0	3	2.5
2001	145	0	0.0	5	3.45
2002	150	0	0.0	0	0.0
2003	150	0	0.0	3	2.0
2004	149	0	0.0	5	3.36
2005	146	0	0.0	6	4.11
2006	143	0	0.0	3	2.1
2007	145	0	0.0	7	4.83
2008	140	0	0.0	11	7.86
2009	130	0	0.0	9	6.92
2010	124	0	0.0	10	8.06
2011	114	0	0.0	11	9.65
2012	105	0	0.0	22	20.95
2013	86	2	2.33	21	24.42
2014	66	0	0.0	9	13.64
2015	64	0	0.0	4	6.25
2016	66	0	0.0	4	6.06
2017	64	0	0.0	4	6.25
2018	64	0	0.0	5	7.81
2019	78	0	0.0	2	2.56

Economy: Czech Republic					
		Defaults		**Others**	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	1	0	0.0	0	0.0
1995	53	0	0.0	1	1.89
1996	150	0	0.0	0	0.0
1997	588	0	0.0	319	54.25
1998	270	1	0.37	30	11.11
1999	241	4	1.66	85	35.27
2000	154	7	4.55	25	16.23
2001	123	2	1.63	39	31.71
2002	83	1	1.2	22	26.51
2003	60	0	0.0	15	25.0
2004	48	0	0.0	11	22.92
2005	37	0	0.0	15	40.54
2006	24	0	0.0	8	33.33
2007	17	0	0.0	2	11.76
2008	16	0	0.0	0	0.0
2009	17	0	0.0	4	23.53
2010	16	0	0.0	0	0.0
2011	19	1	5.26	1	5.26
2012	17	0	0.0	1	5.88
2013	17	0	0.0	3	17.65
2014	15	0	0.0	1	6.67
2015	15	0	0.0	0	0.0
2016	18	0	0.0	2	11.11
2017	16	0	0.0	0	0.0
2018	16	0	0.0	4	25.0
2019	17	0	0.0	0	0.0

Economy: Denmark					
		Defaults		**Others**	
Year	Active	#	%	#	%
1990	105	0	0.0	1	0.95
1991	145	0	0.0	1	0.69
1992	167	0	0.0	0	0.0
1993	173	0	0.0	0	0.0
1994	181	0	0.0	0	0.0
1995	207	0	0.0	0	0.0
1996	220	0	0.0	0	0.0
1997	225	0	0.0	5	2.22
1998	232	0	0.0	11	4.74
1999	227	0	0.0	12	5.29
2000	227	0	0.0	10	4.41
2001	220	5	2.27	15	6.82
2002	200	2	1.0	10	5.0
2003	193	1	0.52	9	4.66
2004	186	2	1.08	10	5.38
2005	181	0	0.0	9	4.97
2006	196	0	0.0	6	3.06
2007	222	1	0.45	3	1.35
2008	227	1	0.44	9	3.96
2009	217	4	1.84	6	2.76
2010	211	0	0.0	13	6.16
2011	200	2	1.0	10	5.0
2012	189	2	1.06	11	5.82
2013	179	4	2.23	10	5.59
2014	168	2	1.19	11	6.55
2015	159	1	0.63	6	3.77
2016	157	0	0.0	15	9.55
2017	147	0	0.0	5	3.4
2018	155	1	0.65	3	1.94
2019	157	0	0.0	5	3.18

Economy: Egypt

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	0	0	NaN	0	NaN
2005	0	0	NaN	0	NaN
2006	174	0	0.0	4	2.3
2007	195	0	0.0	4	2.05
2008	207	0	0.0	3	1.45
2009	209	0	0.0	7	3.35
2010	235	0	0.0	20	8.51
2011	229	0	0.0	3	1.31
2012	232	0	0.0	4	1.72
2013	239	0	0.0	2	0.84
2014	246	0	0.0	4	1.63
2015	249	1	0.4	3	1.2
2016	253	0	0.0	2	0.79
2017	257	0	0.0	2	0.78
2018	265	0	0.0	6	2.26
2019	268	0	0.0	7	2.61

Economy: Estonia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	0	0.0	NaN	0	NaN
1997	17	0.0	0.0	0	0.0
1998	19	0.0	0.0	0	0.0
1999	20	0.0	0.0	0	0.0
2000	21	0.0	0.0	3	14.29
2001	18	0.0	0.0	3	16.67
2002	15	0.0	0.0	3	20.0
2003	12	0.0	0.0	0	0.0
2004	12	0.0	0.0	0	0.0
2005	15	0.0	0.0	1	6.67
2006	16	0.0	0.0	2	12.5
2007	17	0.0	0.0	0	0.0
2008	18	0.0	0.0	0	0.0
2009	18	0.0	0.0	2	11.11
2010	17	0.0	0.0	1	5.88
2011	16	0.0	0.0	0	0.0
2012	17	0.0	0.0	0	0.0
2013	17	0.0	0.0	0	0.0
2014	17	0.0	0.0	1	5.88
2015	17	0.0	0.0	0	0.0
2016	18	0.0	0.0	0	0.0
2017	19	0.0	0.0	0	0.0
2018	20	0.0	0.0	1	5.0
2019	20	0.0	0.0	0	0.0

Economy: Finland					
		Defaults		Others	
Year	Active	#	%	#	%
1990	17	0	0.0	1	5.88
1991	27	0	0.0	0	0.0
1992	92	0	0.0	0	0.0
1993	95	0	0.0	0	0.0
1994	99	0	0.0	1	1.01
1995	106	0	0.0	0	0.0
1996	111	0	0.0	0	0.0
1997	124	0	0.0	0	0.0
1998	135	1	0.74	5	3.7
1999	160	0	0.0	9	5.62
2000	169	0	0.0	11	6.51
2001	166	1	0.6	9	5.42
2002	154	1	0.65	5	3.25
2003	149	1	0.67	5	3.36
2004	144	0	0.0	9	6.25
2005	141	0	0.0	5	3.55
2006	141	0	0.0	7	4.96
2007	139	0	0.0	5	3.6
2008	134	1	0.75	3	2.24
2009	131	1	0.76	2	1.53
2010	129	0	0.0	3	2.33
2011	126	1	0.79	1	0.79
2012	126	0	0.0	5	3.97
2013	127	2	1.57	1	0.79
2014	131	0	0.0	4	3.05
2015	142	3	2.11	3	2.11
2016	146	0	0.0	6	4.11
2017	150	1	0.67	5	3.33
2018	156	0	0.0	2	1.28
2019	159	1	0.63	5	3.14

Economy: France					
		Defaults		Others	
Year	Active	#	%	#	%
1990	260	0	0.0	4	1.54
1991	413	0	0.0	14	3.39
1992	651	0	0.0	6	0.92
1993	674	0	0.0	9	1.34
1994	733	0	0.0	9	1.23
1995	764	0	0.0	6	0.79
1996	823	0	0.0	15	1.82
1997	888	1	0.11	61	6.87
1998	952	0	0.0	112	11.76
1999	930	0	0.0	55	5.91
2000	1001	2	0.2	54	5.39
2001	1020	9	0.88	52	5.1
2002	991	6	0.61	58	5.85
2003	943	5	0.53	37	3.92
2004	931	2	0.21	55	5.91
2005	938	4	0.43	44	4.69
2006	983	3	0.31	37	3.76
2007	1045	4	0.38	44	4.21
2008	1029	9	0.87	59	5.73
2009	994	5	0.5	51	5.13
2010	976	3	0.31	76	7.79
2011	930	1	0.11	59	6.34
2012	896	1	0.11	66	7.37
2013	864	3	0.35	58	6.71
2014	849	2	0.24	46	5.42
2015	867	2	0.23	36	4.15
2016	875	3	0.34	41	4.69
2017	863	5	0.58	43	4.98
2018	847	2	0.24	51	6.02
2019	818	2	0.24	20	2.44

Economy: Germany					
		Defaults		Others	
Year	Active	#	%	#	%
1990	195	0	0.0	2	1.03
1991	385	0	0.0	0	0.0
1992	413	0	0.0	3	0.73
1993	439	0	0.0	5	1.14
1994	610	0	0.0	2	0.33
1995	632	0	0.0	1	0.16
1996	662	4	0.6	9	1.36
1997	697	3	0.43	19	2.73
1998	772	2	0.26	15	1.94
1999	959	2	0.21	19	1.98
2000	1108	2	0.18	24	2.17
2001	1151	28	2.43	26	2.26
2002	1155	38	3.29	75	6.49
2003	1067	18	1.69	52	4.87
2004	1031	8	0.78	30	2.91
2005	1066	4	0.38	39	3.66
2006	1221	7	0.57	34	2.78
2007	1382	5	0.36	45	3.26
2008	1493	17	1.14	59	3.95
2009	1485	11	0.74	76	5.12
2010	1529	1	0.07	80	5.23
2011	1697	4	0.24	243	14.32
2012	1491	10	0.67	411	27.57
2013	1103	16	1.45	66	5.98
2014	1051	7	0.67	74	7.04
2015	1017	7	0.69	81	7.96
2016	956	3	0.31	65	6.8
2017	928	6	0.65	44	4.74
2018	913	4	0.44	38	4.16
2019	896	2	0.22	23	2.57

Economy: Ghana					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	0	0.0	NaN	0	NaN
1997	0	0.0	NaN	0	NaN
1998	0	0.0	NaN	0	NaN
1999	0	0.0	NaN	0	NaN
2000	0	0.0	NaN	0	NaN
2001	0	0.0	NaN	0	NaN
2002	0	0.0	NaN	0	NaN
2003	0	0.0	NaN	0	NaN
2004	0	0.0	NaN	0	NaN
2005	0	0.0	NaN	0	NaN
2006	0	0.0	NaN	0	NaN
2007	0	0.0	NaN	0	NaN
2008	0	0.0	NaN	0	NaN
2009	0	0.0	NaN	0	NaN
2010	12	0.0	0.0	0	0.0
2011	24	0.0	0.0	0	0.0
2012	24	0.0	0.0	0	0.0
2013	25	0.0	0.0	0	0.0
2014	25	0.0	0.0	0	0.0
2015	26	0.0	0.0	0	0.0
2016	29	0.0	0.0	0	0.0
2017	29	0.0	0.0	2	6.9
2018	28	0.0	0.0	0	0.0
2019	30	0.0	0.0	0	0.0

Economy: Greece

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	90	0	0.0	0	0.0
1993	97	0	0.0	0	0.0
1994	162	0	0.0	0	0.0
1995	183	0	0.0	1	0.55
1996	202	0	0.0	6	2.97
1997	211	0	0.0	3	1.42
1998	234	0	0.0	4	1.71
1999	278	0	0.0	6	2.16
2000	318	0	0.0	7	2.2
2001	329	0	0.0	13	3.95
2002	337	0	0.0	18	5.34
2003	329	0	0.0	9	2.74
2004	330	0	0.0	10	3.03
2005	328	0	0.0	20	6.1
2006	310	0	0.0	15	4.84
2007	301	0	0.0	13	4.32
2008	297	0	0.0	15	5.05
2009	284	0	0.0	12	4.23
2010	273	0	0.0	12	4.4
2011	261	0	0.0	14	5.36
2012	247	0	0.0	23	9.31
2013	225	0	0.0	16	7.11
2014	209	0	0.0	12	5.74
2015	198	1	0.51	11	5.56
2016	190	0	0.0	8	4.21
2017	189	0	0.0	12	6.35
2018	181	1	0.55	7	3.87
2019	174	0	0.0	9	5.17

Economy: Hong Kong

		Defaults		Others	
Year	Active	#	%	#	%
1990	238	0	0.0	4	1.68
1991	318	0	0.0	4	1.26
1992	364	0	0.0	2	0.55
1993	432	0	0.0	2	0.46
1994	482	0	0.0	7	1.45
1995	509	0	0.0	5	0.98
1996	553	0	0.0	10	1.81
1997	633	0	0.0	8	1.26
1998	659	2	0.3	9	1.37
1999	704	7	0.99	7	0.99
2000	789	5	0.63	9	1.14
2001	878	10	1.14	16	1.82
2002	974	4	0.41	18	1.85
2003	1025	5	0.49	28	2.73
2004	1064	0	0.0	30	2.82
2005	1105	3	0.27	30	2.71
2006	1146	2	0.17	22	1.92
2007	1230	2	0.16	13	1.06
2008	1258	6	0.48	15	1.19
2009	1307	3	0.23	12	0.92
2010	1387	1	0.07	19	1.37
2011	1448	1	0.07	19	1.31
2012	1498	1	0.07	22	1.47
2013	1595	4	0.25	19	1.19
2014	1693	1	0.06	19	1.12
2015	1813	8	0.44	20	1.1
2016	1913	8	0.42	20	1.05
2017	2056	9	0.44	48	2.33
2018	2228	3	0.13	30	1.35
2019	2364	1	0.04	8	0.34

Economy: Hungary

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	32	0	0.0	0	0.0
1996	37	0	0.0	1	2.7
1997	43	0	0.0	4	9.3
1998	46	0	0.0	1	2.17
1999	55	0	0.0	0	0.0
2000	59	1	1.69	4	6.78
2001	53	0	0.0	4	7.55
2002	49	0	0.0	8	16.33
2003	43	0	0.0	2	4.65
2004	43	0	0.0	3	6.98
2005	41	0	0.0	3	7.32
2006	41	0	0.0	5	12.2
2007	37	0	0.0	3	8.11
2008	36	0	0.0	0	0.0
2009	39	0	0.0	0	0.0
2010	44	0	0.0	0	0.0
2011	48	0	0.0	3	6.25
2012	51	1	1.96	3	5.88
2013	48	0	0.0	2	4.17
2014	48	0	0.0	2	4.17
2015	47	0	0.0	5	10.64
2016	43	1	2.33	5	11.63
2017	40	0	0.0	2	5.0
2018	39	0	0.0	0	0.0
2019	44	0	0.0	1	2.27

Economy: Iceland

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	24	0	0.0	0	0.0
1997	34	0	0.0	0	0.0
1998	51	0	0.0	0	0.0
1999	58	0	0.0	1	1.72
2000	69	0	0.0	5	7.25
2001	68	0	0.0	7	10.29
2002	66	0	0.0	11	16.67
2003	56	0	0.0	16	28.57
2004	40	0	0.0	10	25.0
2005	31	0	0.0	7	22.58
2006	28	0	0.0	3	10.71
2007	28	0	0.0	3	10.71
2008	25	2	8.0	9	36.0
2009	15	1	6.67	2	13.33
2010	12	0	0.0	3	25.0
2011	10	0	0.0	0	0.0
2012	13	0	0.0	0	0.0
2013	16	0	0.0	0	0.0
2014	17	0	0.0	1	5.88
2015	19	0	0.0	0	0.0
2016	21	0	0.0	0	0.0
2017	22	0	0.0	0	0.0
2018	25	0	0.0	0	0.0
2019	27	0	0.0	0	0.0

Economy: India

		Defaults		Others	
Year	Active	#	%	#	%
1990	250	0	0.0	1	0.4
1991	1284	0	0.0	0	0.0
1992	1527	1	0.07	6	0.39
1993	1961	0	0.0	38	1.94
1994	2949	0	0.0	33	1.12
1995	4219	2	0.05	45	1.07
1996	4680	5	0.11	244	5.21
1997	4499	11	0.24	772	17.16
1998	3806	9	0.24	523	13.74
1999	3570	11	0.31	479	13.42
2000	3352	0	0.0	197	5.88
2001	3316	4	0.12	137	4.13
2002	3381	51	1.51	815	24.11
2003	2668	36	1.35	162	6.07
2004	2683	21	0.78	134	4.99
2005	2786	27	0.97	243	8.72
2006	2767	19	0.69	52	1.88
2007	3028	35	1.16	28	0.92
2008	3182	19	0.6	57	1.79
2009	3267	35	1.07	41	1.25
2010	3453	32	0.93	64	1.85
2011	3587	31	0.86	47	1.31
2012	3797	74	1.95	80	2.11
2013	3851	86	2.23	98	2.54
2014	3923	82	2.09	34	0.87
2015	4122	98	2.38	230	5.58
2016	4056	65	1.6	112	2.76
2017	4229	103	2.44	168	3.97
2018	4512	327	7.25	92	2.04
2019	4489	124	2.76	11	0.25

Economy: Indonesia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	110	0	0.0	0	0.0
1992	140	0	0.0	0	0.0
1993	163	0	0.0	2	1.23
1994	208	0	0.0	5	2.4
1995	231	0	0.0	1	0.43
1996	250	1	0.4	0	0.0
1997	283	2	0.71	4	1.41
1998	301	19	6.31	2	0.66
1999	297	24	8.08	5	1.68
2000	299	12	4.01	12	4.01
2001	317	14	4.42	8	2.52
2002	327	7	2.14	14	4.28
2003	319	3	0.94	7	2.19
2004	324	4	1.23	13	4.01
2005	322	1	0.31	13	4.04
2006	327	0	0.0	6	1.83
2007	351	2	0.57	7	1.99
2008	366	0	0.0	16	4.37
2009	378	4	1.06	14	3.7
2010	392	2	0.51	10	2.55
2011	414	0	0.0	10	2.42
2012	441	1	0.23	5	1.13
2013	475	1	0.21	12	2.53
2014	491	3	0.61	4	0.81
2015	508	1	0.2	10	1.97
2016	518	2	0.39	3	0.58
2017	555	1	0.18	10	1.8
2018	605	0	0.0	8	1.32
2019	661	3	0.45	2	0.3

Economy: Ireland

		Defaults		Others	
Year	Active	#	%	#	%
1990	30	0	0.0	0	0.0
1991	31	0	0.0	0	0.0
1992	31	0	0.0	0	0.0
1993	34	0	0.0	0	0.0
1994	37	0	0.0	3	8.11
1995	35	0	0.0	0	0.0
1996	39	0	0.0	0	0.0
1997	49	0	0.0	2	4.08
1998	50	0	0.0	2	4.0
1999	52	0	0.0	3	5.77
2000	56	0	0.0	1	1.79
2001	54	0	0.0	6	11.11
2002	48	0	0.0	6	12.5
2003	42	0	0.0	5	11.9
2004	38	0	0.0	3	7.89
2005	37	0	0.0	2	5.41
2006	42	0	0.0	2	4.76
2007	47	0	0.0	1	2.13
2008	47	0	0.0	3	6.38
2009	45	1	2.22	5	11.11
2010	39	0	0.0	4	10.26
2011	35	0	0.0	2	5.71
2012	34	0	0.0	3	8.82
2013	35	1	2.86	1	2.86
2014	36	0	0.0	1	2.78
2015	37	0	0.0	3	8.11
2016	34	0	0.0	3	8.82
2017	36	0	0.0	3	8.33
2018	33	0	0.0	1	3.03
2019	33	0	0.0	3	9.09

Economy: Israel

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	9	0	0.0	0	0.0
1995	83	0	0.0	0	0.0
1996	629	0	0.0	6	0.95
1997	648	0	0.0	19	2.93
1998	648	0	0.0	22	3.4
1999	643	0	0.0	17	2.64
2000	668	0	0.0	37	5.54
2001	640	0	0.0	60	9.38
2002	594	1	0.17	68	11.45
2003	539	0	0.0	39	7.24
2004	538	0	0.0	17	3.16
2005	552	0	0.0	23	4.17
2006	572	0	0.0	17	2.97
2007	618	0	0.0	17	2.75
2008	606	0	0.0	25	4.13
2009	583	0	0.0	18	3.09
2010	585	2	0.34	23	3.93
2011	574	1	0.17	36	6.27
2012	541	0	0.0	50	9.24
2013	499	2	0.4	32	6.41
2014	471	1	0.21	32	6.79
2015	446	2	0.45	21	4.71
2016	433	1	0.23	18	4.16
2017	433	0	0.0	16	3.7
2018	429	0	0.0	22	5.13
2019	423	0	0.0	14	3.31

Economy: Italy

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	170	0	0.0	2	1.18
1991	183	0	0.0	2	1.09
1992	187	0	0.0	2	1.07
1993	186	0	0.0	2	1.08
1994	198	0	0.0	2	1.01
1995	216	0	0.0	6	2.78
1996	222	0	0.0	6	2.7
1997	228	0	0.0	13	5.7
1998	241	0	0.0	11	4.56
1999	260	0	0.0	7	2.69
2000	298	0	0.0	16	5.37
2001	304	0	0.0	18	5.92
2002	299	1	0.33	12	4.01
2003	299	6	2.01	24	8.03
2004	271	2	0.74	10	3.69
2005	279	0	0.0	11	3.94
2006	295	0	0.0	15	5.08
2007	312	0	0.0	13	4.17
2008	305	1	0.33	15	4.92
2009	300	3	1.0	16	5.33
2010	292	0	0.0	11	3.77
2011	295	0	0.0	11	3.73
2012	295	3	1.02	15	5.08
2013	299	2	0.67	16	5.35
2014	309	1	0.32	13	4.21
2015	328	1	0.3	18	5.49
2016	332	2	0.6	16	4.82
2017	362	2	0.55	16	4.42
2018	388	3	0.77	14	3.61
2019	410	0	0.0	21	5.12

Economy: Jamaica

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	32	0.0	0.0	0	0.0
1994	35	0.0	0.0	0	0.0
1995	36	0.0	0.0	0	0.0
1996	36	0.0	0.0	1	2.78
1997	35	0.0	0.0	5	14.29
1998	30	0.0	0.0	0	0.0
1999	31	0.0	0.0	0	0.0
2000	33	0.0	0.0	0	0.0
2001	33	0.0	0.0	1	3.03
2002	32	0.0	0.0	0	0.0
2003	33	0.0	0.0	0	0.0
2004	33	0.0	0.0	0	0.0
2005	35	0.0	0.0	0	0.0
2006	36	0.0	0.0	1	2.78
2007	36	0.0	0.0	2	5.56
2008	38	0.0	0.0	2	5.26
2009	37	0.0	0.0	0	0.0
2010	45	0.0	0.0	0	0.0
2011	49	0.0	0.0	4	8.16
2012	46	0.0	0.0	4	8.7
2013	49	0.0	0.0	2	4.08
2014	50	0.0	0.0	1	2.0
2015	54	0.0	0.0	1	1.85
2016	62	0.0	0.0	2	3.23
2017	68	0.0	0.0	3	4.41
2018	74	0.0	0.0	1	1.35
2019	83	0.0	0.0	0	0.0

Economy: Japan

		Defaults		Others	
Year	Active	#	%	#	%
1990	2405	0	0.0	5	0.21
1991	2529	0	0.0	2	0.08
1992	2557	3	0.12	3	0.12
1993	2646	4	0.15	6	0.23
1994	2787	0	0.0	5	0.18
1995	2971	2	0.07	5	0.17
1996	3133	5	0.16	7	0.22
1997	3268	7	0.21	16	0.49
1998	3340	16	0.48	21	0.63
1999	3417	8	0.23	40	1.17
2000	3602	12	0.33	54	1.5
2001	3724	16	0.43	59	1.58
2002	3814	30	0.79	96	2.52
2003	3857	19	0.49	96	2.49
2004	3953	13	0.33	86	2.18
2005	4052	9	0.22	88	2.17
2006	4166	2	0.05	81	1.94
2007	4227	6	0.14	99	2.34
2008	4216	36	0.85	108	2.56
2009	4131	28	0.68	135	3.27
2010	4036	9	0.22	129	3.2
2011	3944	4	0.1	100	2.54
2012	3905	6	0.15	98	2.51
2013	3877	3	0.08	74	1.91
2014	3886	0	0.0	44	1.13
2015	3958	4	0.1	68	1.72
2016	3988	0	0.0	70	1.76
2017	4017	1	0.02	41	1.02
2018	4084	1	0.02	66	1.62
2019	4123	0	0.0	42	1.02

Economy: Jordan

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	71	0.0	0.0	1	1.41
1997	105	0.0	0.0	0	0.0
1998	119	0.0	0.0	1	0.84
1999	122	0.0	0.0	0	0.0
2000	128	0.0	0.0	2	1.56
2001	133	0.0	0.0	7	5.26
2002	130	0.0	0.0	4	3.08
2003	139	0.0	0.0	3	2.16
2004	148	0.0	0.0	2	1.35
2005	164	0.0	0.0	2	1.22
2006	195	0.0	0.0	4	2.05
2007	210	0.0	0.0	3	1.43
2008	228	0.0	0.0	3	1.32
2009	233	0.0	0.0	8	3.43
2010	231	0.0	0.0	6	2.6
2011	230	0.0	0.0	4	1.74
2012	228	0.0	0.0	7	3.07
2013	221	0.0	0.0	2	0.9
2014	223	0.0	0.0	11	4.93
2015	214	0.0	0.0	6	2.8
2016	209	0.0	0.0	2	0.96
2017	207	0.0	0.0	20	9.66
2018	188	0.0	0.0	5	2.66
2019	188	0.0	0.0	2	1.06

Economy: Kazakhstan

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	1	0	0.0	0	0.0
2002	7	0	0.0	0	0.0
2003	7	0	0.0	0	0.0
2004	8	0	0.0	2	25.0
2005	6	0	0.0	0	0.0
2006	6	0	0.0	4	66.67
2007	24	0	0.0	0	0.0
2008	27	0	0.0	0	0.0
2009	28	4	14.29	5	17.86
2010	22	1	4.55	4	18.18
2011	18	0	0.0	1	5.56
2012	22	2	9.09	0	0.0
2013	20	0	0.0	3	15.0
2014	18	0	0.0	5	27.78
2015	15	0	0.0	1	6.67
2016	17	0	0.0	0	0.0
2017	20	0	0.0	0	0.0
2018	22	0	0.0	4	18.18
2019	25	0	0.0	0	0.0

Economy: Kenya

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	44	0	0.0	0	0.0
1998	44	0	0.0	0	0.0
1999	44	0	0.0	0	0.0
2000	44	0	0.0	2	4.55
2001	46	0	0.0	1	2.17
2002	45	0	0.0	0	0.0
2003	47	0	0.0	1	2.13
2004	46	0	0.0	1	2.17
2005	46	0	0.0	2	4.35
2006	48	0	0.0	0	0.0
2007	51	0	0.0	0	0.0
2008	53	0	0.0	0	0.0
2009	54	0	0.0	3	5.56
2010	51	0	0.0	0	0.0
2011	55	0	0.0	1	1.82
2012	56	0	0.0	0	0.0
2013	58	0	0.0	3	5.17
2014	60	1	1.67	0	0.0
2015	60	0	0.0	0	0.0
2016	64	2	3.12	0	0.0
2017	64	2	3.12	1	1.56
2018	61	2	3.28	0	0.0
2019	59	0	0.0	0	0.0

Economy: Kuwait

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	51	0	0.0	0	0.0
1997	65	0	0.0	0	0.0
1998	67	0	0.0	0	0.0
1999	75	0	0.0	3	4.0
2000	73	0	0.0	2	2.74
2001	72	0	0.0	0	0.0
2002	80	0	0.0	2	2.5
2003	92	0	0.0	0	0.0
2004	103	0	0.0	0	0.0
2005	140	0	0.0	1	0.71
2006	162	0	0.0	0	0.0
2007	181	0	0.0	2	1.1
2008	187	0	0.0	4	2.14
2009	198	1	0.51	6	3.03
2010	201	0	0.0	9	4.48
2011	196	0	0.0	8	4.08
2012	199	0	0.0	3	1.51
2013	197	0	0.0	5	2.54
2014	195	0	0.0	5	2.56
2015	193	0	0.0	7	3.63
2016	194	0	0.0	16	8.25
2017	179	0	0.0	16	8.94
2018	166	0	0.0	2	1.2
2019	170	0	0.0	4	2.35

Economy: Latvia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	18	0	0.0	0	0.0
2001	34	0	0.0	3	8.82
2002	33	0	0.0	1	3.03
2003	32	0	0.0	7	21.88
2004	30	0	0.0	0	0.0
2005	33	0	0.0	0	0.0
2006	34	0	0.0	2	5.88
2007	36	0	0.0	0	0.0
2008	36	0	0.0	1	2.78
2009	35	0	0.0	2	5.71
2010	33	0	0.0	0	0.0
2011	33	0	0.0	1	3.03
2012	33	0	0.0	1	3.03
2013	33	1	3.03	1	3.03
2014	31	0	0.0	1	3.23
2015	32	1	3.12	3	9.38
2016	29	0	0.0	1	3.45
2017	29	0	0.0	2	6.9
2018	27	1	3.7	3	11.11
2019	23	0	0.0	1	4.35

Economy: Lithuania

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	35	0	0.0	1	2.86
2001	36	0	0.0	0	0.0
2002	42	0	0.0	1	2.38
2003	44	0	0.0	4	9.09
2004	42	0	0.0	0	0.0
2005	42	0	0.0	0	0.0
2006	44	0	0.0	2	4.55
2007	42	0	0.0	3	7.14
2008	40	0	0.0	0	0.0
2009	40	0	0.0	2	5.0
2010	41	0	0.0	2	4.88
2011	40	1	2.5	5	12.5
2012	34	0	0.0	0	0.0
2013	35	1	2.86	1	2.86
2014	37	1	2.7	2	5.41
2015	36	0	0.0	5	13.89
2016	32	0	0.0	2	6.25
2017	31	0	0.0	0	0.0
2018	32	0	0.0	0	0.0
2019	33	0	0.0	0	0.0

Economy: Luxembourg

		Defaults		Others	
Year	Active	#	%	#	%
1990	1	0	0.0	0	0.0
1991	2	0	0.0	1	50.0
1992	1	0	0.0	0	0.0
1993	1	0	0.0	0	0.0
1994	1	0	0.0	0	0.0
1995	22	0	0.0	0	0.0
1996	23	0	0.0	0	0.0
1997	28	0	0.0	2	7.14
1998	28	0	0.0	1	3.57
1999	30	0	0.0	4	13.33
2000	31	0	0.0	3	9.68
2001	28	0	0.0	1	3.57
2002	27	0	0.0	2	7.41
2003	26	0	0.0	0	0.0
2004	26	0	0.0	0	0.0
2005	27	0	0.0	1	3.7
2006	27	0	0.0	3	11.11
2007	25	0	0.0	3	12.0
2008	23	0	0.0	2	8.7
2009	22	1	4.55	3	13.64
2010	19	0	0.0	1	5.26
2011	19	0	0.0	2	10.53
2012	18	0	0.0	2	11.11
2013	16	0	0.0	1	6.25
2014	18	0	0.0	2	11.11
2015	18	0	0.0	2	11.11
2016	18	0	0.0	2	11.11
2017	16	0	0.0	1	6.25
2018	16	0	0.0	2	12.5
2019	16	0	0.0	0	0.0

Economy: Macedonia					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	11	0	0.0	0	0.0
2005	68	0	0.0	0	0.0
2006	88	0	0.0	0	0.0
2007	101	0	0.0	7	6.93
2008	98	0	0.0	7	7.14
2009	91	1	1.1	6	6.59
2010	84	0	0.0	14	16.67
2011	70	0	0.0	4	5.71
2012	70	0	0.0	10	14.29
2013	63	0	0.0	6	9.52
2014	63	0	0.0	4	6.35
2015	64	0	0.0	3	4.69
2016	66	2	3.03	3	4.55
2017	67	0	0.0	3	4.48
2018	77	0	0.0	4	5.19
2019	111	0	0.0	1	0.9

Economy: Malawi					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	0	0.0	NaN	0	NaN
1997	0	0.0	NaN	0	NaN
1998	2	0.0	0.0	0	0.0
1999	2	0.0	0.0	0	0.0
2000	3	0.0	0.0	0	0.0
2001	4	0.0	0.0	0	0.0
2002	4	0.0	0.0	0	0.0
2003	5	0.0	0.0	0	0.0
2004	5	0.0	0.0	0	0.0
2005	5	0.0	0.0	0	0.0
2006	5	0.0	0.0	5	100.0
2007	0	0.0	NaN	0	NaN
2008	0	0.0	NaN	0	NaN
2009	11	0.0	0.0	0	0.0
2010	11	0.0	0.0	0	0.0
2011	11	0.0	0.0	0	0.0
2012	13	0.0	0.0	0	0.0
2013	13	0.0	0.0	0	0.0
2014	13	0.0	0.0	0	0.0
2015	13	0.0	0.0	0	0.0
2016	13	0.0	0.0	1	7.69
2017	12	0.0	0.0	1	8.33
2018	12	0.0	0.0	0	0.0
2019	13	0.0	0.0	0	0.0

Economy: Malaysia

		Defaults		Others	
Year	Active	#	%	#	%
1990	271	0	0.0	0	0.0
1991	314	0	0.0	0	0.0
1992	361	0	0.0	1	0.28
1993	405	0	0.0	0	0.0
1994	472	0	0.0	0	0.0
1995	524	0	0.0	0	0.0
1996	615	0	0.0	0	0.0
1997	703	0	0.0	1	0.14
1998	738	14	1.9	19	2.57
1999	741	8	1.08	11	1.48
2000	779	13	1.67	8	1.03
2001	791	15	1.9	15	1.9
2002	828	13	1.57	24	2.9
2003	885	7	0.79	15	1.69
2004	952	6	0.63	8	0.84
2005	1028	5	0.49	26	2.53
2006	1054	14	1.33	26	2.47
2007	1060	13	1.23	60	5.66
2008	1030	23	2.23	40	3.88
2009	996	19	1.91	30	3.01
2010	1000	22	2.2	28	2.8
2011	991	11	1.11	33	3.33
2012	976	9	0.92	35	3.59
2013	953	5	0.52	27	2.83
2014	939	2	0.21	16	1.7
2015	935	1	0.11	14	1.5
2016	938	2	0.21	23	2.45
2017	937	2	0.21	19	2.03
2018	946	1	0.11	17	1.8
2019	963	5	0.52	8	0.83

Economy: Malta

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	5	0.0	0.0	0	0.0
1997	6	0.0	0.0	0	0.0
1998	7	0.0	0.0	0	0.0
1999	7	0.0	0.0	0	0.0
2000	9	0.0	0.0	0	0.0
2001	11	0.0	0.0	0	0.0
2002	12	0.0	0.0	1	8.33
2003	11	0.0	0.0	0	0.0
2004	11	0.0	0.0	0	0.0
2005	11	0.0	0.0	0	0.0
2006	12	0.0	0.0	0	0.0
2007	13	0.0	0.0	0	0.0
2008	16	0.0	0.0	2	12.5
2009	14	0.0	0.0	2	14.29
2010	12	0.0	0.0	0	0.0
2011	15	0.0	0.0	0	0.0
2012	20	0.0	0.0	0	0.0
2013	21	0.0	0.0	0	0.0
2014	21	0.0	0.0	0	0.0
2015	22	0.0	0.0	2	9.09
2016	22	0.0	0.0	1	4.55
2017	22	0.0	0.0	0	0.0
2018	24	0.0	0.0	0	0.0
2019	25	0.0	0.0	0	0.0

Economy: Mauritius

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	26	0.0	0.0	0	0.0
1996	29	0.0	0.0	0	0.0
1997	29	0.0	0.0	0	0.0
1998	29	0.0	0.0	0	0.0
1999	29	0.0	0.0	0	0.0
2000	29	0.0	0.0	0	0.0
2001	29	0.0	0.0	0	0.0
2002	30	0.0	0.0	0	0.0
2003	30	0.0	0.0	0	0.0
2004	30	0.0	0.0	0	0.0
2005	31	0.0	0.0	0	0.0
2006	32	0.0	0.0	0	0.0
2007	32	0.0	0.0	0	0.0
2008	33	0.0	0.0	0	0.0
2009	33	0.0	0.0	0	0.0
2010	33	0.0	0.0	0	0.0
2011	34	0.0	0.0	0	0.0
2012	38	0.0	0.0	0	0.0
2013	39	0.0	0.0	0	0.0
2014	42	0.0	0.0	0	0.0
2015	42	0.0	0.0	1	2.38
2016	42	0.0	0.0	0	0.0
2017	42	0.0	0.0	2	4.76
2018	45	0.0	0.0	4	8.89
2019	48	0.0	0.0	0	0.0

Economy: Mexico

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	96	0	0.0	3	3.12
1995	100	0	0.0	1	1.0
1996	115	0	0.0	3	2.61
1997	132	1	0.76	8	6.06
1998	126	0	0.0	15	11.9
1999	119	1	0.84	10	8.4
2000	116	1	0.86	6	5.17
2001	111	1	0.9	4	3.6
2002	111	1	0.9	8	7.21
2003	112	2	1.79	3	2.68
2004	111	0	0.0	4	3.6
2005	116	0	0.0	5	4.31
2006	116	0	0.0	2	1.72
2007	121	1	0.83	9	7.44
2008	119	2	1.68	6	5.04
2009	116	5	4.31	2	1.72
2010	122	3	2.46	2	1.64
2011	123	0	0.0	7	5.69
2012	123	2	1.63	3	2.44
2013	135	5	3.7	2	1.48
2014	133	3	2.26	1	0.75
2015	142	1	0.7	3	2.11
2016	149	0	0.0	4	2.68
2017	153	2	1.31	2	1.31
2018	158	0	0.0	3	1.9
2019	157	0	0.0	3	1.91

Economy: Montenegro

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	0	0.0	NaN	0	NaN
1997	0	0.0	NaN	0	NaN
1998	0	0.0	NaN	0	NaN
1999	0	0.0	NaN	0	NaN
2000	0	0.0	NaN	0	NaN
2001	0	0.0	NaN	0	NaN
2002	0	0.0	NaN	0	NaN
2003	40	0.0	0.0	1	2.5
2004	69	0.0	0.0	3	4.35
2005	101	0.0	0.0	2	1.98
2006	132	0.0	0.0	3	2.27
2007	150	0.0	0.0	5	3.33
2008	147	0.0	0.0	29	19.73
2009	126	0.0	0.0	27	21.43
2010	101	0.0	0.0	3	2.97
2011	99	0.0	0.0	26	26.26
2012	74	0.0	0.0	18	24.32
2013	58	0.0	0.0	13	22.41
2014	47	0.0	0.0	7	14.89
2015	43	0.0	0.0	0	0.0
2016	47	0.0	0.0	6	12.77
2017	46	0.0	0.0	4	8.7
2018	56	0.0	0.0	4	7.14
2019	93	0.0	0.0	0	0.0

Economy: Morocco

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	16	0	0.0	0	0.0
1997	43	0	0.0	0	0.0
1998	49	0	0.0	0	0.0
1999	52	0	0.0	1	1.92
2000	53	0	0.0	0	0.0
2001	55	0	0.0	1	1.82
2002	54	0	0.0	0	0.0
2003	54	0	0.0	2	3.7
2004	54	0	0.0	1	1.85
2005	55	0	0.0	2	3.64
2006	63	0	0.0	1	1.59
2007	72	0	0.0	0	0.0
2008	78	0	0.0	1	1.28
2009	77	0	0.0	1	1.3
2010	79	0	0.0	4	5.06
2011	77	0	0.0	1	1.3
2012	77	0	0.0	0	0.0
2013	78	0	0.0	3	3.85
2014	76	0	0.0	2	2.63
2015	77	1	1.3	3	3.9
2016	75	0	0.0	2	2.67
2017	72	0	0.0	2	2.78
2018	73	0	0.0	0	0.0
2019	73	0	0.0	1	1.37

Economy: Namibia					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	0	0.0	NaN	0	NaN
1997	0	0.0	NaN	0	NaN
1998	0	0.0	NaN	0	NaN
1999	0	0.0	NaN	0	NaN
2000	0	0.0	NaN	0	NaN
2001	0	0.0	NaN	0	NaN
2002	0	0.0	NaN	0	NaN
2003	5	0.0	0.0	0	0.0
2004	5	0.0	0.0	0	0.0
2005	5	0.0	0.0	0	0.0
2006	6	0.0	0.0	1	16.67
2007	5	0.0	0.0	0	0.0
2008	5	0.0	0.0	1	20.0
2009	4	0.0	0.0	0	0.0
2010	5	0.0	0.0	0	0.0
2011	6	0.0	0.0	1	16.67
2012	5	0.0	0.0	0	0.0
2013	8	0.0	0.0	0	0.0
2014	8	0.0	0.0	0	0.0
2015	8	0.0	0.0	0	0.0
2016	8	0.0	0.0	0	0.0
2017	11	0.0	0.0	0	0.0
2018	11	0.0	0.0	0	0.0
2019	13	0.0	0.0	1	7.69

Economy: Netherlands					
		Defaults		Others	
Year	Active	#	%	#	%
1990	136	0	0.0	3	2.21
1991	153	0	0.0	1	0.65
1992	156	0	0.0	0	0.0
1993	163	0	0.0	0	0.0
1994	166	0	0.0	1	0.6
1995	176	0	0.0	0	0.0
1996	185	1	0.54	0	0.0
1997	199	0	0.0	11	5.53
1998	210	1	0.48	8	3.81
1999	224	0	0.0	16	7.14
2000	211	0	0.0	18	8.53
2001	205	8	3.9	19	9.27
2002	185	8	4.32	9	4.86
2003	169	5	2.96	12	7.1
2004	155	0	0.0	6	3.87
2005	156	0	0.0	8	5.13
2006	152	1	0.66	7	4.61
2007	149	0	0.0	9	6.04
2008	143	1	0.7	8	5.59
2009	138	4	2.9	2	1.45
2010	134	0	0.0	5	3.73
2011	131	0	0.0	6	4.58
2012	126	0	0.0	5	3.97
2013	123	1	0.81	8	6.5
2014	120	2	1.67	6	5.0
2015	125	2	1.6	7	5.6
2016	124	1	0.81	5	4.03
2017	119	1	0.84	2	1.68
2018	124	0	0.0	5	4.03
2019	123	0	0.0	6	4.88

Economy: New Zealand

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	30	0	0.0	0	0.0
1993	33	0	0.0	0	0.0
1994	41	0	0.0	0	0.0
1995	43	0	0.0	1	2.33
1996	47	0	0.0	1	2.13
1997	49	0	0.0	0	0.0
1998	51	0	0.0	0	0.0
1999	57	0	0.0	0	0.0
2000	64	0	0.0	0	0.0
2001	72	0	0.0	0	0.0
2002	77	0	0.0	0	0.0
2003	89	0	0.0	0	0.0
2004	104	0	0.0	0	0.0
2005	109	0	0.0	0	0.0
2006	114	0	0.0	0	0.0
2007	121	0	0.0	0	0.0
2008	122	0	0.0	1	0.82
2009	122	0	0.0	0	0.0
2010	127	0	0.0	3	2.36
2011	129	0	0.0	2	1.55
2012	130	0	0.0	5	3.85
2013	134	2	1.49	7	5.22
2014	142	0	0.0	6	4.23
2015	140	0	0.0	5	3.57
2016	146	2	1.37	7	4.79
2017	140	0	0.0	8	5.71
2018	135	1	0.74	10	7.41
2019	126	0	0.0	4	3.17

Economy: Nigeria

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	103	0	0.0	0	0.0
2003	107	0	0.0	5	4.67
2004	130	0	0.0	4	3.08
2005	141	0	0.0	2	1.42
2006	157	0	0.0	3	1.91
2007	170	0	0.0	1	0.59
2008	197	0	0.0	12	6.09
2009	198	0	0.0	9	4.55
2010	193	0	0.0	7	3.63
2011	189	0	0.0	12	6.35
2012	180	0	0.0	2	1.11
2013	186	0	0.0	6	3.23
2014	183	0	0.0	4	2.19
2015	180	0	0.0	1	0.56
2016	183	1	0.55	13	7.1
2017	172	1	0.58	18	10.47
2018	159	0	0.0	12	7.55
2019	155	0	0.0	4	2.58

Economy: Norway					
		Defaults		**Others**	
Year	Active	#	%	#	%
1990	38	0	0.0	3	7.89
1991	61	0	0.0	0	0.0
1992	82	0	0.0	0	0.0
1993	98	0	0.0	0	0.0
1994	112	0	0.0	0	0.0
1995	134	0	0.0	0	0.0
1996	157	0	0.0	0	0.0
1997	209	0	0.0	8	3.83
1998	229	0	0.0	11	4.8
1999	229	0	0.0	22	9.61
2000	230	1	0.43	29	12.61
2001	241	3	1.24	18	7.47
2002	224	4	1.79	9	4.02
2003	220	4	1.82	26	11.82
2004	211	0	0.0	13	6.16
2005	251	0	0.0	17	6.77
2006	291	0	0.0	30	10.31
2007	296	0	0.0	33	11.15
2008	280	2	0.71	27	9.64
2009	250	5	2.0	21	8.4
2010	238	1	0.42	18	7.56
2011	236	2	0.85	11	4.66
2012	226	1	0.44	12	5.31
2013	224	3	1.34	22	9.82
2014	217	0	0.0	14	6.45
2015	218	4	1.83	13	5.96
2016	223	5	2.24	5	2.24
2017	235	6	2.55	12	5.11
2018	232	0	0.0	8	3.45
2019	239	1	0.42	7	2.93

Economy: Oman					
		Defaults		**Others**	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	52	0.0	0.0	0	0.0
1997	74	0.0	0.0	0	0.0
1998	88	0.0	0.0	6	6.82
1999	83	0.0	0.0	6	7.23
2000	81	0.0	0.0	2	2.47
2001	80	0.0	0.0	13	16.25
2002	89	0.0	0.0	0	0.0
2003	98	0.0	0.0	2	2.04
2004	102	0.0	0.0	2	1.96
2005	106	0.0	0.0	5	4.72
2006	109	0.0	0.0	3	2.75
2007	108	0.0	0.0	4	3.7
2008	106	0.0	0.0	9	8.49
2009	98	0.0	0.0	1	1.02
2010	99	0.0	0.0	9	9.09
2011	91	0.0	0.0	4	4.4
2012	90	0.0	0.0	4	4.44
2013	91	0.0	0.0	0	0.0
2014	95	0.0	0.0	5	5.26
2015	91	0.0	0.0	6	6.59
2016	89	0.0	0.0	2	2.25
2017	92	0.0	0.0	5	5.43
2018	93	0.0	0.0	2	2.15
2019	97	0.0	0.0	0	0.0

Economy: Pakistan

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	347	0	0.0	0	0.0
1999	420	0	0.0	2	0.48
2000	446	0	0.0	0	0.0
2001	462	1	0.22	7	1.52
2002	492	1	0.2	3	0.61
2003	508	0	0.0	0	0.0
2004	523	0	0.0	2	0.38
2005	538	0	0.0	7	1.3
2006	543	0	0.0	10	1.84
2007	557	0	0.0	6	1.08
2008	564	0	0.0	9	1.6
2009	573	1	0.17	30	5.24
2010	554	2	0.36	26	4.69
2011	532	1	0.19	48	9.02
2012	493	2	0.41	26	5.27
2013	474	0	0.0	10	2.11
2014	477	3	0.63	10	2.1
2015	475	3	0.63	12	2.53
2016	469	0	0.0	16	3.41
2017	462	1	0.22	14	3.03
2018	452	0	0.0	10	2.21
2019	450	0	0.0	3	0.67

Economy: Peru

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	1	0	0.0	0	0.0
1992	1	0	0.0	0	0.0
1993	1	0	0.0	0	0.0
1994	59	0	0.0	0	0.0
1995	90	0	0.0	0	0.0
1996	102	0	0.0	2	1.96
1997	126	0	0.0	8	6.35
1998	127	0	0.0	17	13.39
1999	117	0	0.0	19	16.24
2000	107	2	1.87	18	16.82
2001	92	0	0.0	10	10.87
2002	91	2	2.2	8	8.79
2003	88	2	2.27	9	10.23
2004	88	1	1.14	5	5.68
2005	89	0	0.0	3	3.37
2006	94	0	0.0	4	4.26
2007	99	1	1.01	1	1.01
2008	98	0	0.0	4	4.08
2009	98	0	0.0	3	3.06
2010	96	0	0.0	4	4.17
2011	93	0	0.0	5	5.38
2012	91	0	0.0	7	7.69
2013	87	1	1.15	6	6.9
2014	82	0	0.0	3	3.66
2015	81	0	0.0	5	6.17
2016	79	0	0.0	3	3.8
2017	84	1	1.19	6	7.14
2018	82	0	0.0	1	1.22
2019	92	0	0.0	0	0.0

Economy: Philippines

		Defaults		Others	
Year	Active	#	%	#	%
1990	66	0	0.0	0	0.0
1991	71	0	0.0	0	0.0
1992	94	0	0.0	1	1.06
1993	115	1	0.87	0	0.0
1994	139	0	0.0	4	2.88
1995	161	0	0.0	1	0.62
1996	183	0	0.0	0	0.0
1997	194	0	0.0	2	1.03
1998	197	1	0.51	5	2.54
1999	202	4	1.98	3	1.49
2000	202	2	0.99	6	2.97
2001	199	3	1.51	5	2.51
2002	204	6	2.94	9	4.41
2003	203	5	2.46	2	0.99
2004	206	6	2.91	5	2.43
2005	204	3	1.47	3	1.47
2006	208	2	0.96	4	1.92
2007	224	1	0.45	8	3.57
2008	220	3	1.36	0	0.0
2009	225	3	1.33	1	0.44
2010	229	0	0.0	1	0.44
2011	240	0	0.0	1	0.42
2012	247	1	0.4	9	3.64
2013	247	0	0.0	3	1.21
2014	253	0	0.0	2	0.79
2015	256	0	0.0	13	5.08
2016	247	0	0.0	2	0.81
2017	251	1	0.4	2	0.8
2018	251	0	0.0	5	1.99
2019	250	0	0.0	1	0.4

Economy: Poland

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	31	0	0.0	0	0.0
1995	58	0	0.0	0	0.0
1996	76	0	0.0	0	0.0
1997	138	0	0.0	1	0.72
1998	194	0	0.0	3	1.55
1999	214	0	0.0	3	1.4
2000	225	1	0.44	6	2.67
2001	227	1	0.44	5	2.2
2002	227	1	0.44	20	8.81
2003	210	3	1.43	14	6.67
2004	222	0	0.0	8	3.6
2005	246	1	0.41	9	3.66
2006	264	0	0.0	9	3.41
2007	340	0	0.0	9	2.65
2008	433	0	0.0	2	0.46
2009	469	1	0.21	9	1.92
2010	559	0	0.0	9	1.61
2011	750	0	0.0	13	1.73
2012	855	9	1.05	18	2.11
2013	884	6	0.68	32	3.62
2014	887	6	0.68	28	3.16
2015	902	12	1.33	38	4.21
2016	885	7	0.79	43	4.86
2017	872	7	0.8	54	6.19
2018	838	10	1.19	59	7.04
2019	789	0	0.0	18	2.28

Economy: Portugal

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	1	0	0.0	0	0.0
1992	1	0	0.0	0	0.0
1993	78	0	0.0	1	1.28
1994	89	0	0.0	3	3.37
1995	98	0	0.0	1	1.02
1996	98	0	0.0	1	1.02
1997	105	0	0.0	7	6.67
1998	105	0	0.0	11	10.48
1999	105	0	0.0	14	13.33
2000	101	0	0.0	13	12.87
2001	88	0	0.0	11	12.5
2002	75	0	0.0	7	9.33
2003	70	0	0.0	3	4.29
2004	72	0	0.0	2	2.78
2005	72	0	0.0	3	4.17
2006	71	0	0.0	4	5.63
2007	70	0	0.0	6	8.57
2008	67	0	0.0	2	2.99
2009	65	0	0.0	3	4.62
2010	63	0	0.0	2	3.17
2011	61	0	0.0	3	4.92
2012	60	0	0.0	3	5.0
2013	60	1	1.67	1	1.67
2014	59	1	1.69	1	1.69
2015	58	2	3.45	1	1.72
2016	57	0	0.0	0	0.0
2017	59	0	0.0	4	6.78
2018	57	0	0.0	5	8.77
2019	53	0	0.0	2	3.77

Economy: Qatar

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	0	0.0	NaN	0	NaN
1997	0	0.0	NaN	0	NaN
1998	0	0.0	NaN	0	NaN
1999	0	0.0	NaN	0	NaN
2000	1	0.0	0.0	0	0.0
2001	1	0.0	0.0	0	0.0
2002	1	0.0	0.0	0	0.0
2003	27	0.0	0.0	0	0.0
2004	29	0.0	0.0	0	0.0
2005	31	0.0	0.0	0	0.0
2006	36	0.0	0.0	0	0.0
2007	40	0.0	0.0	0	0.0
2008	43	0.0	0.0	0	0.0
2009	45	0.0	0.0	1	2.22
2010	46	0.0	0.0	3	6.52
2011	42	0.0	0.0	0	0.0
2012	42	0.0	0.0	0	0.0
2013	42	0.0	0.0	0	0.0
2014	43	0.0	0.0	0	0.0
2015	43	0.0	0.0	0	0.0
2016	45	0.0	0.0	1	2.22
2017	45	0.0	0.0	0	0.0
2018	46	0.0	0.0	0	0.0
2019	48	0.0	0.0	0	0.0

Economy: Romania

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	50	0	0.0	0	0.0
1998	75	0	0.0	0	0.0
1999	139	0	0.0	1	0.72
2000	152	0	0.0	15	9.87
2001	147	0	0.0	26	17.69
2002	123	0	0.0	4	3.25
2003	120	0	0.0	12	10.0
2004	119	0	0.0	7	5.88
2005	150	1	0.67	12	8.0
2006	164	0	0.0	21	12.8
2007	158	0	0.0	9	5.7
2008	156	0	0.0	17	10.9
2009	140	0	0.0	21	15.0
2010	121	0	0.0	5	4.13
2011	121	0	0.0	7	5.79
2012	122	0	0.0	6	4.92
2013	120	2	1.67	7	5.83
2014	116	1	0.86	4	3.45
2015	261	2	0.77	27	10.34
2016	248	0	0.0	3	1.21
2017	270	1	0.37	16	5.93
2018	281	0	0.0	9	3.2
2019	318	1	0.31	0	0.0

Economy: Russian Federation

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	58	0	0.0	0	0.0
1998	62	2	3.23	4	6.45
1999	64	0	0.0	10	15.62
2000	68	0	0.0	5	7.35
2001	76	0	0.0	4	5.26
2002	92	0	0.0	26	28.26
2003	95	0	0.0	2	2.11
2004	131	2	1.53	3	2.29
2005	175	0	0.0	6	3.43
2006	249	2	0.8	20	8.03
2007	287	0	0.0	14	4.88
2008	327	1	0.31	26	7.95
2009	327	7	2.14	15	4.59
2010	329	1	0.3	13	3.95
2011	333	0	0.0	41	12.31
2012	298	2	0.67	60	20.13
2013	254	0	0.0	52	20.47
2014	205	2	0.98	33	16.1
2015	237	2	0.84	21	8.86
2016	223	2	0.9	13	5.83
2017	220	5	2.27	13	5.91
2018	204	1	0.49	14	6.86
2019	193	0	0.0	3	1.55

Economy: Rwanda

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0.0	NaN	0.0	NaN
1991	0	0.0	NaN	0.0	NaN
1992	0	0.0	NaN	0.0	NaN
1993	0	0.0	NaN	0.0	NaN
1994	0	0.0	NaN	0.0	NaN
1995	0	0.0	NaN	0.0	NaN
1996	0	0.0	NaN	0.0	NaN
1997	0	0.0	NaN	0.0	NaN
1998	0	0.0	NaN	0.0	NaN
1999	0	0.0	NaN	0.0	NaN
2000	0	0.0	NaN	0.0	NaN
2001	0	0.0	NaN	0.0	NaN
2002	0	0.0	NaN	0.0	NaN
2003	0	0.0	NaN	0.0	NaN
2004	0	0.0	NaN	0.0	NaN
2005	0	0.0	NaN	0.0	NaN
2006	0	0.0	NaN	0.0	NaN
2007	0	0.0	NaN	0.0	NaN
2008	0	0.0	NaN	0.0	NaN
2009	0	0.0	NaN	0.0	NaN
2010	0	0.0	NaN	0.0	NaN
2011	0	0.0	NaN	0.0	NaN
2012	0	0.0	NaN	0.0	NaN
2013	2	0.0	0.0	0.0	0.0
2014	2	0.0	0.0	0.0	0.0
2015	3	0.0	0.0	0.0	0.0
2016	3	0.0	0.0	0.0	0.0
2017	3	0.0	0.0	0.0	0.0
2018	4	0.0	0.0	0.0	0.0
2019	4	0.0	0.0	0.0	0.0

Economy: Saudi Arabia

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	62	0	0.0	0	0.0
2001	65	0	0.0	0	0.0
2002	68	0	0.0	1	1.47
2003	69	0	0.0	0	0.0
2004	72	0	0.0	0	0.0
2005	76	0	0.0	0	0.0
2006	86	0	0.0	0	0.0
2007	111	0	0.0	2	1.8
2008	126	0	0.0	0	0.0
2009	135	0	0.0	1	0.74
2010	145	0	0.0	0	0.0
2011	149	0	0.0	0	0.0
2012	157	0	0.0	0	0.0
2013	163	1	0.61	0	0.0
2014	168	0	0.0	5	2.98
2015	167	1	0.6	0	0.0
2016	172	1	0.58	0	0.0
2017	189	1	0.53	0	0.0
2018	200	0	0.0	1	0.5
2019	207	0	0.0	2	0.97

Economy: Serbia					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	1	0	0.0	0	0.0
2005	183	0	0.0	0	0.0
2006	317	0	0.0	11	3.47
2007	449	0	0.0	29	6.46
2008	467	0	0.0	104	22.27
2009	386	0	0.0	101	26.17
2010	305	0	0.0	62	20.33
2011	273	0	0.0	68	24.91
2012	226	0	0.0	46	20.35
2013	200	0	0.0	36	18.0
2014	173	1	0.58	35	20.23
2015	148	0	0.0	29	19.59
2016	131	0	0.0	29	22.14
2017	116	0	0.0	17	14.66
2018	120	0	0.0	22	18.33
2019	150	0	0.0	7	4.67

Economy: Singapore					
		Defaults		Others	
Year	Active	#	%	#	%
1990	162	0	0.0	8	4.94
1991	168	0	0.0	3	1.79
1992	181	0	0.0	4	2.21
1993	201	0	0.0	0	0.0
1994	231	0	0.0	0	0.0
1995	252	1	0.4	0	0.0
1996	276	2	0.72	1	0.36
1997	310	1	0.32	6	1.94
1998	331	3	0.91	3	0.91
1999	376	4	1.06	11	2.93
2000	447	0	0.0	10	2.24
2001	476	2	0.42	22	4.62
2002	481	2	0.42	21	4.37
2003	519	1	0.19	11	2.12
2004	589	2	0.34	7	1.19
2005	645	4	0.62	8	1.24
2006	696	1	0.14	19	2.73
2007	730	0	0.0	15	2.05
2008	744	4	0.54	23	3.09
2009	752	13	1.73	16	2.13
2010	761	2	0.26	31	4.07
2011	748	1	0.13	34	4.55
2012	735	0	0.0	28	3.81
2013	734	1	0.14	24	3.27
2014	737	0	0.0	27	3.66
2015	731	6	0.82	26	3.56
2016	722	8	1.11	36	4.99
2017	706	10	1.42	34	4.82
2018	688	7	1.02	27	3.92
2019	668	1	0.15	21	3.14

Economy: Slovakia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	0	0.0	NaN	0	NaN
1997	0	0.0	NaN	0	NaN
1998	10	0.0	0.0	0	0.0
1999	12	0.0	0.0	0	0.0
2000	13	0.0	0.0	0	0.0
2001	18	0.0	0.0	1	5.56
2002	27	0.0	0.0	0	0.0
2003	41	0.0	0.0	0	0.0
2004	42	0.0	0.0	0	0.0
2005	44	0.0	0.0	6	13.64
2006	39	0.0	0.0	2	5.13
2007	39	0.0	0.0	6	15.38
2008	38	0.0	0.0	2	5.26
2009	49	0.0	0.0	7	14.29
2010	47	0.0	0.0	1	2.13
2011	51	0.0	0.0	2	3.92
2012	50	0.0	0.0	5	10.0
2013	46	0.0	0.0	3	6.52
2014	43	0.0	0.0	6	13.95
2015	37	0.0	0.0	9	24.32
2016	29	0.0	0.0	4	13.79
2017	27	0.0	0.0	4	14.81
2018	24	0.0	0.0	1	4.17
2019	27	0.0	0.0	0	0.0

Economy: Slovenia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	74	0	0.0	1	1.35
1999	98	0	0.0	3	3.06
2000	118	0	0.0	4	3.39
2001	131	0	0.0	17	12.98
2002	124	0	0.0	19	15.32
2003	116	0	0.0	8	6.9
2004	126	0	0.0	12	9.52
2005	119	0	0.0	26	21.85
2006	95	0	0.0	16	16.84
2007	82	0	0.0	9	10.98
2008	80	0	0.0	2	2.5
2009	79	3	3.8	8	10.13
2010	69	0	0.0	4	5.8
2011	65	1	1.54	6	9.23
2012	59	1	1.69	3	5.08
2013	57	2	3.51	7	12.28
2014	52	2	3.85	4	7.69
2015	46	0	0.0	5	10.87
2016	41	0	0.0	7	17.07
2017	35	0	0.0	2	5.71
2018	54	0	0.0	6	11.11
2019	55	0	0.0	0	0.0

Economy: South Africa					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	388	0	0.0	0	0.0
1993	400	0	0.0	0	0.0
1994	429	0	0.0	2	0.47
1995	475	0	0.0	3	0.63
1996	502	0	0.0	7	1.39
1997	549	0	0.0	12	2.19
1998	639	2	0.31	58	9.08
1999	638	3	0.47	53	8.31
2000	602	6	1.0	85	14.12
2001	514	9	1.75	79	15.37
2002	431	7	1.62	65	15.08
2003	365	1	0.27	41	11.23
2004	331	3	0.91	36	10.88
2005	310	2	0.65	21	6.77
2006	321	0	0.0	17	5.3
2007	361	0	0.0	15	4.16
2008	359	0	0.0	18	5.01
2009	345	1	0.29	16	4.64
2010	340	2	0.59	18	5.29
2011	327	1	0.31	17	5.2
2012	319	5	1.57	17	5.33
2013	326	3	0.92	21	6.44
2014	324	0	0.0	19	5.86
2015	328	2	0.61	24	7.32
2016	311	0	0.0	15	4.82
2017	316	0	0.0	15	4.75
2018	311	0	0.0	13	4.18
2019	304	1	0.33	17	5.59

Economy: South Korea					
		Defaults		Others	
Year	Active	#	%	#	%
1990	617	0	0.0	0	0.0
1991	634	0	0.0	0	0.0
1992	638	1	0.16	0	0.0
1993	645	0	0.0	0	0.0
1994	675	0	0.0	0	0.0
1995	704	1	0.14	0	0.0
1996	760	6	0.79	1	0.13
1997	1112	52	4.68	2	0.18
1998	1125	81	7.2	12	1.07
1999	1162	32	2.75	39	3.36
2000	1296	17	1.31	44	3.4
2001	1430	17	1.19	27	1.89
2002	1576	14	0.89	37	2.35
2003	1617	11	0.68	30	1.86
2004	1649	8	0.49	53	3.21
2005	1696	8	0.47	53	3.12
2006	1731	2	0.12	14	0.81
2007	1802	1	0.06	15	0.83
2008	1855	10	0.54	27	1.46
2009	1907	7	0.37	81	4.25
2010	1940	10	0.52	91	4.69
2011	1921	4	0.21	69	3.59
2012	1886	5	0.27	74	3.92
2013	1905	11	0.58	46	2.41
2014	1961	5	0.25	38	1.94
2015	2090	2	0.1	42	2.01
2016	2186	4	0.18	37	1.69
2017	2274	3	0.13	54	2.37
2018	2351	2	0.09	68	2.89
2019	2409	4	0.17	27	1.12

Economy: Spain

		Defaults		Others	
Year	Active	#	%	#	%
1990	104	0	0.0	0	0.0
1991	156	0	0.0	0	0.0
1992	164	0	0.0	1	0.61
1993	191	0	0.0	5	2.62
1994	257	0	0.0	1	0.39
1995	273	0	0.0	4	1.47
1996	283	0	0.0	5	1.77
1997	291	0	0.0	7	2.41
1998	301	0	0.0	47	15.61
1999	268	0	0.0	33	12.31
2000	248	0	0.0	14	5.65
2001	246	0	0.0	20	8.13
2002	241	2	0.83	18	7.47
2003	227	0	0.0	40	17.62
2004	195	0	0.0	15	7.69
2005	186	0	0.0	8	4.3
2006	197	0	0.0	26	13.2
2007	187	1	0.53	13	6.95
2008	178	2	1.12	8	4.49
2009	175	0	0.0	12	6.86
2010	174	1	0.57	11	6.32
2011	171	0	0.0	12	7.02
2012	165	2	1.21	5	3.03
2013	171	6	3.51	7	4.09
2014	173	0	0.0	9	5.2
2015	191	1	0.52	9	4.71
2016	207	1	0.48	2	0.97
2017	227	2	0.88	7	3.08
2018	249	3	1.2	10	4.02
2019	258	0	0.0	10	3.88

Economy: Sri Lanka

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	1	0	0.0	0	0.0
1994	1	0	0.0	0	0.0
1995	132	0	0.0	0	0.0
1996	145	0	0.0	0	0.0
1997	152	0	0.0	0	0.0
1998	164	0	0.0	1	0.61
1999	167	0	0.0	1	0.6
2000	174	0	0.0	1	0.57
2001	178	0	0.0	1	0.56
2002	186	0	0.0	1	0.54
2003	193	0	0.0	3	1.55
2004	197	0	0.0	0	0.0
2005	211	0	0.0	0	0.0
2006	219	0	0.0	0	0.0
2007	220	0	0.0	1	0.45
2008	222	0	0.0	3	1.35
2009	223	0	0.0	0	0.0
2010	234	0	0.0	0	0.0
2011	261	0	0.0	2	0.77
2012	277	0	0.0	1	0.36
2013	277	0	0.0	1	0.36
2014	283	0	0.0	5	1.77
2015	280	1	0.36	3	1.07
2016	281	1	0.36	6	2.14
2017	280	1	0.36	4	1.43
2018	280	0	0.0	10	3.57
2019	275	0	0.0	2	0.73

Economy: Sweden

		Defaults		Others	
Year	Active	#	%	#	%
1990	41	0	0.0	0	0.0
1991	62	0	0.0	0	0.0
1992	121	0	0.0	0	0.0
1993	145	0	0.0	1	0.69
1994	173	0	0.0	2	1.16
1995	184	0	0.0	0	0.0
1996	238	0	0.0	0	0.0
1997	308	0	0.0	36	11.69
1998	322	1	0.31	20	6.21
1999	367	1	0.27	26	7.08
2000	407	1	0.25	34	8.35
2001	396	4	1.01	26	6.57
2002	388	6	1.55	21	5.41
2003	368	2	0.54	21	5.71
2004	382	1	0.26	21	5.5
2005	407	2	0.49	13	3.19
2006	458	0	0.0	21	4.59
2007	522	1	0.19	13	2.49
2008	543	2	0.37	29	5.34
2009	531	4	0.75	24	4.52
2010	536	2	0.37	28	5.22
2011	537	3	0.56	32	5.96
2012	524	0	0.0	41	7.82
2013	515	3	0.58	21	4.08
2014	572	3	0.52	26	4.55
2015	640	2	0.31	21	3.28
2016	712	1	0.14	21	2.95
2017	819	3	0.37	19	2.32
2018	872	4	0.46	26	2.98
2019	888	1	0.11	24	2.7

Economy: Switzerland

		Defaults		Others	
Year	Active	#	%	#	%
1990	139	0	0.0	0	0.0
1991	158	0	0.0	6	3.8
1992	157	0	0.0	1	0.64
1993	174	0	0.0	0	0.0
1994	184	0	0.0	1	0.54
1995	194	0	0.0	2	1.03
1996	211	0	0.0	1	0.47
1997	222	2	0.9	3	1.35
1998	232	0	0.0	5	2.16
1999	249	0	0.0	8	3.21
2000	267	0	0.0	7	2.62
2001	268	2	0.75	9	3.36
2002	265	1	0.38	10	3.77
2003	252	2	0.79	10	3.97
2004	245	1	0.41	7	2.86
2005	249	1	0.4	6	2.41
2006	259	0	0.0	13	5.02
2007	259	0	0.0	6	2.32
2008	262	0	0.0	8	3.05
2009	260	0	0.0	6	2.31
2010	261	0	0.0	8	3.07
2011	259	2	0.77	10	3.86
2012	252	1	0.4	8	3.17
2013	248	0	0.0	5	2.02
2014	251	1	0.4	7	2.79
2015	248	1	0.4	13	5.24
2016	242	0	0.0	8	3.31
2017	240	0	0.0	13	5.42
2018	242	0	0.0	7	2.89
2019	245	0	0.0	7	2.86

Economy: Taiwan					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	192	0	0.0	0	0.0
1992	233	0	0.0	2	0.86
1993	254	0	0.0	0	0.0
1994	286	0	0.0	0	0.0
1995	332	0	0.0	0	0.0
1996	367	0	0.0	0	0.0
1997	396	0	0.0	2	0.51
1998	428	3	0.7	3	0.7
1999	465	7	1.51	6	1.29
2000	540	7	1.3	9	1.67
2001	602	8	1.33	12	1.99
2002	674	7	1.04	28	4.15
2003	686	1	0.15	10	1.46
2004	757	5	0.66	7	0.92
2005	769	3	0.39	22	2.86
2006	765	2	0.26	15	1.96
2007	792	2	0.25	18	2.27
2008	802	3	0.37	10	1.25
2009	814	1	0.12	4	0.49
2010	847	1	0.12	9	1.06
2011	862	0	0.0	6	0.7
2012	881	0	0.0	4	0.45
2013	894	0	0.0	4	0.45
2014	915	2	0.22	7	0.77
2015	924	0	0.0	3	0.32
2016	946	1	0.11	7	0.74
2017	941	0	0.0	6	0.64
2018	956	0	0.0	10	1.05
2019	956	0	0.0	5	0.52

Economy: Tanzania					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	0	0.0	NaN	0	NaN
1997	0	0.0	NaN	0	NaN
1998	0	0.0	NaN	0	NaN
1999	0	0.0	NaN	0	NaN
2000	0	0.0	NaN	0	NaN
2001	0	0.0	NaN	0	NaN
2002	0	0.0	NaN	0	NaN
2003	0	0.0	NaN	0	NaN
2004	0	0.0	NaN	0	NaN
2005	0	0.0	NaN	0	NaN
2006	0	0.0	NaN	0	NaN
2007	0	0.0	NaN	0	NaN
2008	0	0.0	NaN	0	NaN
2009	9	0.0	0.0	0	0.0
2010	9	0.0	0.0	0	0.0
2011	9	0.0	0.0	0	0.0
2012	10	0.0	0.0	0	0.0
2013	10	0.0	0.0	0	0.0
2014	12	0.0	0.0	0	0.0
2015	12	0.0	0.0	0	0.0
2016	14	0.0	0.0	1	7.14
2017	16	0.0	0.0	0	0.0
2018	20	0.0	0.0	0	0.0
2019	21	0.0	0.0	0	0.0

Economy: Thailand

		Defaults		Others	
Year	Active	#	%	#	%
1990	147	0	0.0	0	0.0
1991	190	0	0.0	1	0.53
1992	279	0	0.0	0	0.0
1993	330	0	0.0	0	0.0
1994	377	0	0.0	0	0.0
1995	408	1	0.25	4	0.98
1996	445	6	1.35	1	0.22
1997	449	21	4.68	29	6.46
1998	408	12	2.94	31	7.6
1999	379	15	3.96	19	5.01
2000	371	20	5.39	9	2.43
2001	362	8	2.21	8	2.21
2002	380	4	1.05	9	2.37
2003	405	4	0.99	6	1.48
2004	449	0	0.0	10	2.23
2005	495	3	0.61	16	3.23
2006	500	0	0.0	5	1.0
2007	510	2	0.39	11	2.16
2008	515	2	0.39	11	2.14
2009	527	10	1.9	8	1.52
2010	526	4	0.76	10	1.9
2011	529	2	0.38	11	2.08
2012	536	1	0.19	6	1.12
2013	561	1	0.18	4	0.71
2014	594	0	0.0	5	0.84
2015	633	1	0.16	10	1.58
2016	652	2	0.31	8	1.23
2017	740	4	0.54	11	1.49
2018	747	0	0.0	3	0.4
2019	794	2	0.25	7	0.88

Economy: Tunisia

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0.0	NaN	0	NaN
1991	0	0.0	NaN	0	NaN
1992	0	0.0	NaN	0	NaN
1993	0	0.0	NaN	0	NaN
1994	0	0.0	NaN	0	NaN
1995	0	0.0	NaN	0	NaN
1996	0	0.0	NaN	0	NaN
1997	0	0.0	NaN	0	NaN
1998	0	0.0	NaN	0	NaN
1999	33	0.0	0.0	0	0.0
2000	37	0.0	0.0	0	0.0
2001	41	0.0	0.0	0	0.0
2002	43	0.0	0.0	0	0.0
2003	43	0.0	0.0	0	0.0
2004	43	0.0	0.0	1	2.33
2005	45	0.0	0.0	0	0.0
2006	48	0.0	0.0	0	0.0
2007	51	0.0	0.0	0	0.0
2008	53	0.0	0.0	4	7.55
2009	51	0.0	0.0	0	0.0
2010	55	0.0	0.0	1	1.82
2011	55	0.0	0.0	0	0.0
2012	56	0.0	0.0	0	0.0
2013	65	0.0	0.0	0	0.0
2014	75	0.0	0.0	1	1.33
2015	77	0.0	0.0	0	0.0
2016	78	0.0	0.0	0	0.0
2017	80	0.0	0.0	0	0.0
2018	81	0.0	0.0	0	0.0
2019	81	0.0	0.0	0	0.0

Economy: Turkey					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	9	0	0.0	0	0.0
1993	15	0	0.0	0	0.0
1994	34	0	0.0	0	0.0
1995	201	0	0.0	0	0.0
1996	222	1	0.45	2	0.9
1997	256	0	0.0	1	0.39
1998	276	0	0.0	2	0.72
1999	283	0	0.0	9	3.18
2000	312	0	0.0	17	5.45
2001	297	0	0.0	13	4.38
2002	293	0	0.0	7	2.39
2003	290	0	0.0	6	2.07
2004	295	0	0.0	0	0.0
2005	304	0	0.0	2	0.66
2006	319	0	0.0	6	1.88
2007	323	0	0.0	5	1.55
2008	319	0	0.0	4	1.25
2009	320	0	0.0	4	1.25
2010	336	0	0.0	0	0.0
2011	363	0	0.0	2	0.55
2012	400	0	0.0	5	1.25
2013	421	0	0.0	6	1.43
2014	430	0	0.0	13	3.02
2015	425	0	0.0	12	2.82
2016	417	0	0.0	14	3.36
2017	411	1	0.24	10	2.43
2018	407	1	0.25	8	1.97
2019	404	0	0.0	5	1.24

Economy: Uganda					
		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	0	0	NaN	0	NaN
2005	0	0	NaN	0	NaN
2006	0	0	NaN	0	NaN
2007	0	0	NaN	0	NaN
2008	0	0	NaN	0	NaN
2009	6	0	0.0	0	0.0
2010	7	0	0.0	0	0.0
2011	7	0	0.0	0	0.0
2012	8	0	0.0	0	0.0
2013	8	0	0.0	0	0.0
2014	9	1	11.11	0	0.0
2015	8	0	0.0	0	0.0
2016	8	0	0.0	0	0.0
2017	8	0	0.0	1	12.5
2018	8	0	0.0	0	0.0
2019	8	0	0.0	0	0.0

Economy: Ukraine

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	30	0	0.0	1	3.33
1999	38	0	0.0	0	0.0
2000	39	0	0.0	5	12.82
2001	34	0	0.0	12	35.29
2002	27	0	0.0	5	18.52
2003	29	0	0.0	7	24.14
2004	44	0	0.0	0	0.0
2005	75	0	0.0	1	1.33
2006	118	0	0.0	2	1.69
2007	133	0	0.0	2	1.5
2008	138	0	0.0	9	6.52
2009	135	1	0.74	39	28.89
2010	98	0	0.0	44	44.9
2011	67	0	0.0	13	19.4
2012	65	0	0.0	8	12.31
2013	77	0	0.0	11	14.29
2014	69	0	0.0	14	20.29
2015	57	0	0.0	27	47.37
2016	31	0	0.0	18	58.06
2017	15	0	0.0	6	40.0
2018	24	0	0.0	1	4.17
2019	29	0	0.0	0	0.0

Economy: United Arab Emirates

Year	Active	Defaults #	Defaults %	Others #	Others %
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	0	0	NaN	0	NaN
2001	0	0	NaN	0	NaN
2002	0	0	NaN	0	NaN
2003	0	0	NaN	0	NaN
2004	0	0	NaN	0	NaN
2005	0	0	NaN	0	NaN
2006	76	0	0.0	0	0.0
2007	87	0	0.0	2	2.3
2008	92	0	0.0	5	5.43
2009	89	0	0.0	1	1.12
2010	93	0	0.0	2	2.15
2011	95	0	0.0	2	2.11
2012	96	1	1.04	1	1.04
2013	96	0	0.0	3	3.12
2014	103	0	0.0	1	0.97
2015	105	0	0.0	5	4.76
2016	103	0	0.0	1	0.97
2017	113	2	1.77	4	3.54
2018	112	0	0.0	5	4.46
2019	112	0	0.0	1	0.89

Economy: UK					
		Defaults		Others	
Year	Active	#	%	#	%
1990	260	0	0.0	2	0.77
1991	1056	1	0.09	5	0.47
1992	1112	0	0.0	6	0.54
1993	1201	0	0.0	5	0.42
1994	1309	0	0.0	2	0.15
1995	1460	0	0.0	2	0.14
1996	1657	0	0.0	10	0.6
1997	1800	0	0.0	36	2.0
1998	1876	0	0.0	147	7.84
1999	1827	3	0.16	199	10.89
2000	1913	2	0.1	171	8.94
2001	1853	12	0.65	114	6.15
2002	1814	14	0.77	109	6.01
2003	1770	5	0.28	126	7.12
2004	1929	2	0.1	96	4.98
2005	2198	2	0.09	120	5.46
2006	2372	0	0.0	175	7.38
2007	2447	3	0.12	169	6.91
2008	2347	24	1.02	231	9.84
2009	2125	32	1.51	216	10.16
2010	1956	4	0.2	172	8.79
2011	1843	10	0.54	131	7.11
2012	1762	18	1.02	129	7.32
2013	1708	10	0.59	107	6.26
2014	1718	7	0.41	97	5.65
2015	1748	6	0.34	127	7.27
2016	1711	3	0.18	134	7.83
2017	1687	4	0.24	95	5.63
2018	1695	6	0.35	102	6.02
2019	1641	2	0.12	99	6.03

Economy: US					
		Defaults		Others	
Year	Active	#	%	#	%
1990	3833	5	0.13	85	2.22
1991	4137	18	0.44	102	2.47
1992	5414	18	0.33	88	1.63
1993	6179	25	0.4	143	2.31
1994	6938	17	0.25	223	3.21
1995	7431	17	0.23	362	4.87
1996	7988	16	0.2	401	5.02
1997	8364	51	0.61	568	6.79
1998	8409	82	0.98	890	10.58
1999	8131	78	0.96	921	11.33
2000	7772	119	1.53	780	10.04
2001	7064	168	2.38	757	10.72
2002	6320	114	1.8	532	8.42
2003	5898	82	1.39	472	8.0
2004	5733	31	0.54	370	6.45
2005	5705	38	0.67	384	6.73
2006	5637	16	0.28	381	6.76
2007	5673	28	0.49	462	8.14
2008	5334	65	1.22	382	7.16
2009	5037	93	1.85	320	6.35
2010	4890	29	0.59	313	6.4
2011	4744	35	0.74	302	6.37
2012	4615	38	0.82	262	5.68
2013	4651	25	0.54	238	5.12
2014	4792	27	0.56	212	4.42
2015	4930	43	0.87	275	5.58
2016	4860	65	1.34	360	7.41
2017	4758	42	0.88	304	6.39
2018	4770	18	0.38	259	5.43
2019	4801	30	0.62	282	5.87

Economy: Venezuela

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	7	0	0.0	0	0.0
1994	12	0	0.0	0	0.0
1995	15	0	0.0	1	6.67
1996	14	0	0.0	0	0.0
1997	47	0	0.0	2	4.26
1998	45	0	0.0	4	8.89
1999	45	0	0.0	9	20.0
2000	36	0	0.0	3	8.33
2001	35	1	2.86	4	11.43
2002	32	0	0.0	5	15.62
2003	30	0	0.0	3	10.0
2004	30	0	0.0	2	6.67
2005	29	0	0.0	0	0.0
2006	30	0	0.0	3	10.0
2007	27	0	0.0	0	0.0
2008	31	0	0.0	1	3.23
2009	30	0	0.0	1	3.33
2010	29	0	0.0	2	6.9
2011	27	0	0.0	7	25.93
2012	21	0	0.0	3	14.29
2013	18	0	0.0	1	5.56
2014	20	0	0.0	0	0.0
2015	21	0	0.0	0	0.0
2016	21	0	0.0	0	0.0
2017	25	0	0.0	0	0.0
2018	26	0	0.0	0	0.0
2019	26	0	0.0	0	0.0

Economy: Vietnam

		Defaults		Others	
Year	Active	#	%	#	%
1990	0	0	NaN	0	NaN
1991	0	0	NaN	0	NaN
1992	0	0	NaN	0	NaN
1993	0	0	NaN	0	NaN
1994	0	0	NaN	0	NaN
1995	0	0	NaN	0	NaN
1996	0	0	NaN	0	NaN
1997	0	0	NaN	0	NaN
1998	0	0	NaN	0	NaN
1999	0	0	NaN	0	NaN
2000	5	0	0.0	0	0.0
2001	10	0	0.0	0	0.0
2002	19	0	0.0	0	0.0
2003	21	0	0.0	0	0.0
2004	24	0	0.0	0	0.0
2005	30	0	0.0	0	0.0
2006	86	0	0.0	0	0.0
2007	206	0	0.0	3	1.46
2008	269	0	0.0	2	0.74
2009	393	0	0.0	28	7.12
2010	582	0	0.0	10	1.72
2011	630	1	0.16	12	1.9
2012	641	0	0.0	10	1.56
2013	646	0	0.0	23	3.56
2014	650	0	0.0	15	2.31
2015	691	0	0.0	16	2.32
2016	710	1	0.14	5	0.7
2017	752	0	0.0	5	0.66
2018	793	0	0.0	45	5.67
2019	774	0	0.0	29	3.75

B APPENDIX: PERFORMANCE ANALYSIS

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

	AR				**AUROC**			
Economy	1mth	1yr	2yr	5yr	1mth	1yr	2yr	5yr
Australia	0.826	0.665	0.531	0.37	0.913	0.833	0.767	0.689
Brazil	0.866	0.802	0.727	0.546	0.933	0.901	0.865	0.777
Canada	0.948	0.832	0.721	0.564	0.974	0.916	0.861	0.785
China	0.698	0.669	0.647	0.588	0.849	0.836	0.826	0.801
Denmark	0.888	0.818	0.665	0.541	0.944	0.909	0.833	0.774
France	0.84	0.746	0.665	0.602	0.92	0.873	0.833	0.802
Germany	0.87	0.716	0.617	0.495	0.935	0.859	0.81	0.753
Hong Kong	0.741	0.564	0.475	0.303	0.871	0.783	0.738	0.654
India	0.73	0.694	0.67	0.592	0.865	0.848	0.838	0.802
Indonesia	0.72	0.695	0.642	0.466	0.86	0.848	0.823	0.741
Italy	0.882	0.814	0.668	0.546	0.941	0.907	0.834	0.775
Japan	0.901	0.856	0.806	0.676	0.951	0.928	0.903	0.839
Malaysia	0.802	0.756	0.695	0.523	0.901	0.878	0.849	0.767
Mexico	0.761	0.708	0.623	0.507	0.88	0.855	0.814	0.761
Netherlands	0.875	0.834	0.708	0.5	0.937	0.917	0.855	0.754
Norway	0.962	0.847	0.719	0.516	0.981	0.924	0.86	0.762
Philippines	0.684	0.655	0.64	0.632	0.842	0.828	0.821	0.82
Poland	0.843	0.738	0.633	0.392	0.921	0.869	0.818	0.701
Russian Federation	0.666	0.471	0.264	0.115	0.833	0.736	0.634	0.562
Singapore	0.787	0.721	0.588	0.271	0.894	0.861	0.795	0.64
South Africa	0.915	0.847	0.725	0.46	0.958	0.924	0.863	0.733
South Korea	0.886	0.753	0.686	0.585	0.943	0.877	0.844	0.795
Spain	0.841	0.633	0.504	0.454	0.921	0.817	0.753	0.73
Sweden	0.914	0.84	0.764	0.554	0.957	0.92	0.882	0.779
Taiwan	0.922	0.808	0.72	0.596	0.961	0.904	0.86	0.799
Thailand	0.833	0.799	0.74	0.604	0.916	0.9	0.871	0.807
UK	0.869	0.747	0.622	0.426	0.935	0.874	0.812	0.715
US	0.942	0.858	0.764	0.6	0.971	0.929	0.883	0.804
Developed Asia-Pacific	0.864	0.759	0.676	0.532	0.932	0.879	0.839	0.768
Emerging MKT	0.802	0.752	0.69	0.541	0.901	0.876	0.846	0.774
Europe	0.87	0.753	0.644	0.485	0.935	0.877	0.823	0.745
North America	0.943	0.855	0.759	0.595	0.971	0.928	0.881	0.801

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, Aggregate DTDs (financial and non–financial), CA/CL Level and Trend (non–financial firms), and CASH/TA Level and Trend (financial firms). Solid lines are the parameter estimates and dashed lines are the 90% confidence level. Horizontal axis is the horizon in months.

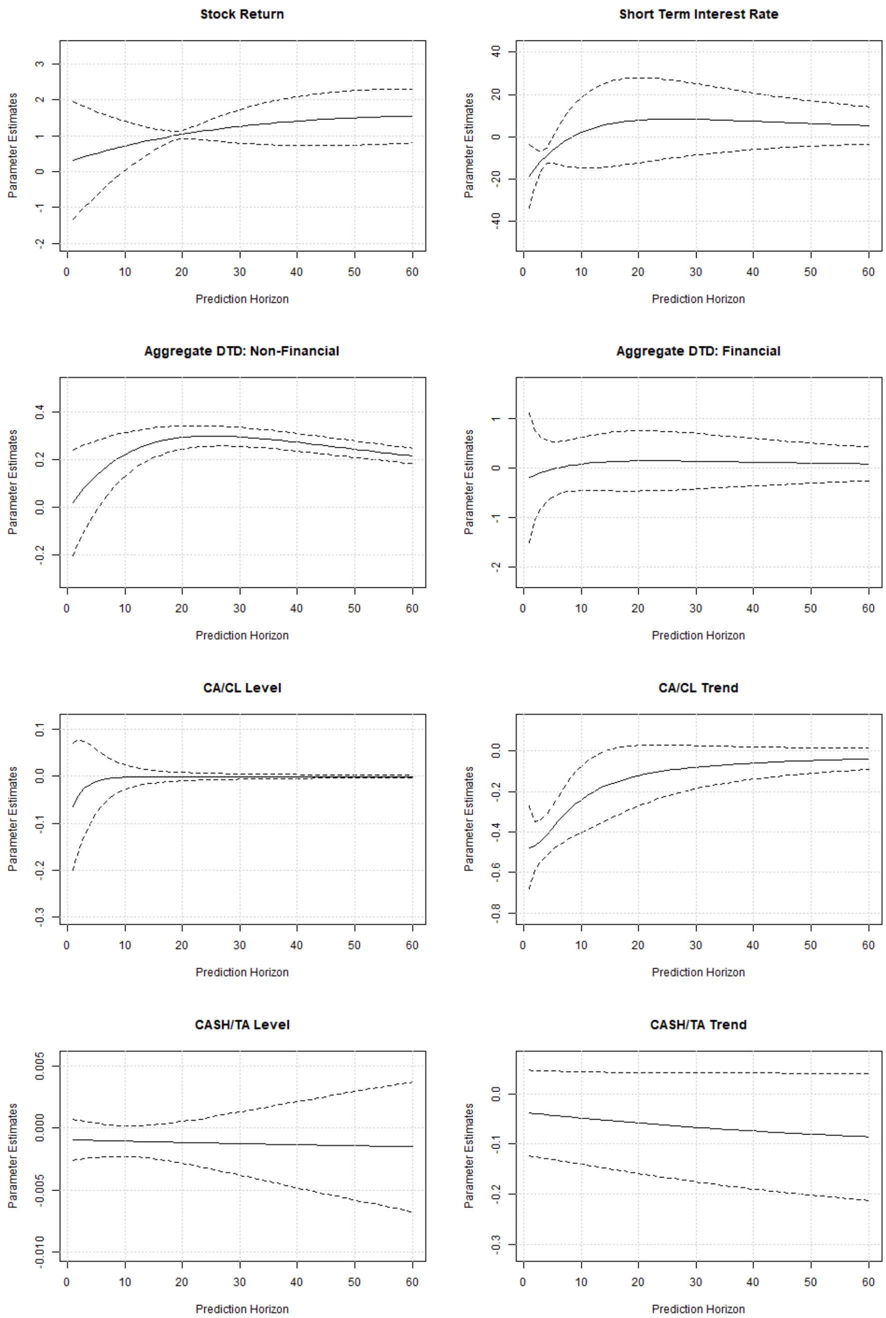


Figure B.2: Plots of US default parameters across all horizons for DTD Level, DTD Trend, the NI/TA Level, NI/TA Trend, SIZE Level, SIZE Trend, M/B, and SIGMA. Solid lines are the parameter estimates and dashed lines are the 90% confidence level. Horizontal axis is the horizon in months.

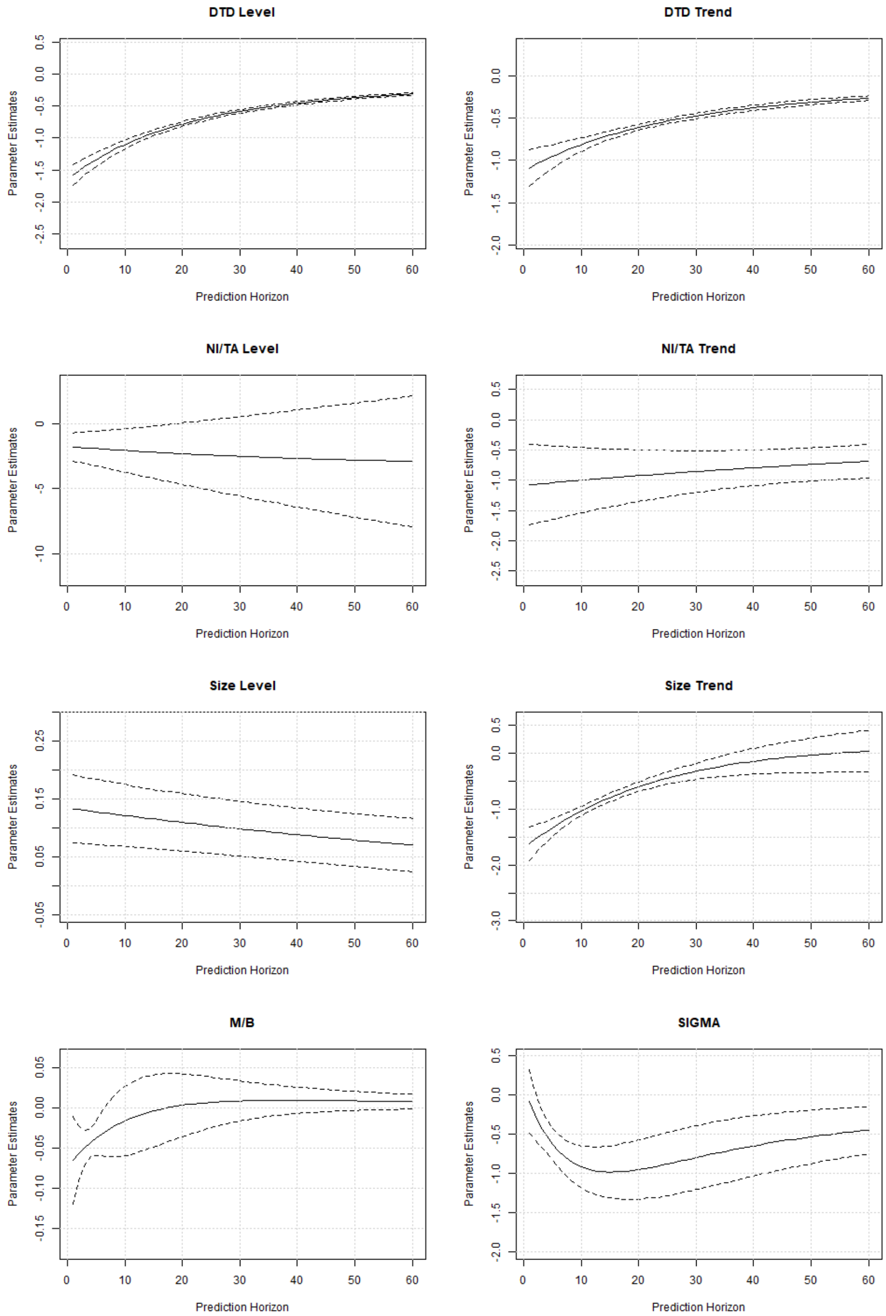
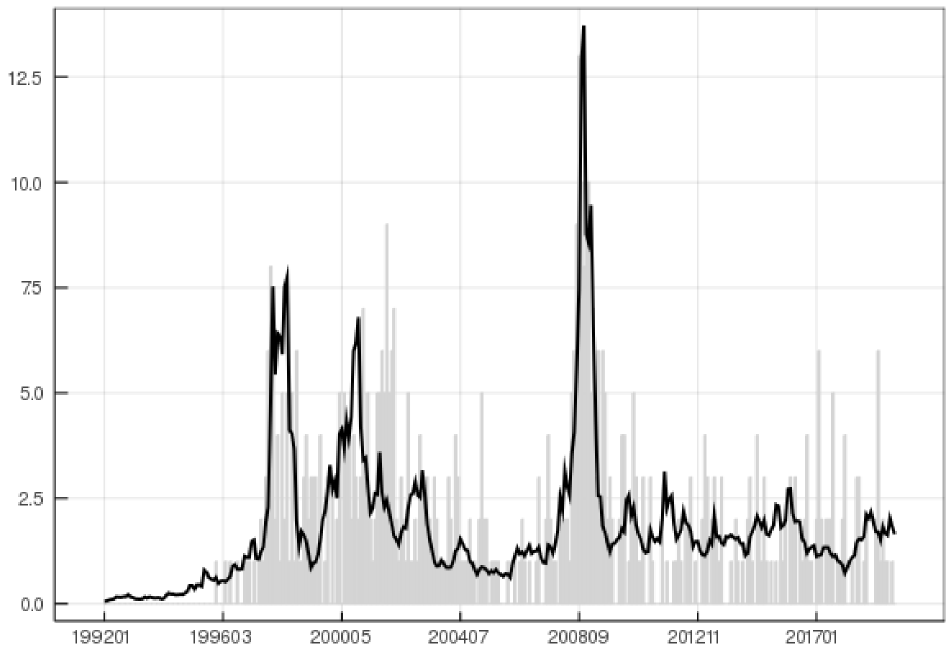
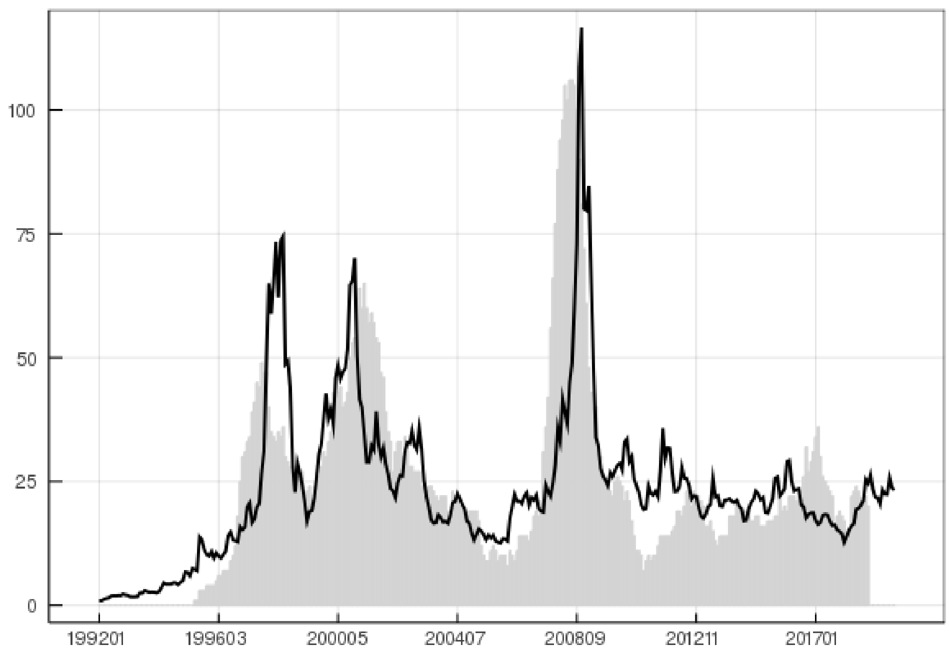


Figure B.3: Performance test with different prediction horizons for Asia Pacific (Developed), in sample. The solid lines represent the predicted default, whereas the grey bars represent the actual default. x-axis is the number of default, and y-axis is the time period.

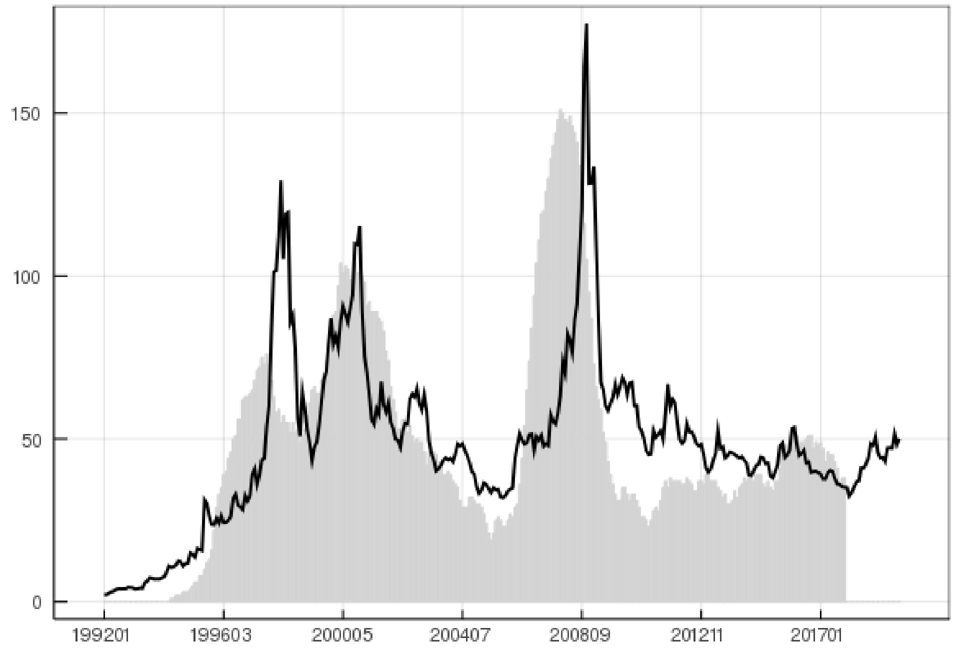
B.3(a) Horizon = 1 month



B.3(b) Horizon = 12 months



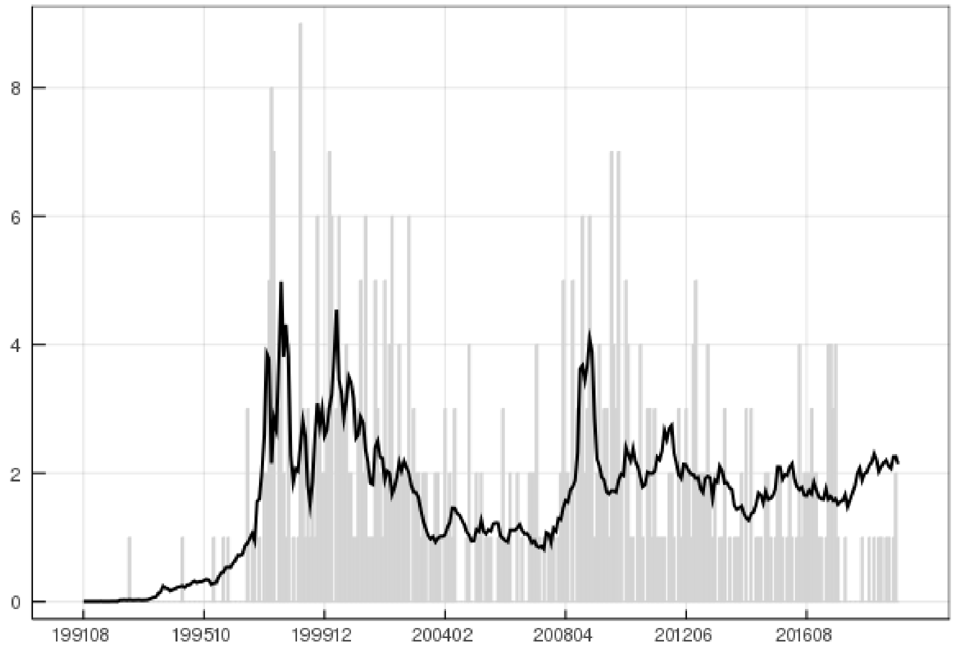
B.3(c) Horizon = 2 years



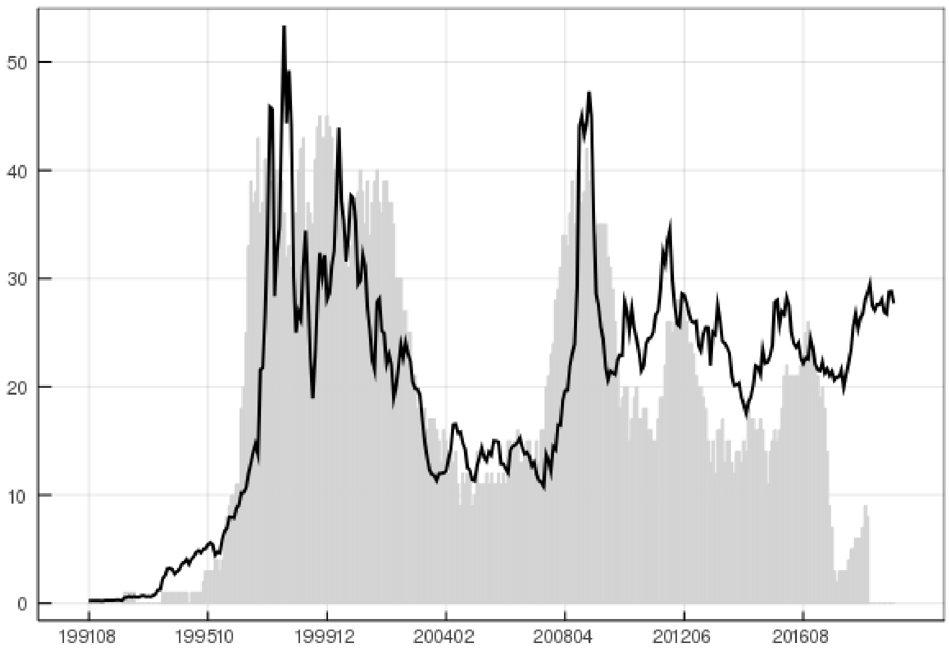
B.3(d) Horizon = 5 years

Figure B.4: Performance test with different prediction horizons for the Emerging Market, in sample.The solid lines represent the predicted default, whereas the grey bars represent the actual default. x-axis is the number of default, and y-axis is the time period.

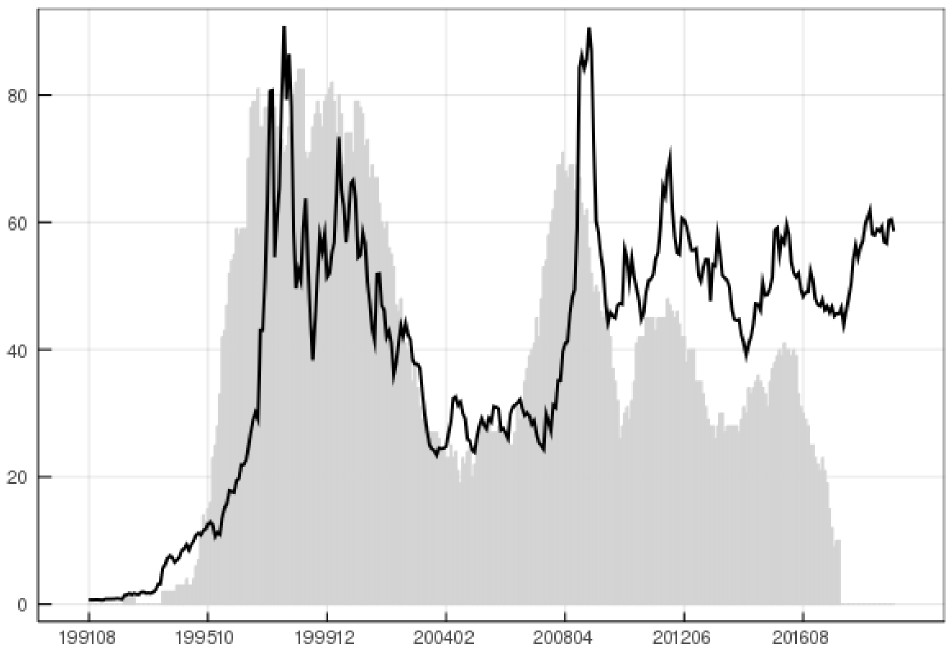
B.4(a) Horizon = 1 month



B.4(b) Horizon = 12 months



B.4(c) Horizon = 2 years



B.4(d) Horizon = 5 years

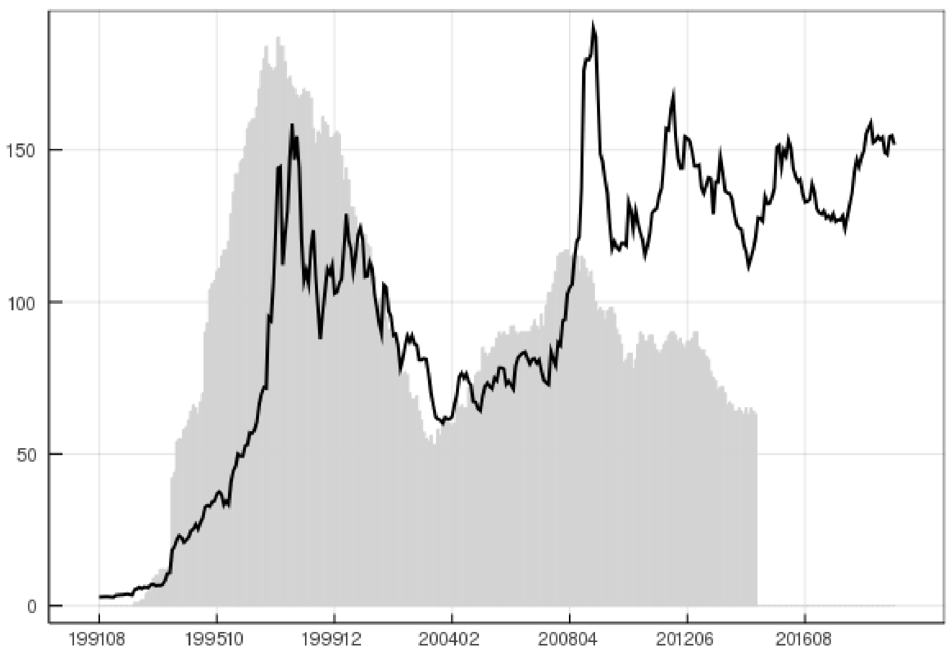
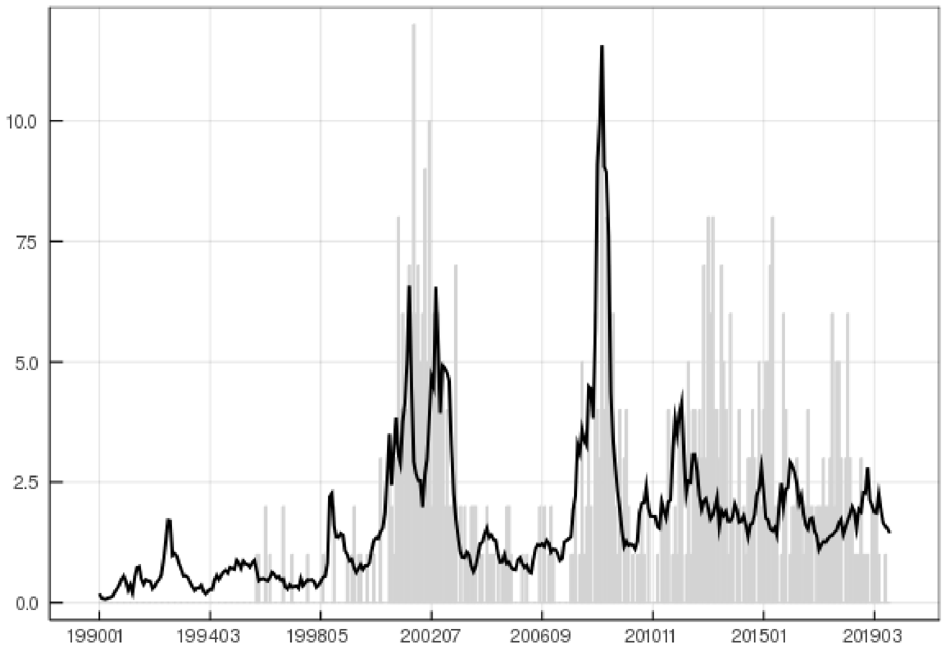
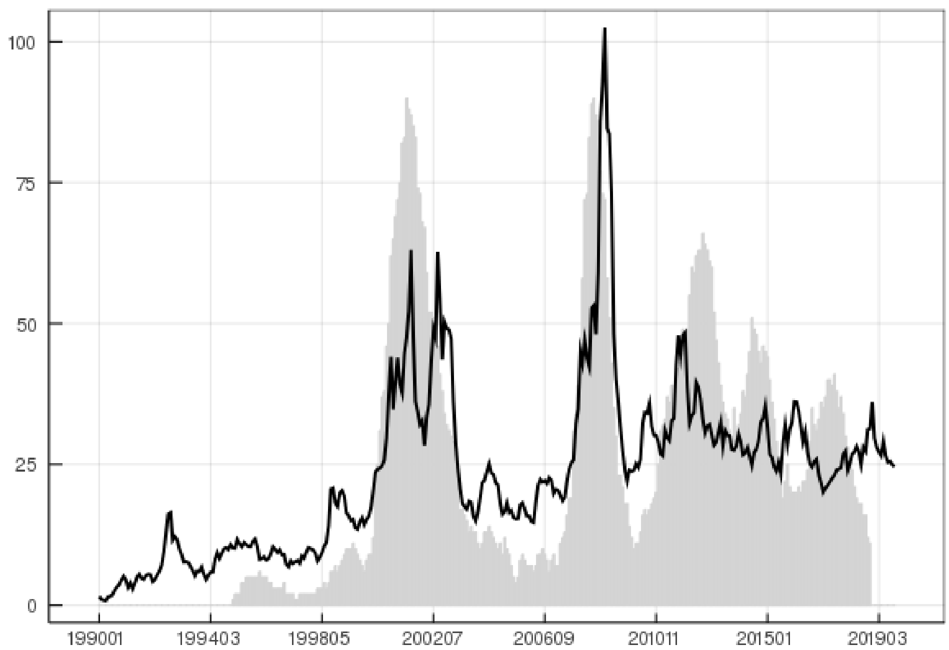


Figure B.5: Performance test with differenct prediction horizons for the Europe group, in sample. The solid lines represent the predicted default, whereas the grey bars represent the actual default. x-axis is the number of default, and y-axis is the time period.

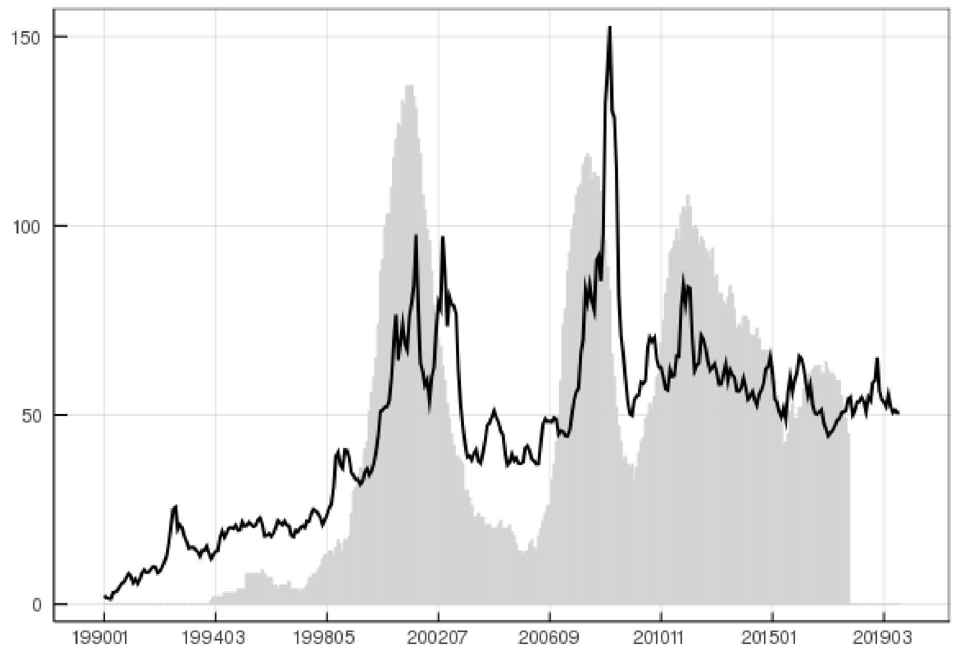
B.5(a) Horizon = 1 month



B.5(b) Horizon = 12 months



B.5(c) Horizon = 2 years



B.5(d) Horizon = 5 years

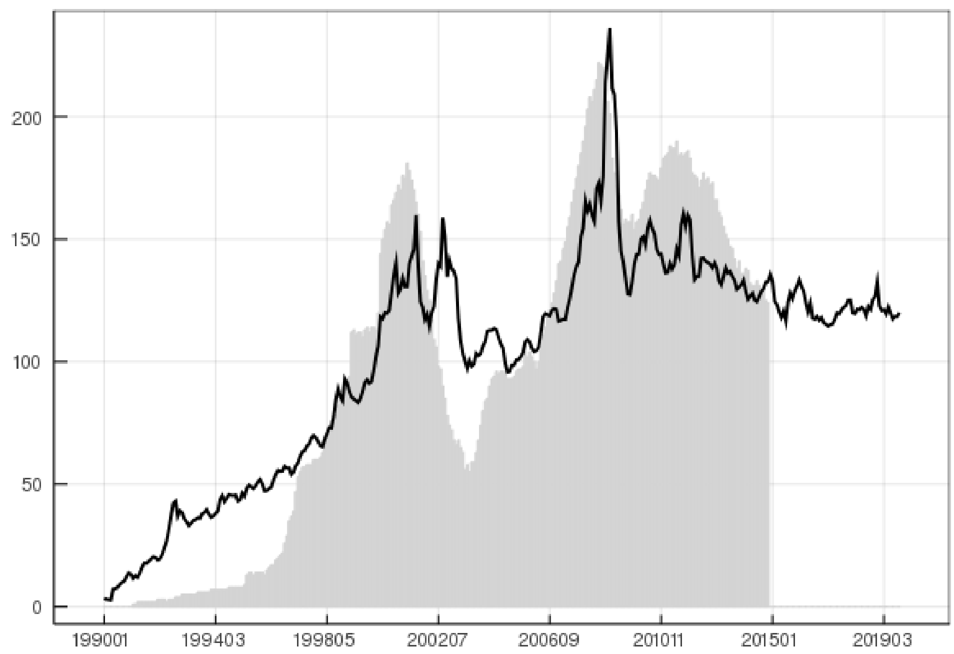
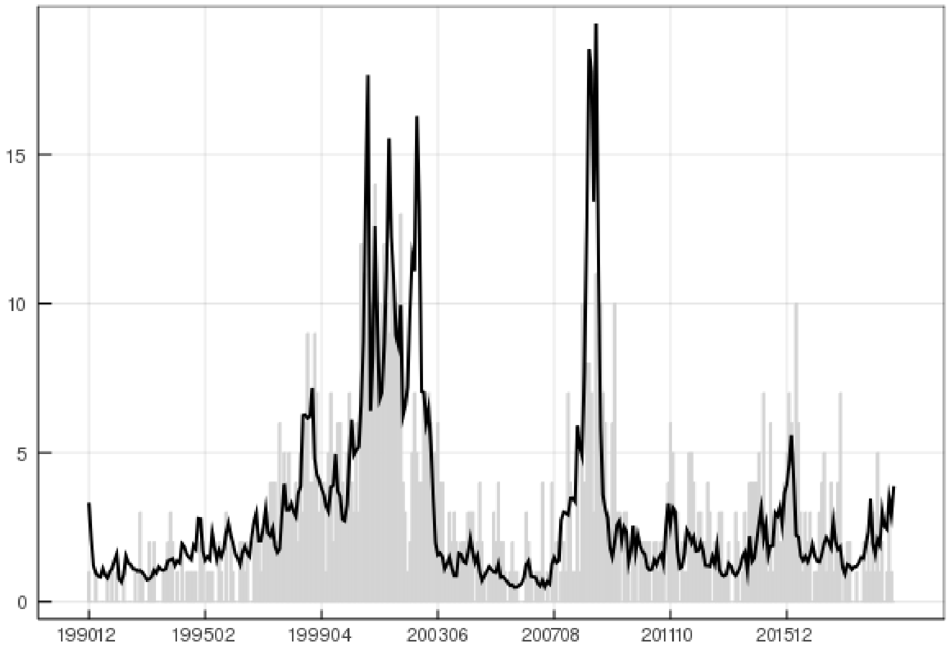
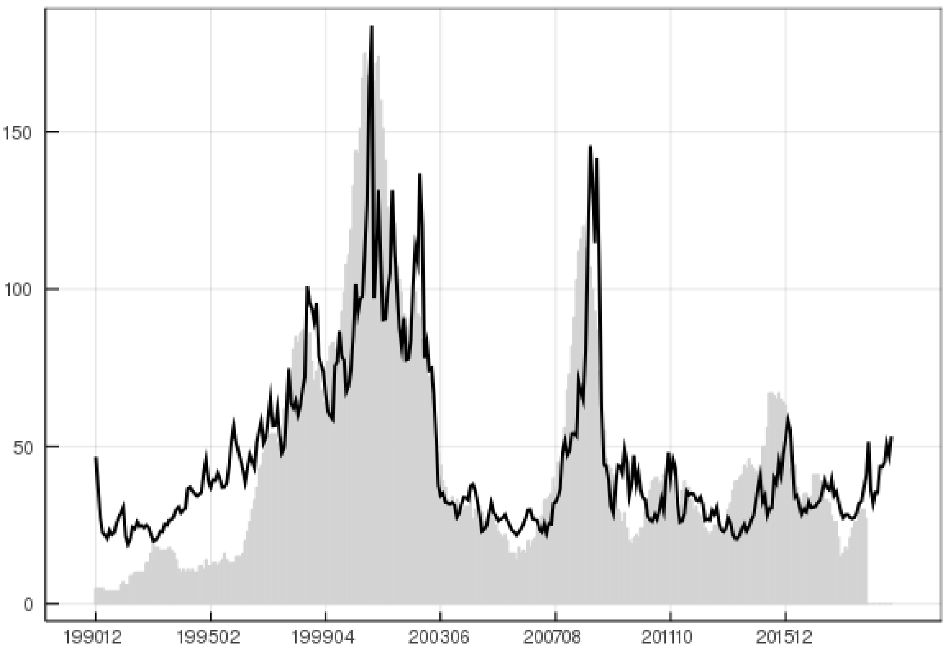


Figure B.6: Performance test with different horizons for North America group, in sample. The solid lines represent the predicted default, whereas the grey bars represent the actual default. x-axis is the number of default, and y-axis is the time period.

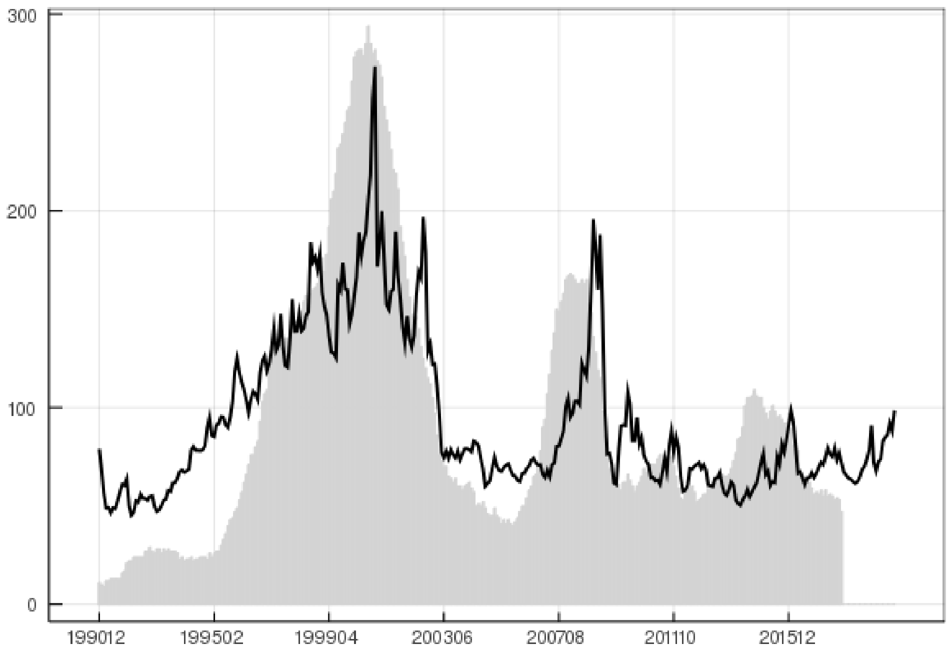
B.6(a) Horizon = 1 month



B.6(b) Horizon = 12 months



B.6(c) Horizon = 2 years



B.6(d) Horizon = 5 years

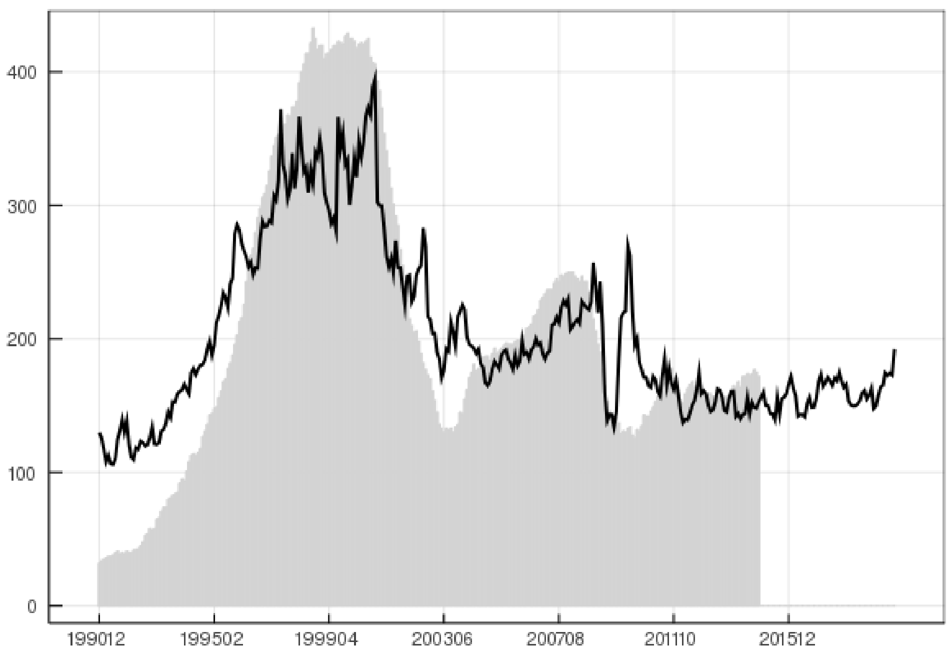
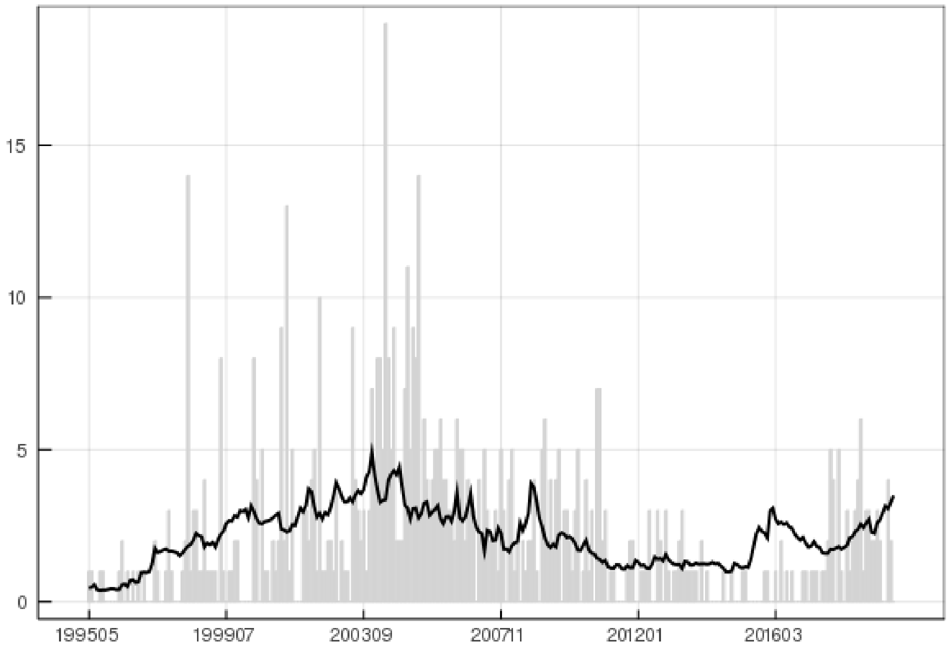
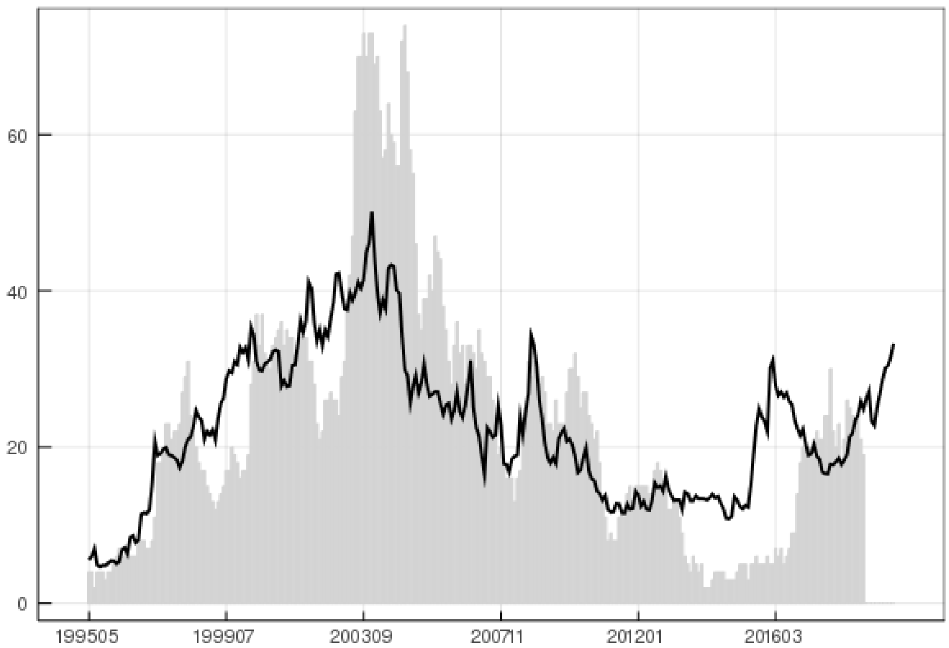


Figure B.7: Performance test with different prediction horizons for China, in sample. The solid lines represent the predicted default, whereas the grey bars represent the actual default. x-axis is the number of default, and y-axis is the time period.

B.7(a) Horizon = 1 month



B.7(b) Horizon = 12 months



B.7(c) Horizon = 2 years

B.7(d) Horizon = 5 years

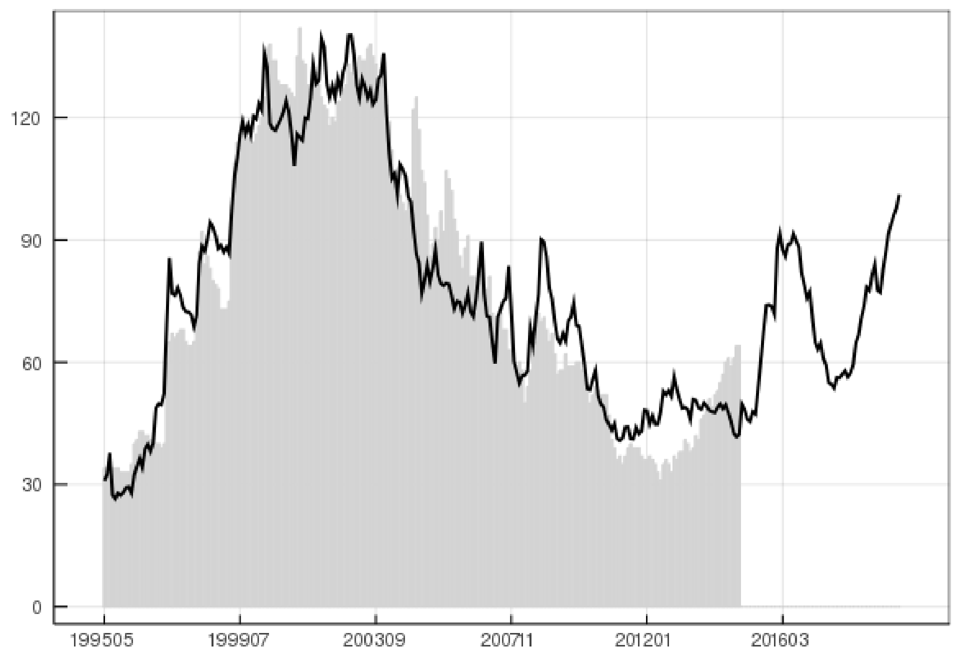
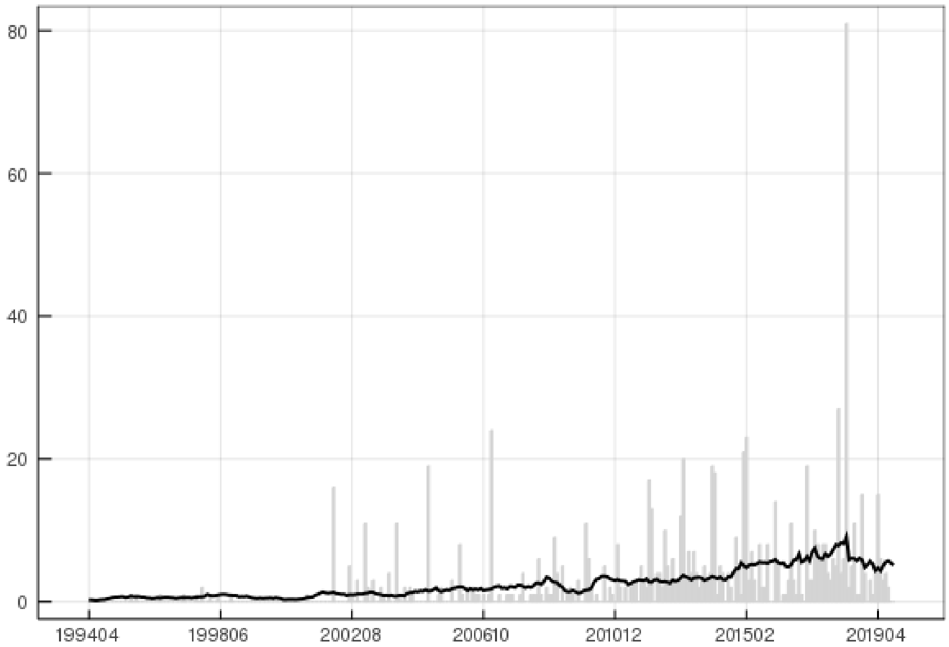


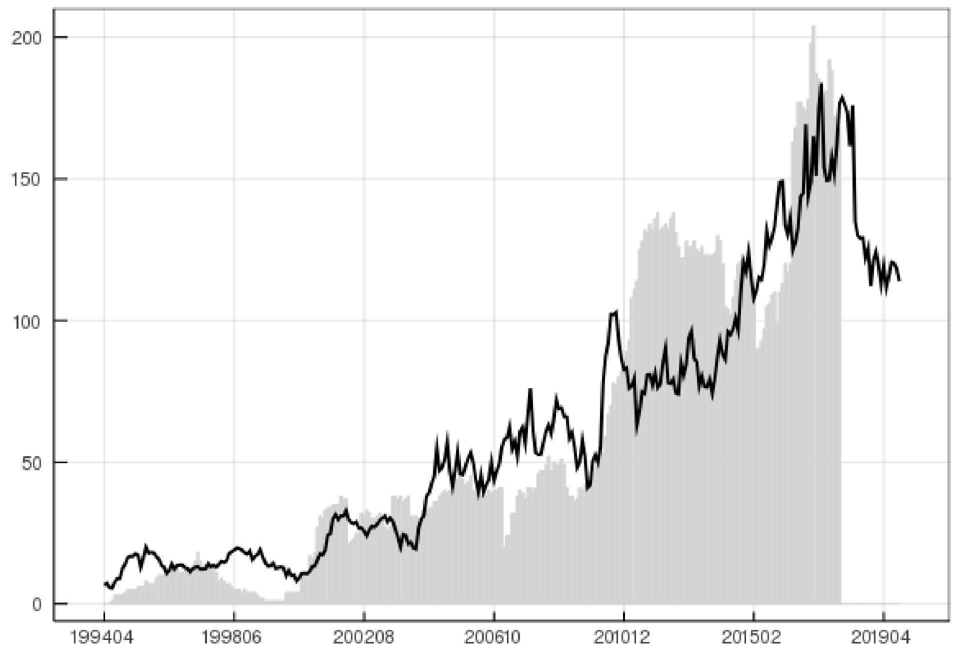
Figure B.8: Performance test with different prediction horizons for India, in sample. The solid lines represent the predicted default, whereas the grey bars represent the actual default. x-axis is the number of default, and y-axis is the time period.

B.8(a) Horizon = 1 month

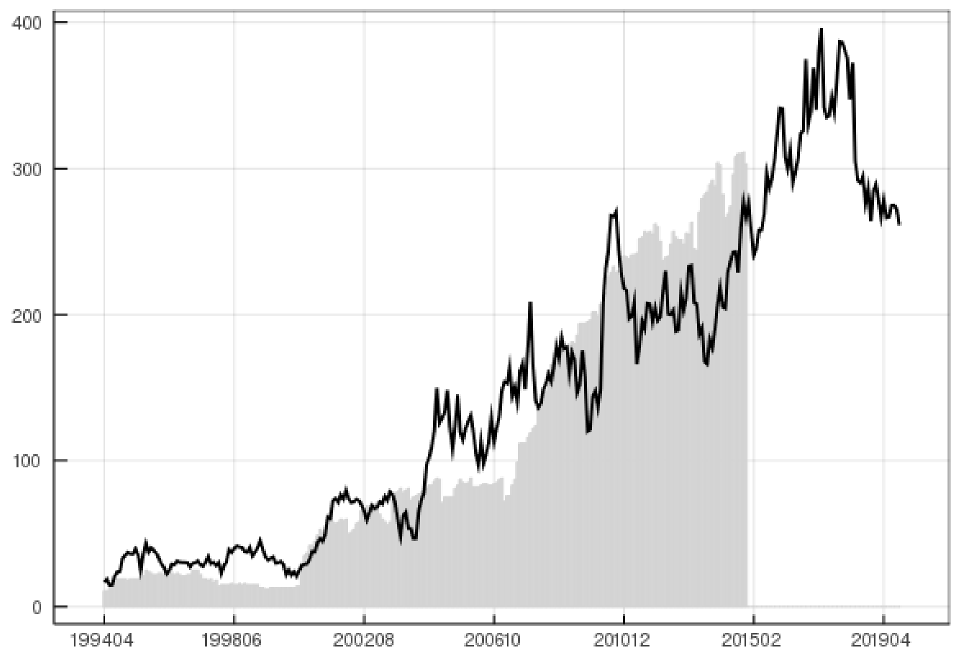


B.8(b) Horizon = 12 months

B.8(c) Horizon = 2 years



B.8(d) Horizon = 5 years



C APPENDIX: PDiR MAPPING TABLE OF 1-YEAR CRI-PD

Table C.1: Mapping 10-day moving average 1-year CRI PD to the S&P experience

Rating Category	Initial Assignment		Upgrade To		Downgrade To	
	lb (bps)	ub (bps)	lb (bps)	ub (bps)	lb (bps)	ub (bps)
AAA	0	0.0035	0	0.0027	-	-
AA+	0.0035	0.1044	0.0027	0.0035	0.1044	0.3060
AA	0.1044	0.3060	0.0035	0.1044	0.3060	0.4069
AA-	0.3060	0.4069	0.1044	0.3060	0.4069	1.2928
A+	0.4069	1.2928	0.3060	0.4069	1.2928	3.0646
A	1.2928	3.0646	0.4069	1.2928	3.0646	3.9506
A-	3.0646	3.9506	1.2928	3.0646	3.9506	9.9936
BBB+	3.9506	9.9936	3.0646	3.9506	9.9936	22.0796
BBB	9.9936	22.0796	3.9506	9.9936	22.0796	28.1227
BBB-	22.0796	28.1227	9.9936	22.0796	28.1227	46.2056
BB+	28.1227	46.2056	22.0796	28.1227	46.2056	82.3715
BB	46.2056	82.3715	28.1227	46.2056	82.3715	100.4544
BB-	82.3715	100.4544	46.2056	82.3715	100.4544	357.0556
B+	100.4544	357.0556	82.3715	100.4544	357.0556	870.2578
B	357.0556	870.2578	100.4544	357.0556	870.2578	1126.8589
B-	870.2578	1126.8589	357.0556	870.2578	1126.8589	1630.8764
CCC+	1126.8589	1630.8764	870.2578	1126.8589	1630.8764	2638.9113
CCC	1630.8764	2638.9113	1126.8589	1630.8764	2638.9113	3142.9287
CCC-	2638.9113	3142.9287	1630.8764	2638.9113	3142.9287	4449.8571
CC	3142.9287	8370.6423	2638.9113	7063.7139	4449.8571	8777.9817
C	8370.6423	10000	-	-	8777.9817	10000

Table C.2: Mapping 10-day moving average 1-year CRI PDs to Moody's experience

Rating Category	initial assignment		Upgrade to		Downgrade to	
	lb (bps)	ub (bps)	lb (bps)	ub (bps)	lb (bps)	ub (bps)
Aaa	0	0.0065	0	0.0049	-	-
Aa1	0.0065	0.0662	0.0049	0.0065	0.0662	0.1860
Aa2	0.0662	0.1860	0.0065	0.0662	0.1860	0.2450
Aa3	0.1860	0.2450	0.0662	0.1860	0.2450	0.8970
A1	0.2450	0.8970	0.1860	0.2450	0.8970	2.2008
A2	0.8970	2.2008	0.2450	0.8970	2.2008	2.8526
A3	2.2008	2.8526	0.8970	2.2008	2.8526	9.2961
Baa1	2.8526	9.2961	2.2008	2.8526	9.2961	22.1830
Baa2	9.2961	22.1830	2.8526	9.2961	22.1830	28.6265
Baa3	22.1830	28.6265	9.2961	22.1830	28.6265	43.3585
Ba1	28.6265	43.3585	22.1830	28.6265	43.3585	72.8224
Ba2	43.3585	72.8224	28.6265	43.3585	72.8224	87.5544
Ba3	72.8224	87.5544	43.3585	72.8224	87.5544	122.7975
B1	87.5544	122.7975	72.8224	87.5544	122.7975	193.2836
B2	122.7975	193.2836	87.5544	122.7975	193.2836	228.5267
B3	193.2836	228.5267	122.7975	193.2836	228.5267	356.9571
Caa1	228.5267	356.9571	193.2836	228.5267	356.9571	613.8180
Caa2	356.9571	613.8180	228.5267	356.9571	613.8180	742.2484
Caa3	613.8180	742.2484	356.9571	613.8180	742.2484	857.5755
Ca	742.2484	1203.5566	613.8180	1088.2295	857.5755	3402.6674
C	1203.5566	10000	-	-	3402.6674	10000

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