

# The Growth of Global Equity Markets: A Panel Data Analysis

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## Abstract

This paper examines cross-country patterns of growth in equity markets. It adopts a flexible valuation model that allows for the breakdown of changes in equity market capitalization into growth in valuation inputs, changes in valuation technology, and improvement in valuation efficiency. Using panel data on 16 developed markets and 16 emerging markets, we find that both the country size and the development of financial intermediaries are positively related to the valuation of equity markets. *Ceteris paribus*, greater economic freedom, liberalization, privatization, and enforcement of insider trading laws are accompanied by more efficient valuation, while countries within the French, German, or Scandinavian legal families tend to be valued less. Overall, there is wide variation in valuation efficiency across the developed markets, while equities in the emerging markets tend to be valued very inefficiently. Over time, the developed markets experience moderate improvement in valuation efficiency, while for the emerging markets, the improvement in valuation efficiency over time is drastic.

JEL classification: G15, International financial markets; G28, Government policy and regulations; G14, Information and market efficiency; C11, Bayesian analysis; C15, Statistical simulation methods

Keywords: Valuation; Efficiency; Stochastic frontier; Bayesian inference; Gibbs sampling

# 1 Introduction

The process of growth in global equity markets is still imperfectly understood. Standard economic models imply that the value of a country's equity market (an output) should depend only on the inputs used. However, what the relevant input factors are in the valuation function, and how these input factors are related to the market value of an equity market, are questions left unanswered by the theory.

This paper develops a modeling strategy and presents empirical evidence that sheds light on questions such as: Why do some countries have so much bigger equity markets than others? Why are some emerging markets valued far below those developed countries with comparable macroeconomic characteristics? Which country in the world has the most efficient valuation of its equity market? Do global equity markets become more efficiently valued over time? Is growth in the equity market driven by countries removing valuation inefficiency and moving closer to the valuation frontier? Or is it driven by movements of or along the valuation frontier itself? A structural methodology is adopted that allows for the breakdown of changes in equity market capitalization into growth in valuation inputs, changes in valuation technology, and improvement in valuation efficiency.

The valuation model used in this paper is a generalization of what are called stochastic frontier or composed error models first developed by Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977). These models are based on the idea that comparable economic agents can be assumed to operate according to a common technology, or production frontier. "Frontier" here means the maximum technically feasible output given inputs. In this paper, we view individual countries as producers of the market capitalization of their equity market (an output) given valuation inputs, such as the GDP growth, size of the economy, development of financial intermediaries, size of the government, and trade openness. Accordingly, countries can be thought of as operating either on or within the valuation frontier; and the distance from the frontier as reflecting inefficiency in valuation, i.e., mispricing. Over time, a country's equity market can become more efficiently valued and "catch up" to the frontier or the frontier itself can evolve over time, indicating change/progress in the valuation technology. In addition, a country can move along the valuation

frontier by changing inputs. Hence growth in equity markets can be thought of in terms of three different components: Improvement in valuation efficiency, changes in valuation technology, and growth in inputs.

Our paper begins with a valuation model where the dependent variable is the size of a country's equity market and the choice of valuation input factors is guided by finance theory and prior research. The decomposition of growth in the equity market into components due to inputs, valuation technology, and valuation efficiency provides us with a convenient way of thinking about model extensions. For any new possible explanatory variable, one can ask whether it should affect (1) the input component and thus should enter as an input, or (2) the change in valuation technology component and thus should affect the frontier parameters directly, or (3) the change in valuation efficiency component, in which case it should enter the efficiency distribution. This approach is in contrast to the standard growth literature that considers a myriad of possible additional explanatory variables, and can be thought of as using economic theory to move one step away from reduced-form regression approaches.

Our work is motivated by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997) who examine the relationship between legal systems and capital markets and find that the legal environment matters for the size and extent of a country's capital markets. Our work is distinguished by the use of time-series as well as cross-sectional information. Indeed, the growth of global equity markets suggests a temporal dimension that is not captured by the standard cross-country estimation methodology employed by La Porta et al. (1997).

Our work is related to a vast literature that tries to explain the cross-sectional determinants of economic growth using different sets of explanatory variables (Barro (1991), Barro and Sala-i-Martin (1992), Levine and Renelt (1992), and Persson and Tabellini (1994)). The early focus on theoretical models that generate self-sustaining growth and endogenous technological advance has been increasingly replaced with attempts to shed light on the diversity of experience with economic growth. On the empirical front, the search for sources of growth has gone beyond macroeconomic variables to examine "deeper" determinants of economic performance such as institutions,

macroeconomic policies, geography, etc. (Rodrik (2001)). For instance, there is now an interest in determining the influence of the financial sector on the cross-section of economic growth (King and Levine (1993), Levine and Zervos (1998a, 1998b), and Beck, Levine and Loayza (2000)). The most innovative research in this area are two recent papers by Bekaert, Harvey and Lundblad (2001a, 2001b) that focus on the link between financial liberalizations and economic development in emerging markets. Using panel data techniques, Bekaert et al. find that liberalization does spur growth.

Our work is also directly related to the growth accounting literature (Maddison (1987)), which decomposes economic growth into two parts: One explained by input change and the other the unexplained residual, or “technical change.” Research in the growth accounting literature has increased our understanding of economic growth, however the interpretation of the unexplained residual as technical change is unreasonable unless it is assumed that all countries are producing on their frontier. In contrast, by making some reasonable assumptions, the valuation model used in this paper allows us to give a structural interpretation to the unexplained residual. We interpret this residual as a combination of inefficiency in valuation and measurement error. The change in valuation technology is associated with the movement of the best-practice valuation frontier.

The focus of this paper is on the determinants of financial development across countries. Following La Porta et al. (1997) and Levine and Zervos (1998a, 1998b) we use the log of a country’s equity market capitalization in real terms as a measure of the size of the local equity market. Although large markets do not necessarily function effectively and taxes or legal systems may distort incentives to list on the exchange, many observers use the market capitalization as an indicator of stock market development under the assumption that stock market size is positively correlated with the ability to mobilize capital and diversify risk (Levine and Zervos (1998a, 1998b), and Bekaert et al. (2001a)).

Using panel data on 16 developed markets for the period 1974-1997 and 16 emerging markets for the period 1984-1997, we find that for the developed markets, the size of the equity market is positively related to the size of a country’s economy and the development of its financial interme-

diaries. For the emerging markets, two additional factors are found to be important to the growth of local equity markets: Government consumption is positively related to, while trade openness is negatively related to the size of the equity market.

Other empirical results indicate that the flexibility of the model advocated in this paper is important. In particular, we find that (1) valuation technology changes over time, (2) the developed markets and the emerging markets exhibit completely different valuation technologies, and (3) the efficiency in valuation improves over time across countries, indicating a catch-up effect.

Regarding the growth decomposition, changes in valuation inputs are found to play a key role in explaining the growth of equity markets in developed countries. Efficiency changes have little role to play for many developed countries except for countries such as Austria, Denmark, France, Germany, Japan, and Switzerland, that start with the lowest level of valuation efficiency at the beginning of the sample period. The contribution of improvement in valuation efficiency to the growth of these equity markets is found to be significant. For the emerging country group, improvement in efficiency turns out to be the most important driver for the growth of equity markets. Most emerging markets experience deterioration in valuation technology and some of them have reduced valuation inputs over the sample period.

Regarding changes in valuation efficiency over time, we find there is a general improvement in efficiency levels both for the developed markets and for the emerging markets, and the improvement in the latter group is more drastic. Overall, efficiency in valuation improves with greater economic freedom, liberalization, privatization, and enforcement of insider trading laws; inefficiency is associated with countries belonging to the French, German, or Scandinavian legal families.

Finally, we show that the efficiency component is empirically important as it explains over 38% of the total expected squared distance from the valuation frontier for the developed countries, and over 95% for the emerging market countries. Many of these findings could not be obtained using other methodologies and hence have no counterpart in the existing empirical literature.

The rest of the paper proceeds as follows. In the next section we introduce the valuation model and decompose growth in equity markets into its three components. Our choice of explanatory

variables is discussed in Section 3. We report the empirical results in Section 4 and conclude in Section 5.

## 2 The Modeling Framework

### 2.1 The Valuation Frontier

The stochastic frontier model has been widely used in many areas of economics. Most recently, applications of variants of the model are found in economic growth by Koop, Osiewalski and Steel (1999, 2000), and Koop (2001) and in corporate finance by Hunt-McCool, Koh and Francis (1996), and Koop and Li (2001).

The valuation model used in this paper is based on the following specification for country  $i$  ( $i = 1, \dots, N$ ) in period  $t$  ( $t = 1, \dots, T_i$ ):

$$Y_{ti} = f_{ti}(X_{ti}, \beta_{ti})\tau_{ti}\varepsilon_{ti}, \quad (1)$$

where  $Y$  is the size of a country's equity market, measured as the market capitalization in real terms,  $X$  is a  $(K+3) \times 1$  vector of relevant input factors used for producing the stock market value, as implied by finance theory and prior literature.  $\beta_{ti}$  is a  $(K+3) \times 1$  vector of parameters.  $f_{ti}(\cdot)$  is the valuation frontier which can vary over time and across countries, and captures the maximum possible market value that can be obtained from given levels of valuation input factors. We will interpret shifts over time in  $f_{ti}(\cdot)$  as reflecting changes in valuation technology.  $\tau_{ti}$  is valuation efficiency,  $0 < \tau_{ti} \leq 1$ , and  $\tau_{ti} = 1$  implies no mispricing.  $\varepsilon_{ti}$  reflects the random character of the valuation frontier, possibly, due to measurement error or other effects not captured by the model.

We assume a translog valuation frontier, by taking the log a loglinear model based on (1) is obtained

$$y_{ti} = x_{ti}'\beta_{ti} + v_{ti} - u_{ti}, \quad (2)$$

where  $y_{ti} = \ln(Y_{ti})$ ,  $x_{ti} = \ln(X_{ti})$ ,  $v_{ti} = \ln(\varepsilon_{ti})$ , and  $u_{ti} = -\ln(\tau_{ti})$  a nonnegative random variable. We make the usual assumption that measurement error ( $v_{ti}$ ) is normally distributed with mean 0 and variance  $\sigma_t^2$ , denoted by  $N(0, \sigma_t^2)$ , and we take inefficiency ( $u_{ti}$ ) to be independent of  $v_{ti}$  and

exponentially distributed with mean  $\lambda_{ti}$ .<sup>1</sup> We further assume independence over time and across countries for both  $v_{ti}$  and  $u_{ti}$ .

The model given in (2) is, of course, unidentified. The valuation frontier  $f_{ti}(\cdot)$  is specified in a way that it can be different for every time period and for every country. Moreover, the measurement error distribution and the inefficiency distribution are assumed to be completely independent over time. In Koop et al. (1999) they work with models similar to (2) and find, even assuming a common world valuation frontier, such unstructured models to be very poorly identified and subject to computational problems. In practice, the valuation frontier is likely changing only slowly over time and the distributions from which measurement errors and inefficiencies are drawn are likely to be roughly constant over time. Hence we assume

$$\sigma_t^2 = \sigma^2. \quad (3)$$

We also place more structure on the distribution of valuation inefficiency by allowing it to depend on other explanatory variables. This fits in with one of the purposes of the paper, that is, to try to explain patterns of valuation efficiency over time and across countries. Specifically, we allow the mean of the inefficiency distribution to depend on  $m$  different exogenous variables  $W_j$ , a  $T \times N$  matrix,  $j = 1, \dots, m$ , in the following way

$$\lambda_{ti} = \prod_{j=1}^m \phi_j^{-w_{tij}}, \quad (4)$$

where  $w_{tij}$  is the  $ti$ 'th element of  $W_j$ ,  $W_1$  is a matrix of ones and  $\phi_j > 0$ ,  $j = 1, \dots, m$ , are unknown parameters. The specification in (4) is chosen because it fulfils the technical requirement that the mean of the inefficiency distribution is positive.

It is worth noting that, in the preceding specification, we can directly test whether a particular country characteristic tends to be associated with valuation inefficiency. If  $\phi_j = 1$ , then the  $j^{th}$

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<sup>1</sup>Common distributions for  $u_{ti}$  are the truncated Normal or various members of the Gamma class. Ritter and Simar (1997) have noted some identification problems which occur if we allow the distribution of  $u_{ti}$  to be too flexible. For instance, the truncated Normal distribution becomes indistinguishable from the Normal if the truncation point is too far out in the tail of the distribution. The unrestricted Gamma distribution runs into similar problems. For this reason, researchers have worked with restricted versions of these general classes. Meeusen and van den Broeck (1977) and Koop, Osiewalski and Steel (1997) use an exponential distribution. Van den Broeck, Koop, Osiewalski and Steel (1994) and Koop, Osiewalski and Steel (1995) extend this by working with Erlang distributions (i.e., Gamma distributions with integer degrees of freedom). Here, we work with an exponential distribution following Koop and Li (2001).

country characteristic has no effect on the inefficiency distribution, whereas if  $\phi_j > 1$  ( $< 1$ ) then the  $j^{\text{th}}$  characteristic is associated with a lower (higher) degree of valuation inefficiency. For instance, in our empirical application,  $w_{ti2}$  is a dummy variable that equals one if the economic freedom of the world index for country  $i$  at time  $t$  is greater than 7 (out of 10), and zero otherwise,<sup>2</sup> so a finding of  $\phi_2 > 1$  ( $< 1$ ) indicates greater economic freedom in a country is associated with lower (higher) valuation inefficiency. As shown in Koop et al. (2000), the Bayesian approach allows us both to estimate  $\phi_2$  and to statistically test whether it is equal to one or not.

The question of how to impose structure on the valuation frontier parameters ( $\beta_{ti}$ 's) is of crucial importance to any cross-country study. The assumption that every country and every time period employs a completely different valuation technology as in (2) yields an unidentified model and one that violates common sense. Surely there is some common structure underlying valuation technology. Moreover, the idea of using a very loosely structured model with many parameters and letting the data speak is very risky given the poor quality and the scarcity of the data. In this paper we impose some structure for the valuation frontier which we feel is a reasonable compromise between very loosely structured models and models which dogmatically impose the economist's views on the data. We select our particular structure based partly on preliminary empirical work and partly on our knowledge of finance.

The extreme assumption that a common world valuation frontier with no change in valuation technology exists (i.e.,  $\beta_{ti} = \beta$ ) is intuitively unreasonable and preliminary empirical investigations indicate that this assumption is not supported by the data. Consider first the issue of how to place structure across countries. Koop et al. (2000) argue for four different regional country groupings (i.e., the Western industrialized economies, East Asia, Latin America, and Africa) in their study of GDP growth across a panel of countries. Given that the number of Asian, Latin American, and African countries included in our sample is small, we separate countries into the Developed Market (DM) group and the Emerging Market (EM) group based on the classifications of Morgan Stanley Capital International and S&P/IFC Emerging Market Data Base. Of course, this division of

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<sup>2</sup>As computational burdens are greatly reduced if the  $W_j$ 's are 0-1 dummy variables, we transform our variables accordingly.

countries is to some extent subjective. However, we feel that it is a reasonable compromise between the overly restrictive assumption of a common world valuation frontier and the assumption, which is unappealing from a finance or econometric perspective, that there are dozens of substantially different valuation technologies around the world. In our empirical application we assume that there are fundamental differences in the economic, legal, and valuation environment across these two groups of countries. In other words, not only could they have different valuation technologies, but also different inefficiency distributions. The empirical results reported later confirm the above conjecture.

Finance theory offers us little guidance in how to model the change in valuation technology over time. *A priori*, it is perhaps reasonable to assume that the change in valuation technology is gradual, i.e.,  $\beta_{ti}$  is not too different from  $\beta_{t-1,i}$ . In this paper, we follow Koop et al. (2000) and let the  $K \times 1$  vector of slope parameters in the valuation frontier evolve stochastically. Formally, the specification we choose is an AR(1) process, that is, this year's valuation technology is closely related to last year's,

$$\beta_t = (1 - r) \cdot 5\iota_K + r\beta_{t-1} + \xi_t, \tag{5}$$

where  $r \in [0, 1)$  is a fixed hyperparameter that captures the close relationship between  $\beta_{ti}$  and  $\beta_{t-1,i}$ ,  $\iota_K$  is a  $K$ -dimensional vector of ones, and  $\xi_t$  is i.i.d.  $N(0, (1 - r)^2 c_2 D_2)$  with choice of  $c_2$  and  $D_2$  discussed later in the section. As a result, the implied marginal prior, i.e., not conditional on  $\beta_{t-1}$ , for  $\beta_t$  is  $N(.5\iota_K, c_2 D_2)$ . In the empirical section of the paper, we report results setting  $r = .90$  implying  $\beta_{ti}$  is not too different from  $\beta_{t-1,i}$ , although values in the interval  $[.50, .99]$  yield very similar results.

In contrast to the  $K$  slope parameters in the valuation frontier, it is, in our view, quite reasonable to make the intercept term in the valuation frontier a deterministic function of time. To allow for time-varying neutral change in valuation technology, we have opted for a quadratic specification for the intercept,

$$\beta_{0t} = m_0 + m_1 t + m_2 t^2. \tag{6}$$

In sum, our modeling framework assumes that there is a valuation frontier which contains at

least some common structure across countries and over time. The difference between actual valuation and that implied by the frontier is decomposed into measurement error and inefficiency. In order to do this decomposition, we make the standard assumption that symmetric measurement error is independent of inefficiency and use different stochastic specifications: normal for the former and exponential for the latter. In contrast, cross-country regressions leave out the valuation inefficiency component. In the case where the inefficiency component is i.i.d., this will only cause bias in the intercept. However, if finance theory and common sense dictate that the inefficiency component depends on other observables such as  $w_{tij}$ 's and these are omitted then OLS estimates of other parameters will typically be biased. If the  $w_{tij}$ 's are included as explanatory variables in the linear regression (i.e., the valuation frontier), then the model is misspecified. Overall we would argue that, if considerations of valuation inefficiency or mispricing are important in cross-country analysis of financial market development, then our manner of including them is preferable.

## 2.2 Decomposing Growth in Equity Markets

Given the valuation frontiers in periods  $t$  and  $t + 1$ , and the valuation inputs and inefficiencies of country  $i$  in both periods, the expected increase in the log of country  $i$ 's market value is:

$$(x_{t+1,i}'\beta_{t+1} - x_{ti}'\beta_t) + (u_{ti} - u_{t+1,i}), \quad (7)$$

where the first term is due to both the change in valuation technology and changes in input factors in country  $i$  and the second term reflects changes in valuation efficiency. Note that the first term can be further written as

$$\frac{1}{2}(x_{t+1,i} + x_{ti})'(\beta_{t+1} - \beta_t) + \frac{1}{2}(\beta_{t+1} + \beta_t)'(x_{t+1,i} - x_{ti}), \quad (8)$$

where the first component reflects technological change in valuation (TC), and the second captures changes in input factors (IC).

First, we consider changes in valuation technology. Note that, if the valuation inputs were fixed at some level  $x_{*i}$ , we would be able to measure the change in valuation technology in country  $i$  as:

$$\exp[x_{*i}'(\beta_{t+1} - \beta_t)]. \quad (9)$$

Since valuation inputs vary over time, we measure the effect of changes in valuation technology on the market value of country  $i$  as a geometric average of pure technical changes for  $x_{*i} = x_{ti}$  and  $x_{*i} = x_{t+1,i}$ . In other words,

$$TC_{t+1,i} = \exp\left[\frac{1}{2}(x_{ti} + x_{t+1,i})'(\beta_{t+1} - \beta_t)\right]. \quad (10)$$

Similarly, the input change is captured by

$$IC_{t+1,i} = \exp\left[\frac{1}{2}(\beta_{t+1} + \beta_t)'(x_{t+1,i} - x_{ti})\right], \quad (11)$$

which is a geometric average of two “pure” input change effects: one measured with respect to the old valuation frontier, and the other measured with respect to the new frontier.

Finally, the change in valuation efficiency (EC) of country  $i$  is

$$EC_{t+1,i} = \exp(u_{ti} - u_{t+1,i}). \quad (12)$$

In sum, the change in the valuation of country  $i$ 's equity market (VC) is decomposed into

$$VC_{t+1,i} = TC_{t+1,i} \times IC_{t+1,i} \times EC_{t+1,i}. \quad (13)$$

Corresponding cumulative changes and their components are given by

$$CVC_i = CTC_i \times CIC_i \times CEC_i, \quad (14)$$

where

$$\begin{aligned} CTC_i &= \prod_{t=1}^{T-1} TC_{t+1,i}, \\ CIC_i &= \prod_{t=1}^{T-1} IC_{t+1,i}, \\ CEC_i &= \prod_{t=1}^{T-1} EC_{t+1,i} = \exp(u_{1i} - u_{Ti}). \end{aligned}$$

Corresponding average changes are defined as geometric averages of annual changes. In other words,

$$\begin{aligned} AVC_i &= ATC_i \times AIC_i \times AEC_i \\ &= (CTC_i)^{\frac{1}{T-1}} \times (CIC_i)^{\frac{1}{T-1}} \times (CEC_i)^{\frac{1}{T-1}} \end{aligned} \quad (15)$$

To reiterate, we expect a country's stock market to grow due to changes in valuation technology, inputs, and valuation efficiency. To facilitate interpretation, we use average annual growth rates in our empirical section:  $AVG = AVC - 1$ ,  $ATG = ATC - 1$ ,  $AIG = AIC - 1$ ,  $AEG = AEC - 1$ .

### 2.3 Prior Distributions and Model Estimation

Bayesian analysis requires both the specification of a likelihood function and a prior distribution for the parameters.<sup>3</sup> The assumptions given in Section 2.1 define the likelihood function and some aspects of the prior. In completing the specification, we will attempt to introduce as little subjective prior information as possible, although we will use a proper prior, which ensures that the resulting posterior distribution is well-defined.

Let  $f_N^M(\cdot|A, B)$  denote the density function of the  $M$ -variate normal distribution with mean  $A$  and variance-covariance matrix  $B$ ,  $f_G(\cdot|a, b)$  denote that of the Gamma distribution with shape parameter  $a$  and precision parameter  $b$ , the mean being  $a/b$  and the variance  $a/b^2$  (Poirier (1995), p. 99). Let  $y_t = (y_{t1}, \dots, y_{tN})'$ ,  $X_t = (x_{t1}, \dots, x_{tN})'$ , and  $u_t, v_t$  are defined conformably with  $y_t$ . To write the model in matrix form we first introduce some notation.

Let

$$Q_t = (1 \quad t \quad t^2), \quad Q = \begin{bmatrix} Q_1 \\ Q_2 \\ \vdots \\ Q_T \end{bmatrix},$$

$$X_\beta = \begin{bmatrix} X_1 & 0 & \cdots & 0 \\ 0 & X_2 & 0 & \vdots \\ \vdots & 0 & \ddots & 0 \\ 0 & \cdots & 0 & X_T \end{bmatrix},$$

$$X = \begin{bmatrix} Q & X_\beta \end{bmatrix},$$

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<sup>3</sup>The Bayesian methods used in this paper enable us to (1) obtain exact small sample results in a way that is particularly appropriate for the treatment of this paper's small data set, (2) focus on any quantity of interest and derive its full posterior distribution; and in particular, the full posterior distribution of any component of valuation change or function thereof so that we can make inferences about whether the change in one country's valuation inefficiency is statistically different from that of another, (3) easily integrate out parameters so that we can take into account parameter uncertainty, a characteristic which is bound to be important since our small sample size tends to prohibit precise estimation, and (4) conduct a formal test of various parameters using Bayes factors.

and  $\beta = (m_0 \ m_1 \ m_2 \ \beta_1, \dots, \beta_T)'$ . The model specified in Section 2.1 can then be written as

$$y = X\beta - u + v, \quad (16)$$

where  $y = (y'_1, \dots, y'_T)'$ ,  $u = (u'_1, \dots, u'_T)'$ ,  $v = (v'_1, \dots, v'_T)'$ , and  $\beta$  is a  $(3 + KT)$ -dimensional vector of parameters.

We complete the model specification with the following prior structure

$$p(\beta, \sigma^{-2}, \phi) = p(\beta)p(\sigma^{-2})p(\phi), \quad (17)$$

where  $\phi = (\phi_1, \dots, \phi_m)'$ . In addition to the assumptions about the prior for  $\beta$  made in Section 2.1, we have the following prior for  $\beta$ :

$$p(\beta) = f_N^{3+KT}(\beta|b_0, B_0^{-1}), \quad (18)$$

where

$$b_0 = \begin{bmatrix} 0_3 \\ .5\iota_{KT} \end{bmatrix},$$

and

$$B_0^{-1} = \begin{bmatrix} c_1 I_3 & 0 \\ 0 & c_2 R \otimes D_2 \end{bmatrix},$$

with  $c_1, c_2$ , and  $D_2$  being prior hyperparameters and

$$R = \begin{bmatrix} 1 & r & \dots & r^{T-1} \\ r & 1 & \dots & r^{T-2} \\ \vdots & \vdots & \ddots & \vdots \\ r^{T-1} & r^{T-2} & \dots & 1 \end{bmatrix}.$$

We set  $c_1 = c_2 = 100$ , and  $D_2 = I_K$ . We vary these values in a prior sensitivity analysis, and find that changing them by a factor 10 in either direction has little effect on results. We choose

$$p(\sigma^{-2}) = f_G(\sigma^{-2} | \frac{n_0}{2}, \frac{a_0}{2}), \quad (19)$$

with  $n_0 = a_0 = 10^{-6}$  so as to make the prior on  $\sigma^{-2}$  very close to the “usual” noninformative prior (flat on  $\ln(\sigma^{-2})$ ) for values of the precision that are not very large. We assume that the  $\phi_j$ 's are a priori independent Gamma

$$p(\phi_j) = f_G(\phi_j | a_j, g_j), \quad j = 1, \dots, m. \quad (20)$$

We set  $a_j = 1$  ( $j = 1, \dots, m$ ),  $g_1 = -\ln(\tau^*)$  and  $g_j = 1$  ( $j = 2, \dots, m$ ). This prior on the  $\phi_j$ 's is very noninformative and centered reasonably. In particular, if the explanatory variables  $W_2, \dots, W_m$  have no effect on the efficiency distribution, then the prior median efficiency would be  $\tau^*$ . This is a natural quantity to elicit in practice. We choose  $\tau^* = .75$ , and find that values of  $\tau^*$  in the interval [.10, .99] yield results that are virtually identical to those presented here. The priors for  $\phi_2, \dots, \phi_m$  are all centered at one (in terms of the mean), a value which implies that the explanatory variables  $W_2, \dots, W_m$  have no effect on valuation efficiency.

The full Bayesian model can be written as

$$p(y, \beta, \sigma^{-2}, \phi) = f_N^{TN}(y|X\beta - u, \sigma^2 I_{TN}) \prod_{t=1}^T \prod_{i=1}^N f_G(u_{ti}|1, \prod_{j=1}^m \phi_j^{w_{tij}}) p(\beta, \sigma^{-2}, \phi), \quad (21)$$

where we implicitly condition on all the explanatory variables.

To evaluate posterior properties of the model in (21), we use Gibbs sampling methods (see Gelfand and Smith (1990) for an introduction). Gibbs sampling involves taking random draws from conditional posterior distributions. Under very mild conditions, these draws converge to draws from the joint posterior (Tierney (1994)). Once draws from the joint distribution have been obtained, any posterior feature of interest can be calculated. For  $\beta$  we obtain

$$p(\beta|y, \sigma^{-2}, u, \phi) = f_N^{3+KT}(\beta|B^{-1}[B_0 b_0 + \sigma^{-2} X'(y + u)], B^{-1}), \quad (22)$$

where  $B = B_0 + \sigma^{-2} X'X$ . The next conditional is

$$p(\sigma^{-2}|y, \beta, u, \phi) = f_G(\sigma^{-2}|\frac{1}{2}(n_0 + TN), \frac{1}{2}[a_0 + (y - X\beta + u)'(y - X\beta + u)]). \quad (23)$$

Then, we get

$$p(u|y, \beta, \sigma^{-2}, \phi) = f_N^{TN}(u|X\beta - y - \sigma^2 \eta, \sigma^2 I_{TN}) I(u \in R_+^{TN}), \quad (24)$$

where  $\eta = (\lambda_{11}^{-1}, \dots, \lambda_{TN}^{-1})$ ,  $I(\cdot)$  is an indicator function, which equals one if  $u$  is positive, and zero otherwise. The conditional distribution of any of the  $\phi_h$ 's ( $h = 1, \dots, m$ ) depends only on  $u$  and  $\phi^{(-h)} = (\phi_1, \dots, \phi_{h-1}, \phi_{h+1}, \dots, \phi_m)'$  and is given by

$$p(\phi_h|u, \phi^{(-h)}) = f_G(\phi_h|a_h + \sum_{t=1}^T \sum_{i=1}^N w_{tih}, g_h + \sum_{t=1}^T \sum_{i=1}^N w_{tih} u_{ti} \prod_{j \neq h} \phi_j^{w_{tij}}). \quad (25)$$

The Gibbs chain is constructed from sequential draws from (22)-(25). After a burn-in of 1,000 draws, we retain 20,000 Gibbs draws. Many runs of different lengths and from various starting values are conducted and the results are similar to those reported here. More formally, we also use a plot of all Gibbs draws and the Convergence Diagnostic and Output Analysis software (CODA, see Cowles and Carlin (1996) for an introduction) to ensure convergence. Bayes factors for considering various restricted versions of our model are calculated using the Savage-Dickey density ratio (see Verdinelli and Wasserman (1995)).

### **3 Choice of Explanatory Variables**

In Section 2, we have outlined a framework where the dependent variable is the size of a country’s equity market. The variables used to explain the dependent variable are broken down into “valuation factors” (i.e., inputs) which are expected to directly affect the value of an equity market (an output) and “efficiency factors.” In this section, we motivate why we label some of our explanatory variables as the former and some as the latter.

#### **3.1 The Valuation Factors**

We draw on standard finance theories and prior research to select explanatory variables which are expected to influence valuation of a country’s equity market.

According to La Porta et al. (1997), growth of a nation’s output is likely to affect valuations, we include the GDP growth rate as our first input factor. We also control for the (log) real GDP on the theory that setting up capital markets might be an increasing returns to scale activity, and therefore larger economies might have larger capital markets.

Financial intermediaries play a pivotal role in economic development because they research and identify profitable ventures, monitor and control managers, ease risk management, and facilitate resources mobilization. An alternative view in development economics argues that capital accumulation is the key factor underlying economic growth. Beck et al. (2000) evaluates the empirical relation between the level of financial intermediary development and economic growth and conclude that financial intermediaries exert a large, positive impact on overall GDP growth. We expect that

better developed financial intermediaries in a country as an indicator of financial development, have a positive effect on the valuation of that country's equity market. Following Levine and Zervos (1998a), Beck et al. (2000), and Bekaert et al. (2001a), our measure of financial intermediary development is the value of credits issued by financial intermediaries to the private sector divided by GDP under the assumption that the size of the financial system is positively correlated with the provision and quality of financial services. This measure excludes credits issued by the central bank and development banks, and thus carefully distinguishes who is conducting the intermediation, and to where the funds are flowing.

Barro (1991) finds that the ratio of real government consumption expenditure to real GDP has a negative association with growth and investment. The intuition is that government consumption has no direct effect on private productivity, but lowers saving and growth through the distorting effects from taxation or government-expenditure programs. Levine and Renelt (1992) identify a positive, robust correlation between growth and the ratio of international trade to GDP. Consistent with Bekaert and Harvey (1997), Beck et al. (2000), and Bekaert et al. (2001a), we use the share of government consumption in GDP as an indicator of macroeconomic stability, and the sum of exports and imports as a share of GDP to capture the degree of openness of an economy.

### **3.2 The Efficiency Factors**

There are many other variables which may not be directly regarded as input factors to producing the valuation of an equity market, but are relevant nonetheless for the growth of equity markets. For example, government decisions and the general economic and legal environment can prevent market valuation from reaching the "best-practice" frontier. The logic of our structural model implies that such variables should be incorporated in the distribution of valuation efficiency. In fact, the valuation model adopted in this paper allows for time-varying country-specific characteristics to directly affect valuation efficiency.

First, we include an index of economic freedom which combines factors relating to trade policy, taxation policy, government consumption, monetary policy, foreign investment, banking, wage and price controls, property rights, regulation policy, and the black market. The general focus of the

index is to measure the extent to which a business can operate in a stable environment in an unrestricted manner and keep as much of its profit as possible. In our case, we are interested in evaluating the effect of various restrictions on the valuation of equity markets. We use the Economic Freedom of the World (EFW) index published by the Fraser Institute.<sup>4</sup> The data start in 1970 and are on a scale of 0 to 10, with higher values of the index indicating greater economic freedom.

Erb, Harvey and Viskanda (1996a) find that country credit ratings are a very good proxy for the ex ante risk exposure, particularly of segmented emerging markets. Their data come from Institutional Investor's semi-annual survey of leading international banks that rate the credit quality of each country on a scale of 0 to 100 where 100 represents the least chance of default.<sup>5</sup> The data start in September 1979 and cover both the developed and the emerging markets. We use the average of the March and September ratings to construct the annual measure.

Recently, there has been a growing interest among researchers in the link between the legal institutional framework and corporate finance. In a series of cross-country studies, La Porta et al. (1997, 1998) show that countries with poorer investor protections, measured by both the character of legal rules and the quality of law enforcement, have smaller capital markets. Demirgüç-Kunt and Maksimovic (1998) show that firms in countries with high ratings for the effectiveness of their legal systems are able to grow faster by relying more on external finance. The intuition of these findings is as follows. The willingness of an entrepreneur to sell her equity depends to a large extent on the terms at which she can obtain external finance. For equity, these terms are reflected by valuation relative to the underlying cashflows. If the terms are good, an entrepreneur would sell more of her shares. Countries whose financial systems offer entrepreneurs better terms of external finance would

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<sup>4</sup>According to the Fraser Institute, the core ingredients of economic freedom are personal choice, protection of private property, and freedom of exchange. The purpose of the EFW index is to provide an objective measure of economic freedom. The EFW index comprises 21 components designed to identify the consistency of institutional arrangements and policies with economic freedom in seven major areas (Gwartney et al. (2001)). They are (1) size of government, (2) economic structure and use of markets, (3) monetary policy and price stability, (4) freedom to use foreign currencies, (5) legal structure and security of private ownership, (6) freedom to trade with foreigners, and (7) freedom of exchange in capital markets. Cummings (2000) compares the EFW index of the Fraser Institute with another much well known Index of Economic Freedom of the Heritage Foundation and find the two indices are similar in terms of both country rankings and index values.

<sup>5</sup>According to Erb, Harvey and Viskanda (1996b), the top three factors to make the credit rankings are debt service, political outlook, and economic outlook.

then have both higher valuations of securities and broader capital markets in the sense that more firms would access them. To the extent that better legal protections enable the financiers to offer entrepreneurs money at better terms, we would expect that countries with better legal protections of shareholders should have more external finance in the form of both higher valued and broader equity markets. La Porta et al. (1997, 1998) find that in terms of protection against expropriation by insiders, common law countries protect shareholders the most, French civil law countries the least, German civil law and Scandinavian civil law countries somewhere in the middle. Based on these results, we introduce the following variables to measure the character of legal rules and the quality of law enforcement.

French origin is equal to one if the legal origin of the country is the French civil law, zero otherwise. German origin and Scandinavian origin dummies are defined similarly. The intercept term captures the effect of the baseline case, the Anglo-Saxon origin.

Law and order, compiled by the Political Risk Services (PRS), is a commercial index of experts' evaluation of the efficiency of the state in enforcing property rights within each country and provides an indicator of the ease with which firms can enter into long-term contracts. PRS aggregates reports by a panel of more than one hundred analysts on a scale of 0 to 6. Low levels of the index denote less reliance on the legal system to mediate disputes. The data are available since 1984. We use the average of the April and October indices to construct the annual measure. Demirgüç-Kunt and Maksimovic (1998) in their examination of the relationship between law, finance, and firm growth also use the same measure.

La Porta et al. (2001) examine companies from 27 wealthy countries around the world and find that poor shareholder protection is penalized with lower valuations. This finding adds an important link to the explanation of the consequences of investor protection for financial market development. Following La Porta et al. (1997, 1998, 2001) and Bhattacharya and Daouk (2001), we construct an index measuring shareholder rights by adding one when (1) there is one share-one vote; (2) shareholders are allowed to mail their proxy vote to the firm; (3) shareholders are not required to deposit their shares prior to the shareholders' meeting; (4) cumulative voting or proportional

representation of minorities on the board of directors is allowed; (5) there are mechanisms to allow oppressed minority shareholders to make legal claims against the directors; (6) there is possibility for minority shareholders to call for an extraordinary shareholder meeting. The index ranges from 0 to 6, and the data are obtained from Table 2 of La Porta et al. (1998).

Stock market liberalization is a policy that allows foreigners to purchase shares in a country's stock market. Bekaert and Harvey (2000) and Henry (2000a, 2000b) provide evidence that stock market liberalization in developing countries leads to a decrease in the cost of capital, an increase in a country's equity price index, and a boom in private investment. Bekaert et al. (2001a, 2001b) conclude that financial liberalizations are associated with significant increases in real economic growth. We expect that equity markets will be more accurately valued after a country's government lift all restrictions on capital inflows and outflows. We use the liberalization dates provided by Bekaert et al. (2001a) to construct our liberalization indicator variable. The indicator changes from zero to one in the years after the capital market in the country of interest is liberalized.

Recently, Bhattacharya and Daouk (2001) find that the cost of equity in a country does not change after the introduction of insider trading laws, but decreases significantly after the first prosecution. This is an important finding which has direct relevance on the issue we examine here. Intuitively, a major purpose of stock markets is to make it easier for companies to raise funds through equity, and if companies have to pay an extra return in stock markets because insiders trade with impunity, it would be in the interest of companies (and shareholders as well) to avoid paying this extra cost by having their equity traded in markets where there are insider trading laws and enforcement, everything else remaining constant. This implies that the presence of legal rules on insider trading has a positive effect on the growth of a country's equity market through the above described channel. Following Bhattacharya and Daouk (2001), we construct two insider trading regulation variables. The first one, Insider Trading Law Enactment, is related to the existence of laws prohibiting insider trading in the country of interest. This indicator variable changes from zero to one in the years after the insider trading laws are instituted. The second variable, Insider Trading Law Enforcement, relates to legal persecution for insider trading in the country of interest,

and it changes from zero to one in the years after the first prosecution is recorded. The data are available from Table 1 of Bhattacharya and Daouk (2001).

The political and economic policy of privatization, broadly defined as the deliberate sale by a government of state-owned enterprises or assets to private economic agents, was first introduced in the early 1980s by the British and Chilean governments, and is now in use worldwide. One important motivation for privatization, according to Megginson and Netter (2001), is to help develop security markets. New share listings through share issue privatization can directly create some net new wealth, but the principal economic payoff from increasingly efficient and liquid capital markets comes from the financing opportunities and monitoring possibilities they provide. Therefore, privatization has a direct role in promoting stock market development, especially, in improving efficiency of equity markets. While the privatization process in developing countries has been studied extensively, little attention has been given to its impact on the development of the local equity markets.<sup>6</sup> In theory, as countries carry out privatization sales through offerings on the local stock exchange, sales certainly lead to increase in market capitalization. However, according to Perotti and van Oijen (2001) and Perotti and Laeven (2001), this direct effect of privatization does not account for much of the growth in local stock markets. The total global privatization sale revenue over their sample period 1988-1996 represents only a small fraction of the increase in market capitalization over the same period. And many privatization transactions are not carried out through public issues. Thus, although privatization appears to be associated with stock market development, the temporal relationship between privatization and the growth of equity markets in developing markets is not clear from existing research. We include in the distribution of valuation efficiency a privatization dummy, which changes from zero to one in the years after the country of interest has actually engaged in some privatization activities. The starting dates of privatization come from Table A1 of Perotti and van Oijen (2001), and Table 1 of Perotti and Laeven (2001).

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<sup>6</sup>Perotti and van Oijen (2001) and Perotti and Laeven (2001) are known exceptions. They investigate whether privatization in emerging economies has a significant indirect effect on local stock market development through the resolution of political risk. They provide evidence suggesting that progress in privatization is indeed correlated with improvements in perceived political risk, and changes in political risk affect local market development and excess returns in emerging markets.

Finally, consistent with the corporate finance literature (Choe et al. (1993)), we hypothesize that there will be less of a misvaluation problem during economic booms. We introduce the state of business cycle variable which is equal to one if GDP in country  $i$  at time  $t$  is growing by more than 3.5 percent per year, and zero otherwise.

## 4 Empirical Results

### 4.1 Summary Statistics

The equity market capitalization of the DM countries comes from Datastream, and the equity market capitalization of the EM countries comes from S&P/IFC Emerging Market Data Base. The availability of this key variable determines our choices of countries and sample periods. The DM group includes 14 OECD countries: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Italy, Japan, the Netherlands, Switzerland, the UK, and the US, and two Asian economies: Hong Kong and Singapore. The sample period is 1974-1997. The EM group includes the following 16 countries: Argentina, Brazil, Chile, Colombia, Greece, India, Jordan, South Korea, Malaysia, Mexico, Nigeria, Pakistan, Philippines, Thailand, Venezuela, and Zimbabwe. The sample period is 1984-1997. Valuation input factors are mainly obtained from the World Bank's World Development Indicators 2001 CD-ROM (WDI). On a few occasions, when the data on Germany is not available from WDI prior to 1989, we resort to the IMF's International Financial Statistics and construct the relevant variables by definition. Tables 1 through 4 present some basic properties of the data.

Table 1 provides summary statistics on market capitalization and valuation input factors for the DM countries. Over the sample period 1974-1997, the three largest equity markets in the DM group are the US, Japan, and the UK. The average GDP growth during the sample period for most of the DM countries is between 2 to 3 percent. The exceptions are Hong Kong and Singapore which experienced a more rapid GDP growth of 7 to 8 percent per year. Nonetheless, the three largest economies, in terms of real GDP are the US, Japan, and Germany. Our measure of financial intermediary development is the ratio of credit issued by financial intermediaries to

the private sector to GDP. According to WDI, private credit refers to financial resources provided to the private sector, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable that establish a claim for repayment. Three countries stand out in terms of this measure. They are Japan, Hong Kong, and Switzerland. All of them have the amount of private credit issued by financial intermediaries greater than GDP. It is not surprising to find that the two financial centers Hong Kong and Switzerland are the leader in this metric. It is interesting to note that Japan has the highest level of financial intermediary development among the developed countries. La Porta et al. (1997) observe the high indebtedness in the German civil law countries which are known for bank-focused financial systems, and Morck and Nakamura (1999) document the dominant role played by big banks in the Japanese economy. The number reported here is consistent with the above findings. According to WDI, government consumption includes all current expenditures for purchases of goods and services by all levels of government, excluding most government enterprises. It also includes capital expenditure on national defense and security. We find most European governments tend to spend more than their American or Asian counterparts. Hong Kong turns out to have the lowest government spending relative to GDP in the developed world. Finally, in terms of trade openness, two Asian economies, Hong Kong and Singapore stand out as having the sum of imports and exports more than twice their respective GDP.

Table 2 provides summary statistics on market capitalization and valuation input factors for the EM countries. Over the sample period 1984-1997, Brazil has the largest equity market, and Zimbabwe the smallest. Some EM countries, in particular, Chile, South Korea, Malaysia, and Thailand experienced rapid GDP growth during the sample period. The three largest economies in the EM group are Brazil, South Korea, and India. Malaysia and Thailand have the highest level of financial intermediary development, but their private credit/GDP ratios of less than unity are not comparable to the leaders in the developed world. Interestingly, we find that government spending relative to GDP in most of the EM countries is lower than that in the DM countries, and only Jordan has government spending comparable to the developed countries. In terms of trade openness, Jordan and Malaysia have the sum of imports and exports more than their respective

GDP, while countries like Argentina, Brazil, and India, which have the largest market capitalization in the EM group, have very low volume of foreign trade over the sample period.

Tables 3a and 3b present summary statistics on time-varying and time invariant efficiency factors, respectively, for the DM countries. Hong Kong scores the highest while Italy the lowest in terms of economic freedom among the DM countries. Switzerland, Japan, and the US have the highest credit rating. Hong Kong, interestingly, scores the lowest in this measure. There is little variation in the law and order measure among the developed countries. Australia, Austria, Canada, Denmark, Netherlands, Switzerland, and the US have the full score throughout the sample period. Regarding insider trading legislation, Canada, France, the US, and Singapore established insider trading laws long before 1974, the year when our sample starts. Only Austria and Germany instituted similar laws late in the sample period, around the second half of 1990s. Most of the DM countries have had their first insider trading prosecution during the sample period 1974-1997. The exceptions are Austria and Ireland which never had an insider trading lawsuit up to 1997, the end of our sample period.

Table 3b shows that among the developed countries, the legal systems in Belgium, France, Italy, and the Netherlands are of the French origin; the legal systems in Austria, Germany, Japan, and Switzerland are of the German origin; Denmark is the only country with a Scandinavian civil law system. The rest of the DM countries are of the Anglo-Saxon origin. In terms of shareholder rights, the US and Hong Kong offer the strongest protections for shareholders, while Belgium and Italy offer the weakest protections.

Tables 4a and 4b present summary statistics on time-varying and time invariant efficiency factors, respectively, for the EM countries. Malaysia and Chile score the highest while Nigeria the lowest in terms of economic freedom among the EM countries. Over the sample period 1984-1997, Argentina makes the greatest improvement in this measure. Overall, the economic freedom in the EM countries is lower than that in the DM countries. South Korea and Malaysia have the highest credit rating, while Nigeria has the lowest. Over time, all EM countries have made some improvement in their credit ratings, but given their very poor scores to start with, they are not able

to catch up with the DM countries. Between 1984-1997, all EM countries in our sample experience financial market liberalizations, with Greece and Thailand pioneering the wave of globalization in 1987. In terms of law and order, Chile and Malaysia are found to have the most efficient legal systems, while Colombia has the least efficient. Regarding insider trading legislation, Brazil, Chile, South Korea, Malaysia, Mexico, Nigeria, and Philippines established insider trading laws before 1984, while Jordan, Venezuela, and Zimbabwe did not have relevant laws instituted by 1997, the end of our sample period. In contrast to the DM countries, more than half of the EM countries did not have their first insider trading prosecution by the end of 1997. For the EM countries which have had their first insider trading cases during the sample period, most of these trials took place in the mid- or late 1990s (Brazil and South Korea are two exceptions). Most of the EM economies, except Jordan, South Korea, and Zimbabwe, have gone through privatization over the sample period. Three countries, Chile, Malaysia, and Mexico started their privatization in the mid-1980s.

Table 4b shows that among the developing countries, more than half of our sample, including Argentina, Brazil, Chile, Colombia, Greece, Jordan, Mexico, Philippines, and Venezuela have their legal origin in the French civil law system; South Korea is the only country with a German legal system. None of the EM countries belongs to the Scandinavian legal system. The rest of the EM countries are of the Anglo-Saxon origin. In terms of shareholder rights, Pakistan has the strongest, while Nigeria the weakest, protections of shareholders.

## 4.2 Basic Findings

Table 5 presents posterior means and standard deviations of the valuation frontier parameters (i.e.,  $\beta$ ) in (2). For the DM countries, the size of a country's economy and the level of its financial intermediary development turn out to be the most important factors influencing valuation. *Ceteris paribus*, the larger the economy, the larger the equity market; the more developed a country's financial intermediaries, the larger its equity market. Our results are consistent with both La Porta et al. (1997) and Beck et al. (2000) who find that both the country size and financial intermediaries matter for capital market development. Moreover, faster growing economies, smaller government spending, and more trade openness are associated with larger equity markets, but their effects are

not statistically significant. Finally, we do not find there is a quadratic trend in the valuation frontier.

For the EM countries, the size of a country's economy and the level of its financial intermediary development remain to be important valuation factors. Moreover, larger government spending and less trade openness are associated with larger equity markets. These are interesting results. Note that among the EM countries, the share of government spending in GDP is in general fairly small, compared to their more developed counterparts. Hence it is not the size of the government consumption, rather the stability of this measure, that is reflected in the valuation of equity markets. Another possible explanation, according to Barro (1991), is that if a big portion of government consumption is government spending on education and defense, then expenditures like this are more like public investment than public consumption, in particular, these expenditures are likely to positively affect private-sector productivity and property rights, hence enhances the value of equity markets. The lack of data on the breakdown of government expenditure into education, defense and the rest, prevents us from a careful examination of the above conjecture.<sup>7</sup> As for the inverse relationship between market capitalization and trade openness, a careful look at the data sheds some insight. According to Table 2, Brazil and Argentina have the largest equity markets in the EM group, while the same two countries have the lowest volume of foreign trade relative to GDP. In contrast, while Jordan is one of the most open economies in the EM group, it also has one of the smallest equity markets. These properties of the data might drive the above, rather counter-intuitive result. Finally, we find faster growing economies are associated with larger equity markets, but the linkage is not statistically strong. Again, we do not find there is a quadratic trend in the valuation frontier.

The posterior means and standard deviations of the efficiency parameters (i.e.,  $\phi$ ) in (4) are presented in Table 6. Remember that if  $\phi_j > 1$  then the variable  $j$  is associated with a higher degree of valuation efficiency (i.e., less misvaluation). If  $\phi_j < 1$  then the variable is associated with

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<sup>7</sup>We have collected government expenditure on education and defense from various issues of the IMF's Government Finance Statistics Yearbook. They are items 2 and 4 respectively in Table B: Expenditure by Function in the yearbooks. There is a severe missing data problem that prevents a careful examination of our conjecture.

more misvaluation, and  $\phi_j = 1$  indicates that the variable has no effect. Bayes factors for the latter hypothesis are also given in Table 6.

For the DM countries, more economic freedom, higher levels of law and order, and stronger shareholder protections are associated with more efficient valuation. This finding is consistent with the result in La Porta et al. (2001) and Rodrik (2001) that the presence or creation of institutions that have generated market-oriented incentives, protected the property rights of investors, and enabled social and political stability, is the key to economic growth of a nation. On the other hand, markets in countries with the French, German, or Scandinavian legal origin are valued less, which is consistent with the finding in La Porta et al. (1997) that the legal environment has large effects on the size and breadth of capital markets across countries. There is some evidence in favor of the hypothesis that markets with higher credit ratings are valued more efficiently. The variables relating to the insider trading laws, and business cycle all seem to have no effect on the degree of misvaluation.

For the EM countries, more economic freedom is again associated with more efficient valuation. Moreover, both liberalization and privatization enable the equity market of a developing country to be more efficiently valued, hence enhance the growth of equity markets in these countries. Bekaert et al. (2001a, 2001b) find that financial liberalizations are positively related to the growth of real GDP. Perotti and Oijen (2001) and Perotti and Laeven (2001) conclude that privatization in emerging economies has a significant indirect effect on local stock market development through the resolution of political risk. Our result using different empirical methodologies complements these findings. Interestingly, the establishment of insider trading laws is associated with less efficient valuation, whereas the enforcement of insider trading laws improves the valuation efficiency. Bhattacharya and Daouk (2001) in their comprehensive cross-country study of insider trading regulations, conclude that the enforcement, not the institution of insider trading laws, is associated with a reduction in the cost of equity in a country. Bekaert et al. (2001b) conclude that insider trading prosecution is associated with high economic growth prospects. Our finding in this paper shares the similar view with Bhattacharya and Daouk (2001) and Bekaert et al. (2001b) on insider trading legislations.

There is some evidence in favor of the hypothesis that markets in countries with the German legal origin are valued less efficiently. The variables relating to country credit ratings, the French legal origin, measures of law and order, shareholder rights, and business cycle all seem to have no effect on the degree of misvaluation. Levine and Zervos (1998b) also find that among the 16 EM countries they examine, improving investor protection rules does not promote stock market development.

### 4.3 The Efficiency Distribution

The role of the explanatory variables in the inefficiency distribution can be partly understood through  $\phi$ , but an examination of the inefficiency distributions themselves is more informative. In the stochastic frontier literature, it is common to work with efficiency,  $\tau_i$ , rather than inefficiency,  $u_i$ . As noted in Section 2.1,  $\tau_i = \exp(-u_i)$  and, since efficiency is bounded between zero and one, it is easier to interpret. For instance, a value of .85 indicates that the market value of an equity market is only 85% of the maximum it could be (or, equivalently, the country’s equity market is undervalued by about 15%). Hence, next we will present results relating to valuation inefficiency using  $\tau_i$ . An advantage of the Bayesian approach is that, unlike traditional econometric approaches, we can derive the entire posterior distribution of the efficiency of any market and, hence, can calculate both point estimates and standard deviations. Note that the inefficiency distribution varies across countries and over time, i.e.,  $\tau$  depends on  $W$ , a matrix containing an intercept and the 0-1 time-varying dummies and, hence, we cannot present results for every country over the sample period. Instead, we present the inefficiency distribution for a baseline economy where the efficiency factors take values that maximize valuation. Then we change the values of the efficiency factors, one at a time, to examine the effects of individual factors on the inefficiency distribution.

Table 7 gives the means and standard deviations of these inefficiency distributions for different types of economies. For the DM countries, the baseline economy is defined by “economic freedom of the world = 1, country credit rating = 1, French origin = 0, German origin = 0, Scandinavian origin = 0, law and order = 1, shareholder rights = 1, insider trading law enactment = 1, insider trading law enforcement = 0, business cycle = 1”. Panel A of Table 7 reports the inefficiency distributions for both the baseline economy and economies where the efficiency factors change values away from

the baseline case, one at a time.

For the DM countries, the legal origin dummies have the largest effect on valuation inefficiency. In particular, *ceteris paribus*, the equity market in a country with the German legal origin is only valued at 64% of what the valuation frontier says is the maximum possible, with the French origin, the value is at 82% of the possible maximum, and with the Scandinavian origin, the value is at 86%. The second important factor is economic freedom. *Ceteris paribus*, the equity market in a country whose index of economic freedom is below the cutoff level of 7, is valued at 95% of what the valuation frontier says is the maximum possible. Other numbers in Panel A can be interpreted similarly.

For the EM countries, the baseline economy is defined by “economic freedom of the world = 1, country credit rating = 1, French origin = 0, German origin = 0, Liberalization = 1, law and order = 0, shareholder rights = 1, insider trading law enactment = 0, insider trading law enforcement = 1, business cycle = 0, privatization = 1”. Panel B of Table 7 reports the inefficiency distributions for both the baseline economy and economies where the efficiency factors change values away from the baseline case, one at a time.

For the EM countries, the enforcement of insider trading laws has the largest effect on valuation inefficiency. *Ceteris paribus*, the equity market in a country where there have been no insider trading persecutions is valued at 82% of what the valuation frontier says is the maximum possible. The second important factor is economic freedom. Everything else being the same, the equity market in a country whose index of economic freedom is below the cutoff level of 7, is valued at 85% of what the valuation frontier says is the maximum possible. The absence of liberalization or privatization is associated with undervaluation by 14% and 12%, respectively. Other numbers in Panel B can be interpreted similarly.

To examine the valuation efficiency in more detail, we also look at how efficiency evolves over time and differs across countries. Table 8 presents posterior moments of the average efficiency levels in each year during the sample period, and Table 9 presents similar statistics of the average efficiency levels of each country in the sample.

Clearly, the valuation efficiency has improved over time both for the DM countries and for the EM countries, and the improvement in the latter group is more drastic. In particular, on average, the equity markets in the EM group are only valued at 8.2% of what the valuation frontier says is the maximum possible in 1984, by the end of the sample period in 1997, the same set of equity markets is valued at 69% of the possible maximum. In contrast, for the DM countries, over 24 years of the sample period, the average valuation efficiency is improved only by 10%.

Among all the countries examined, which country has the most efficient valuation of its equity market? Table 9 gives us the answer. Over time, the average valuation efficiency in Singapore is 98.1%, that is, the equity market in Singapore is valued at 98.1% of what the valuation frontier says is the maximum possible. Canada and the US are two close followers, valued at 97.9% of their respective possible maximum. For the DM countries, the most severely undervalued markets are those within the German legal family, in particular, Austria, with its equity market valued at about 11% of what the valuation frontier says is the maximum possible. For the EM countries, Brazil stands out to be the most efficient, with its equity market valued on average at 75% of the possible maximum over the years, while Greece is at the other end of the spectrum, with its market valued at 20% of what the valuation frontier says is the maximum possible. Overall, within each country group, there is fairly large variation in average efficiency levels, and the efficiency levels of the DM group tend to be higher than those of the EM group. In other words, equity markets in the former set of countries are valued more relative to those in the latter set with comparable levels of valuation input factors.

#### **4.4 The Sources of Equity Market Growth**

As described in Section 2.2, our model specification allows for the breakdown of changes in equity market capitalization into growth in inputs, changes in valuation technology, and changes in valuation efficiency. The empirical results for this breakdown are given in Tables 10 and 11. Note that all the numbers in these two tables are interpreted as average annual changes. The first column presents the actual growth in market capitalization ( $\Delta y$ ) while the second presents posterior moments of the expected growth in market capitalization ( $AVG$ ). Comparing these two columns is

analogous to comparing actual and fitted values in a regression model. It is clear that our model fits nearly perfectly for the majority of countries. This is especially noteworthy in view of the massive heterogeneity among countries: Observed growth rates for the DM group vary from 5.7% for Italy to 18.2% for Singapore; for the EM group, they vary from -78% for Brazil to 29.2% for Philippines. More formally, we define

$$FIT = \frac{\sum_{i=1}^N (AVG_i - \Delta y_i)^2}{\sum_{i=1}^N (\Delta y_i - \Delta \bar{y})^2}, \quad (26)$$

where  $\Delta y_i$  is the geometric average of market value growth in country  $i$  and  $\Delta \bar{y} = \frac{1}{N} \sum_{i=1}^N \Delta y_i$ .  $FIT$  is similar to a  $R^2$  but does not necessarily have to increase in more general models since our error is composed of two parts and one of them (i.e., inefficiency) is included in  $AVG$ . For the current model,  $FIT = .83$  for the DM countries, and  $FIT = .99$  for the EM countries, which indicates a high degree of explanation.

From Table 10, it appears that for many developed countries in our sample, a large part of the expected growth in equity market is achieved from expanding valuation inputs rather than by squeezing higher valuation from given inputs. For countries such as Austria, Denmark, France, Germany, Japan, and Switzerland, whose efficiency levels, according to Table 9, are at the bottom of the group, the contribution of improvement in valuation efficiency to the growth of equity markets is significant. Not surprisingly, for countries such as Australia, Canada, the US, Hong Kong, and Singapore, which are the most efficient countries in the world in terms of equity valuation, the contribution of valuation efficiency to the growth of their equity market is almost none.

In contrast, for the EM countries, there are three dominant features which emerge from Table 11. First, almost all developing countries experience deterioration in valuation technology to various extent (i.e., generate lower valuation from given inputs), the exception is Jordan. Second, some developing countries also experience reduction in valuation inputs. Finally, improvement in valuation efficiency plays an overwhelming role in the growth of emerging markets. It appears that for most developing countries in our sample, their growth in equity markets is achieved from improving valuation efficiency rather than either from expanding valuation inputs or by squeezing higher valuation from given inputs (i.e., improvement in valuation technology). The exceptions

are Brazil, whose equity market is already the most efficiently valued in the EM group according to Table 9, and Jordan where the change in valuation technology contributes most to the growth of its equity market. Our finding of the dominant role played by efficiency improvement in the growth of equity markets is consistent with our earlier evidence that during the sample period, all emerging markets have increased economic freedom, and launched financial market liberalization and privatization that drastically improve valuation efficiency. As a result, the EM countries are characterized by relatively low efficiency across countries and drastic improvement in valuation efficiency over time.

## 5 Conclusions

One main goal of this paper is to investigate, in the broadest sense, why and how the equity markets of some countries grow faster than others? To investigate this issue in further detail we have decomposed the growth in national equity markets into three components: Input growth, changes in valuation technology, and changes in valuation efficiency. While considerable effort in the past has been expended on the economic and legal fundamentals that explain the cross-section of growth in equity markets, we focus on the time-series component of growth in addition to the cross-sectional relation.

The valuation model used in this paper is an extension of a stochastic production frontier model and, as such, is more structured than is usual in the literature. We argue that such models are useful for understanding the dynamics of growth in equity markets. By placing some reasonable structure on the model, we gain insight into the sources of growth in equity markets beyond that given by a simple regression. Even if the particular structure we place on the model is merely an abstraction, we would argue that the results we find are very suggestive. For instance, we find that both the size of an economy and development of financial intermediaries increase the valuation of a country's equity market. Greater economic freedom, liberalization, privatization, and enforcement of insider trading laws are associated with more efficient valuation, while countries with the French, German, or Scandinavian legal origin tend to be valued less, everything else being the same. Overall, equity

markets in the developing countries tend to be very inefficiently valued, but they experience drastic improvement in valuation efficiency over time.

Our model is empirically implemented using Bayesian methods which allow for exact finite sample inference on any feature of interest (e.g. an efficiency level or change). Hence, we can easily report the uncertainty that is inherent in our findings in a manner that is difficult to reproduce using classical statistical methods. The actual computations are carried out using Gibbs sampling. This numerical technique proves very reliable in all required integrations.

Our empirical results indicate that the separate modeling of the DM valuation frontier and the EM frontier is essential to adequately model cross-country patterns of growth in equity markets. The valuation input factors and efficiency factors vary greatly across these two groups of countries. The growth decompositions indicate that input growth is the most important component for the growth of developed markets, while efficiency improvement plays the dominant role in the growth of emerging markets. It is also interesting to note that even though most industrialized countries have roughly the same growth rates, but they could come from very different sources.

Overall, we would argue that our valuation model with time-varying efficiency distribution is a very useful tool for examining the sources of equity market growth in a cross-country setting.

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Table 1. Summary statistics for market capitalization and valuation input factors: developed markets

Market capitalization is the log of the nominal market capitalization obtained from Datastream, divided by CPI obtained from the World Development Indicators CD-ROM (WDI). GDP growth is the growth rate of real gross domestic product obtained from WDI. GDP is the log of the real gross domestic product obtained from WDI. Private credit refers to financial resources provided to the private sector, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable that establish a claim for repayment. Private credit/GDP is obtained from WDI. Government consumption includes all current expenditures for purchases of goods and services by all levels of government, excluding most government enterprises. It also includes capital expenditure on national defense and security. Government consumption/GDP is obtained from WDI. Trade is the sum of exports and imports of goods and services. Trade/GDP is obtained from WDI. The sample period is 1974-1997.

Country	Mean	Std. dev.	Median	Min	Max
A. Market Capitalization					
Australia	6.410	.690	6.269	5.482	7.797
Austria	3.329	1.502	2.689	1.749	5.544
Belgium	5.298	.878	4.890	4.161	6.817
Canada	6.895	.751	6.903	5.254	8.152
Denmark	4.576	.903	4.350	3.618	6.230
France	6.666	1.048	6.201	5.342	8.454
Germany	7.310	.780	7.198	6.299	8.675
Ireland	3.859	.985	3.602	2.546	5.682
Italy	6.356	.932	6.312	4.960	7.633
Japan	9.112	1.151	8.901	7.426	10.594
Netherlands	6.515	.889	6.172	5.365	8.245
Switzerland	6.117	1.017	5.765	4.713	8.133
UK	8.235	.742	8.013	6.932	9.551
US	9.812	.518	9.704	9.132	10.939
Hong Kong	6.443	.902	6.474	4.677	8.127
Singapore	4.978	1.374	4.927	2.603	7.134
B. GDP Growth					
Australia	.032	.019	.037	-.024	.056
Austria	.024	.017	.023	-.004	.055
Belgium	.020	.019	.021	-.015	.056
Canada	.028	.022	.030	-.030	.057
Denmark	.017	.022	.015	-.021	.064
France	.022	.013	.020	-.009	.046
Germany	.027	.041	.022	-.019	.188
Ireland	.046	.029	.043	-.004	.107
Italy	.023	.019	.026	-.021	.065
Japan	.032	.019	.035	-.012	.062
Netherlands	.024	.016	.023	-.012	.051
Switzerland	.010	.025	.011	-.073	.046
UK	.020	.021	.025	-.022	.052
US	.029	.022	.034	-.020	.073
Hong Kong	.069	.043	.062	.002	.172
Singapore	.079	.030	.082	-.016	.129

Country	Mean	Std. dev.	Median	Min	Max
<b>C. GDP</b>					
Australia	12.533	.223	12.530	12.185	12.922
Austria	12.148	.165	12.127	11.881	12.401
Belgium	12.352	.135	12.325	12.131	12.572
Canada	13.036	.186	13.057	12.705	13.328
Denmark	11.937	.120	11.961	11.732	12.158
France	14.066	.155	14.054	13.804	14.286
Germany	14.232	.305	14.262	13.611	14.715
Ireland	10.698	.283	10.644	10.242	11.279
Italy	13.710	.163	13.717	13.408	13.937
Japan	15.168	.249	15.169	14.744	15.517
Netherlands	12.718	.157	12.692	12.485	13.003
Switzerland	12.512	.109	12.514	12.338	12.655
UK	13.726	.157	13.714	13.500	13.995
US	15.538	.211	15.548	15.195	15.887
Hong Kong	11.256	.486	11.274	10.378	11.936
Singapore	10.578	.533	10.512	9.746	11.487
<b>D. Private Credit/GDP</b>					
Australia	.437	.192	.368	.246	.755
Austria	.793	.143	.798	.507	1.029
Belgium	.402	.220	.287	.209	.782
Canada	.717	.100	.713	.520	.894
Denmark	.431	.074	.431	.311	.568
France	.884	.163	.894	.285	1.068
Germany	.918	.100	.931	.753	1.128
Ireland	.427	.154	.440	.247	.835
Italy	.582	.070	.566	.499	.740
Japan	1.662	.326	1.555	1.279	2.089
Netherlands	.827	.120	.840	.618	1.073
Switzerland	1.362	.310	1.421	.791	1.684
UK	.713	.396	.653	.267	1.209
US	.888	.117	.888	.743	1.200
Hong Kong	1.522	.080	1.513	1.341	1.756
Singapore	.919	.160	.978	.613	1.149

Country	Mean	Std. dev.	Median	Min	Max
E. Government Consumption/GDP					
Australia	.192	.007	.191	.181	.205
Austria	.191	.010	.193	.162	.206
Belgium	.233	.020	.237	.206	.268
Canada	.221	.011	.220	.198	.246
Denmark	.260	.011	.258	.241	.287
France	.224	.017	.229	.181	.245
Germany	.198	.005	.198	.183	.207
Ireland	.184	.018	.183	.152	.212
Italy	.181	.015	.183	.153	.203
Japan	.096	.003	.097	.090	.100
Netherlands	.264	.021	.264	.229	.295
Switzerland	.134	.009	.133	.114	.148
UK	.207	.010	.206	.184	.224
US	.168	.009	.169	.148	.182
Hong Kong	.073	.008	.072	.060	.088
Singapore	.104	.014	.103	.084	.143
F. Trade/GDP					
Australia	.339	.034	.338	.282	.411
Austria	.727	.061	.738	.610	.866
Belgium	1.322	.119	1.328	1.099	1.538
Canada	.555	.089	.534	.454	.782
Denmark	.655	.043	.660	.563	.725
France	.426	.029	.428	.361	.480
Germany	.551	.048	.555	.453	.638
Ireland	1.116	.156	1.094	.864	1.470
Italy	.432	.039	.443	.371	.500
Japan	.223	.043	.208	.163	.286
Netherlands	1.105	.076	1.102	.957	1.274
Switzerland	.685	.045	.681	.567	.755
UK	.536	.035	.523	.473	.596
US	.195	.024	.193	.161	.246
Hong Kong	2.231	.472	2.118	1.625	3.032
Singapore	3.624	.358	3.556	3.025	4.390

Table 2. Summary statistics for market capitalization and valuation input factors: emerging markets

Market capitalization is the log of the nominal market capitalization obtained from Datastream, divided by CPI obtained from the World Development Indicators CD-ROM (WDI). GDP growth is the growth rate of real gross domestic product obtained from WDI. GDP is the log of the real gross domestic product obtained from WDI. Private credit refers to financial resources provided to the private sector, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable that establish a claim for repayment. Private credit/GDP is obtained from WDI. Government consumption includes all current expenditures for purchases of goods and services by all levels of government, excluding most government enterprises. It also includes capital expenditure on national defense and security. Government consumption/GDP is obtained from WDI. Trade is the sum of exports and imports of goods and services. Trade/GDP is obtained from WDI. The sample period is 1984-1997.

Country	Mean	Std. dev.	Median	Min	Max
<b>A. Market Capitalization</b>					
Argentina	8.175	3.645	5.841	4.570	14.548
Brazil	15.672	7.572	14.630	6.709	26.416
Chile	5.210	.836	5.472	3.774	6.190
Colombia	4.181	.444	4.334	3.329	4.930
Greece	4.162	.894	4.453	2.465	5.293
India	5.511	.785	5.578	3.896	6.580
Jordan	3.183	.201	3.206	2.875	3.551
South Korea	5.965	1.320	6.676	3.326	7.175
Malaysia	6.016	.975	5.971	4.785	7.404
Mexico	6.444	.575	6.376	5.419	7.493
Nigeria	3.983	1.000	3.891	2.732	5.837
Pakistan	3.446	.780	3.495	2.518	4.608
Philippines	4.338	1.361	4.421	1.752	6.101
Thailand	4.967	1.442	5.128	2.811	6.856
Venezuela	4.829	.963	5.186	3.212	6.006
Zimbabwe	2.557	.688	2.730	1.008	3.904
<b>B. GDP Growth</b>					
Argentina	.029	.066	.042	-.076	.127
Brazil	.032	.033	.034	-.043	.080
Chile	.077	.022	.074	.037	.123
Colombia	.041	.012	.040	.021	.058
Greece	.021	.015	.023	-.005	.045
India	.056	.022	.054	.004	.099
Jordan	.035	.069	.033	-.135	.188
South Korea	.082	.023	.085	.050	.116
Malaysia	.076	.035	.090	-.011	.100
Mexico	.025	.035	.036	-.062	.068
Nigeria	.037	.041	.028	-.048	.099
Pakistan	.051	.020	.051	.010	.078
Philippines	.022	.045	.039	-.073	.068
Thailand	.078	.037	.085	-.017	.133
Venezuela	.028	.047	.038	-.086	.097
Zimbabwe	.034	.048	.040	-.084	.102

Country	Mean	Std. dev.	Median	Min	Max
<b>C. GDP</b>					
Argentina	12.331	.146	12.268	12.145	12.594
Brazil	13.347	.105	13.323	13.135	13.524
Chile	10.736	.313	10.707	10.275	11.228
Colombia	11.231	.172	11.225	10.961	11.489
Greece	11.600	.078	11.611	11.472	11.732
India	12.522	.231	12.527	12.164	12.887
Jordan	8.646	.142	8.624	8.470	8.877
South Korea	12.746	.332	12.785	12.200	13.215
Malaysia	11.015	.337	10.988	10.610	11.561
Mexico	12.502	.106	12.509	12.367	12.680
Nigeria	10.084	.180	10.144	9.768	10.313
Pakistan	10.796	.211	10.813	10.431	11.070
Philippines	11.085	.134	11.102	10.875	11.321
Thailand	11.621	.360	11.661	11.084	12.089
Venezuela	11.138	.121	11.147	10.957	11.316
Zimbabwe	8.768	.147	8.800	8.518	8.995
<b>D. Private Credit/GDP</b>					
Argentina	.204	.064	.201	.126	.397
Brazil	.494	.240	.423	.215	.963
Chile	.570	.100	.540	.448	.824
Colombia	.275	.090	.304	.144	.376
Greece	.363	.039	.360	.307	.423
India	.267	.032	.252	.230	.313
Jordan	.700	.043	.711	.623	.750
South Korea	.634	.060	.643	.556	.788
Malaysia	.986	.260	.946	.648	1.515
Mexico	.204	.084	.181	.111	.387
Nigeria	.114	.040	.094	.067	.205
Pakistan	.284	.023	.275	.255	.335
Philippines	.312	.141	.261	.174	.622
Thailand	.950	.375	.862	.568	1.659
Venezuela	.312	.167	.270	.092	.564
Zimbabwe	.243	.078	.246	.143	.386

Country	Mean	Std. dev.	Median	Min	Max
<b>E. Government Consumption/GDP</b>					
Argentina	.071	.045	.044	.030	.135
Brazil	.153	.039	.174	.083	.196
Chile	.108	.015	.102	.097	.145
Colombia	.117	.037	.099	.086	.199
Greece	.149	.005	.148	.143	.160
India	.115	.006	.114	.107	.126
Jordan	.249	.019	.256	.217	.270
South Korea	.103	.003	.103	.097	.108
Malaysia	.134	.015	.137	.108	.164
Mexico	.095	.010	.092	.083	.116
Nigeria	.133	.032	.133	.080	.184
Pakistan	.133	.016	.128	.116	.168
Philippines	.098	.017	.098	.070	.132
Thailand	.106	.015	.100	.092	.135
Venezuela	.088	.018	.094	.050	.112
Zimbabwe	.195	.035	.191	.149	.275
<b>F. Trade/GDP</b>					
Argentina	.170	.031	.160	.123	.233
Brazil	.173	.022	.169	.132	.215
Chile	.590	.046	.591	.496	.671
Colombia	.326	.038	.343	.243	.361
Greece	.452	.020	.454	.425	.485
India	.190	.045	.177	.138	.257
Jordan	1.214	.181	1.213	.847	1.546
South Korea	.634	.057	.625	.550	.716
Malaysia	1.456	.322	1.488	1.032	1.921
Mexico	.397	.119	.368	.257	.623
Nigeria	.642	.226	.704	.278	.973
Pakistan	.371	.027	.371	.332	.410
Philippines	.658	.176	.615	.459	1.083
Thailand	.719	.155	.769	.481	.945
Venezuela	.506	.065	.517	.403	.596
Zimbabwe	.566	.145	.484	.414	.813

Table 3a. Summary statistics for time-varying efficiency factors: developed markets

The economic freedom of the world index provides an objective measure of economic freedom in each country on a scale of 0 to 10 and is published by the Fraser Institute. The country credit rating comes from Institutional Investor's semi-annual survey of bankers who rate the credit quality of each country on a scale of 0 to 100. The law and order measure is a commercial index on a scale of 0 to 6, of experts' evaluation of the efficiency of the state in enforcing property rights within each country and is compiled by the Political Risk Services. The insider trading law enactment indicator changes from zero to one in the year after the insider trading laws are instituted. The insider trading law enforcement indicator changes from zero to one in the year after the first prosecution is recorded. Both variables are obtained from Bhattacharya and Daouk (2001). The sample period is 1974-1997.

Country	Mean	Std. dev.	Median	Min	Max
<b>A. Economic Freedom of the World</b>					
Australia	7.541	.639	7.760	6.470	8.390
Austria	6.841	.574	6.740	5.990	7.640
Belgium	7.911	.315	7.880	7.540	9.060
Canada	7.949	.372	8.040	7.330	8.430
Denmark	6.953	.646	6.690	6.280	8.000
France	6.770	.735	6.330	6.040	7.880
Germany	7.761	.272	7.750	7.330	8.080
Ireland	6.899	.765	6.670	6.070	8.580
Italy	6.203	.781	5.890	5.430	7.220
Japan	7.590	.442	7.580	6.930	8.140
Netherlands	7.859	.457	7.910	7.110	8.500
Switzerland	8.313	.257	8.320	7.890	8.780
UK	7.437	.977	7.880	6.290	8.720
US	8.413	.327	8.510	7.650	8.760
Hong Kong	9.415	.206	9.350	9.170	9.730
Singapore	8.386	.602	8.400	7.650	9.360
<b>B. Country Credit Rating</b>					
Australia	79.460	9.143	81.850	66.800	90.200
Austria	84.910	1.835	85.425	81.400	86.950
Belgium	80.602	4.874	79.650	72.600	87.150
Canada	87.410	4.846	86.825	79.650	93.100
Denmark	74.110	3.110	73.800	68.800	82.100
France	87.346	4.068	87.825	79.050	92.000
Germany	94.042	3.021	93.500	89.650	98.050
Ireland	69.071	4.637	70.275	61.700	76.200
Italy	75.044	2.440	75.250	70.650	79.950
Japan	94.142	1.810	95.100	91.000	95.850
Netherlands	88.490	1.548	88.675	85.850	90.250
Switzerland	95.035	2.367	94.725	91.700	98.100
UK	88.238	2.055	88.650	84.150	90.600
US	94.090	4.078	95.750	87.050	98.400
Hong Kong	70.840	5.508	69.200	64.050	77.800
Singapore	78.619	2.444	78.050	74.300	84.050

Country	Mean	Std. dev.	Median	Min	Max
<b>C. Law and Order</b>					
Australia	6.000	.000	6.000	6.000	6.000
Austria	6.000	.000	6.000	6.000	6.000
Belgium	5.938	.224	6.000	5.000	6.000
Canada	6.000	.000	6.000	6.000	6.000
Denmark	6.000	.000	6.000	6.000	6.000
France	5.208	.415	5.000	5.000	6.000
Germany	5.938	.224	6.000	5.000	6.000
Ireland	4.521	.773	4.000	4.000	6.000
Italy	5.104	.294	5.000	5.000	6.000
Japan	5.229	.416	5.000	5.000	6.000
Netherlands	6.000	.000	6.000	6.000	6.000
Switzerland	6.000	.000	6.000	6.000	6.000
UK	5.313	.656	5.500	4.000	6.000
US	6.000	.000	6.000	6.000	6.000
Hong Kong	4.979	.521	5.000	4.000	6.000
Singapore	4.938	.538	5.000	4.500	6.000
<b>D. Insider Trading Law Enactment</b>					
Australia	.250	.442	.000	.000	1.000
Austria	.167	.381	.000	.000	1.000
Belgium	.292	.464	.000	.000	1.000
Canada	1.000	.000	1.000	1.000	1.000
Denmark	.250	.442	.000	.000	1.000
France	1.000	.000	1.000	1.000	1.000
Germany	.125	.338	.000	.000	1.000
Ireland	.292	.464	.000	.000	1.000
Italy	.250	.442	.000	.000	1.000
Japan	.375	.495	.000	.000	1.000
Netherlands	.333	.482	.000	.000	1.000
Switzerland	.375	.495	.000	.000	1.000
UK	.708	.464	1.000	.000	1.000
US	1.000	.000	1.000	1.000	1.000
Hong Kong	.250	.442	.000	.000	1.000
Singapore	1.000	.000	1.000	1.000	1.000

Country	Mean	Std. dev.	Median	Min	Max
E. Insider Trading Law Enforcement					
Australia	.042	.204	.000	.000	1.000
Austria	.000	.000	.000	.000	.000
Belgium	.125	.338	.000	.000	1.000
Canada	.875	.338	1.000	.000	1.000
Denmark	.042	.204	.000	.000	1.000
France	.917	.282	1.000	.000	1.000
Germany	.083	.282	.000	.000	1.000
Ireland	.000	.000	.000	.000	.000
Italy	.042	.204	.000	.000	1.000
Japan	.292	.464	.000	.000	1.0000
Netherlands	.125	.338	.000	.000	1.000
Switzerland	.083	.282	.000	.000	1.000
UK	.667	.482	1.000	.000	1.000
US	1.000	.000	1.000	1.000	1.000
Hong Kong	.125	.338	.000	.000	1.000
Singapore	.792	.415	1.000	.000	1.000

Table 3b. Summary statistics for time invariant efficiency factors: developed markets

French origin is equal to one if the legal origin of the country is the French civil law, and zero otherwise. German origin and Scandinavian origin dummies are defined similarly. The intercept term captures the effect of the baseline case, the English origin. Shareholder rights is a composite index on a scale of 0 to 6 following Bhattacharya and Daouk (2001).

Country	French Origin	German Origin	Scandinavian Origin	Shareholder Rights
Australia	0	0	0	4
Austria	0	1	0	2
Belgium	1	0	0	0
Canada	0	0	0	4
Denmark	0	0	1	3
France	1	0	0	2
Germany	0	1	0	1
Ireland	0	0	0	3
Italy	1	0	0	0
Japan	0	1	0	4
Netherlands	1	0	0	2
Switzerland	0	1	0	1
UK	0	0	0	4
US	0	0	0	5
Hong Kong	0	0	0	5
Singapore	0	0	0	4

Table 4a. Summary statistics for time-varying efficiency factors: emerging markets

The economic freedom of the world index provides an objective measure of economic freedom in each country on a scale of 0 to 10 and is published by the Fraser Institute. The country credit rating comes from Institutional Investor's semi-annual survey of bankers who rate the credit quality of each country on a scale of 0 to 100. The law and order measure is a commercial index on a scale of 0 to 6, of experts' evaluation of the efficiency of the state in enforcing property rights within each country and is compiled by the Political Risk Services. The insider trading law enactment indicator changes from zero to one in the year after the insider trading laws are instituted. The insider trading law enforcement indicator changes from zero to one in the year after the first prosecution is recorded. Both variables are obtained from Bhattacharya and Daouk (2001). The sample period is 1984-1997.

Country	Mean	Std. dev.	Median	Min	Max
A. Economic Freedom of the World					
Argentina	5.201	1.395	5.250	3.870	7.520
Brazil	4.037	.710	4.240	3.210	5.020
Chile	6.942	.730	7.260	6.000	7.930
Colombia	5.039	.197	5.030	4.500	5.300
Greece	5.981	.752	6.070	5.230	7.190
India	4.147	.211	4.040	4.000	4.490
Jordan	5.530	.522	5.830	4.890	6.020
South Korea	6.251	.448	6.330	5.780	6.960
Malaysia	7.300	.238	7.440	7.030	7.530
Mexico	5.914	.926	6.460	4.880	7.010
Nigeria	3.359	.123	3.420	3.070	3.470
Pakistan	4.289	.558	4.180	3.460	5.260
Philippines	5.694	.862	5.590	5.020	7.210
Thailand	6.466	.555	6.570	5.810	7.340
Venezuela	5.596	.837	5.660	4.190	6.970
Zimbabwe	4.571	.519	4.620	4.070	5.420
B. Country Credit Rating					
Argentina	27.736	7.807	24.500	18.500	40.550
Brazil	31.007	3.931	29.700	26.800	39.150
Chile	40.607	14.090	38.600	24.150	62.750
Colombia	40.739	4.620	39.550	32.750	47.450
Greece	48.954	1.845	48.550	46.300	52.150
India	45.282	4.079	46.350	37.550	50.150
Jordan	30.186	6.599	32.100	20.850	38.200
South Korea	65.700	5.676	68.175	55.700	72.050
Malaysia	62.946	4.715	63.550	54.950	68.850
Mexico	37.904	6.314	38.725	27.900	46.500
Nigeria	20.204	4.363	19.550	15.000	31.150
Pakistan	28.664	2.226	29.075	22.450	31.100
Philippines	27.718	7.211	25.175	19.500	43.300
Thailand	58.739	4.310	60.450	52.050	63.650
Venezuela	35.711	2.665	36.550	31.050	39.450
Zimbabwe	26.346	4.500	27.250	19.150	33.050

Country	Mean	Std. dev.	Median	Min	Max
<b>C. Liberalization</b>					
Argentina	.571	.514	1.000	.000	1.000
Brazil	.429	.514	.000	.000	1.000
Chile	.357	.497	.000	.000	1.000
Colombia	.429	.514	.000	.000	1.000
Greece	.714	.469	1.000	.000	1.000
India	.357	.497	.000	.000	1.000
Jordan	.143	.363	.000	.000	1.000
South Korea	.357	.497	.000	.000	1.000
Malaysia	.643	.497	1.000	.000	1.000
Mexico	.571	.514	1.000	.000	1.000
Nigeria	.143	.363	.000	.000	1.000
Pakistan	.429	.514	.000	.000	1.000
Philippines	.429	.514	.000	.000	1.000
Thailand	.714	.469	1.000	.000	1.000
Venezuela	.500	.519	.500	.000	1.000
Zimbabwe	.286	.469	.000	.000	1.000
<b>D. Law and Order</b>					
Argentina	3.643	.929	3.000	3.000	5.000
Brazil	3.607	.525	4.000	2.500	4.000
Chile	4.286	.469	4.000	4.000	5.000
Colombia	1.321	.464	1.000	1.000	2.000
Greece	4.071	1.222	3.500	3.000	6.000
India	2.679	1.103	2.500	1.000	4.000
Jordan	3.071	1.254	2.250	2.000	5.000
South Korea	3.464	1.337	3.250	2.000	5.000
Malaysia	4.250	.893	4.750	3.000	5.000
Mexico	3.071	.267	3.000	3.000	4.000
Nigeria	1.929	.997	1.500	1.000	3.000
Pakistan	2.214	.871	2.000	1.000	4.000
Philippines	2.107	1.417	1.000	1.000	4.000
Thailand	4.107	.836	4.000	3.000	5.000
Venezuela	3.964	.134	4.000	3.500	4.000
Zimbabwe	2.679	1.030	2.000	1.000	4.000

Country	Mean	Std. dev.	Median	Min	Max
<b>E. Insider Trading Law Enactment</b>					
Argentina	.429	.514	.000	.000	1.000
Brazil	1.000	.000	1.000	1.000	1.000
Chile	1.000	.000	1.000	1.000	1.000
Colombia	.500	.519	.500	.000	1.000
Greece	.643	.497	1.000	.000	1.000
India	.357	.497	.000	.000	1.000
Jordan	.000	.000	.000	.000	.000
South Korea	1.000	.000	1.000	1.000	1.000
Malaysia	1.000	.000	1.000	1.000	1.000
Mexico	1.000	.000	1.000	1.000	1.000
Nigeria	1.000	.000	1.000	1.000	1.000
Pakistan	.143	.363	.000	.000	1.000
Philippines	1.000	.000	1.000	1.000	1.000
Thailand	.929	.267	1.000	.000	1.000
Venezuela	.000	.000	.000	.000	.000
Zimbabwe	.000	.000	.000	.000	.000
<b>F. Insider Trading Law Enforcement</b>					
Argentina	.143	.363	.000	.000	1.000
Brazil	1.000	.000	1.000	1.000	1.000
Chile	.071	.267	.000	.000	1.000
Colombia	.000	.000	.000	.000	.000
Greece	.071	.267	.000	.000	1.000
India	.000	.000	.000	.000	.000
Jordan	.000	.000	.000	.000	.000
South Korea	.643	.497	1.000	.000	1.000
Malaysia	.071	.267	.000	.000	1.000
Mexico	.000	.000	.000	.000	.000
Nigeria	.000	.000	.000	.000	.000
Pakistan	.000	.000	.000	.000	.000
Philippines	.000	.000	.000	.000	.000
Thailand	.286	.469	.000	.000	1.000
Venezuela	.000	.000	.000	.000	.000
Zimbabwe	.000	.000	.000	.000	.000

Country	Mean	Std. dev.	Median	Min	Max
G. Privatization					
Argentina	.500	.519	.500	.000	1.000
Brazil	.429	.514	.000	.000	1.000
Chile	.857	.363	1.000	.000	1.000
Colombia	.429	.514	.000	.000	1.000
Greece	.500	.519	.500	.000	1.000
India	.429	.514	.000	.000	1.000
Jordan	.000	.000	.000	.000	.000
South Korea	.000	.000	.000	.000	.000
Malaysia	.857	.363	1.000	.000	1.000
Mexico	.857	.363	1.000	.000	1.000
Nigeria	.571	.514	1.000	.000	1.000
Pakistan	.500	.519	.500	.000	1.000
Philippines	.571	.514	1.000	.000	1.000
Thailand	.357	.497	.000	.000	1.000
Venezuela	.500	.519	.500	.000	1.000
Zimbabwe	.000	.000	.000	.000	.000

Table 4b. Summary statistics for time invariant efficiency factors: emerging markets

French origin is equal to one if the legal origin of the country is the French civil law, and zero otherwise. German origin dummy is defined similarly. The intercept term captures the effect of the baseline case, the English origin. Shareholder rights is a composite index on a scale of 0 to 6 following Bhattacharya and Daouk (2001).

Country	French Origin	German Origin	Shareholder Rights
Argentina	1	0	4
Brazil	1	0	4
Chile	1	0	4
Colombia	1	0	1
Greece	1	0	2
India	0	0	2
Jordan	1	0	1
South Korea	0	1	3
Malaysia	0	0	3
Mexico	1	0	0
Nigeria	0	0	3
Pakistan	0	0	5
Philippines	1	0	4
Thailand	0	0	3
Venezuela	1	0	1
Zimbabwe	0	0	3

Table 5. Posterior estimates of the valuation frontier parameters

The dependent variable is the log of the market capitalization in real terms. GDP growth is the growth rate of real gross domestic product obtained from WDI. GDP is the log of the real gross domestic product obtained from WDI. Private credit refers to financial resources provided to the private sector, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable that establish a claim for repayment. Private credit/GDP is obtained from WDI. Government consumption includes all current expenditures for purchases of goods and services by all levels of government, excluding most government enterprises. It also includes capital expenditure on national defense and security. Government consumption/GDP is obtained from WDI. Trade is the sum of exports and imports of goods and services. Trade/GDP is obtained from WDI. The sample period is 1974-1997 for the DM countries, and 1984-1997 for the EM countries.

Variable	Mean	Std. dev.
A. Developed Markets		
Intercept	-6.224	1.373
$t$	-.151	.272
$t^2$	.003	.011
GDP Growth	3.509	4.393
GDP	1.068	.074
Private Credit/GDP	.884	.468
Government Consumption/GDP	-1.295	2.698
Trade/GDP	.077	.159
B. Emerging Markets		
Intercept	-34.921	7.627
$t$	2.913	1.636
$t^2$	-0.053	.090
GDP Growth	4.762	5.465
GDP	2.106	.226
Private Credit/GDP	4.223	2.208
Government Consumption/GDP	21.804	5.152
Trade/GDP	-5.038	1.551

Table 6. Posterior estimates of the efficiency parameters

Economic freedom of the world is equal to one if the corresponding index is greater than 7, and zero otherwise. Country credit rating is equal to one if the actual rating is greater than 70, and zero otherwise. French origin is equal to one if the legal origin of the country is the French civil law, and zero otherwise. German origin and Scandinavian origin dummies are defined similarly. The intercept term captures the effect of the baseline case, the English origin. Law and order is equal to one if the corresponding index is greater than 4.5, and zero otherwise. Shareholder rights is equal to one if the index is greater than 4, and zero otherwise. The insider trading law enactment indicator changes from zero to one in the year after the insider trading laws are instituted. The insider trading law enforcement indicator changes from zero to one in the year after the first prosecution is recorded. Business cycle is equal to one if the real GDP growth rate exceeds 3.5% (the country average), and zero otherwise. The parameter  $\phi_j > 1$  ( $< 1$ ) indicates the factor  $j$  is associated with less (greater) valuation inefficiency. Bayes factors give the evidence in favor of  $H_0 : \phi_j = 1$  (i.e., the factor  $j$  has no effect on misvaluation). Values of Bayes factors greater than one indicate support for  $H_0$ . The sample period is 1974-1997 for the DM countries, and 1984-1997 for the EM countries.

	Mean	Std. dev.	Bayes Factor
A. Developed Markets			
Intercept	2.270	1.245	—
Economic Freedom of the World	3.198	.575	.000
Country Credit Rating	1.996	.925	.948
French Origin	.078	.040	.000
German Origin	.029	.015	.000
Scandinavian Origin	.116	.065	.000
Law and Order	2.980	1.306	.243
Shareholder Rights	1.691	.406	.554
Insider Trading Law Enactment	1.194	.293	3.593
Insider Trading Law Enforcement	.856	.254	2.989
Business Cycle	1.154	.212	4.676
B. Emerging Markets			
Intercept	.171	.038	—
Economic Freedom of the World	3.326	1.122	.008
Country Credit Rating	1.405	.962	1.551
French Origin	1.001	.181	6.017
German Origin	.487	.199	.358
Liberalization	2.967	.592	.000
Law and Order	.847	.270	2.752
Shareholder Rights	1.418	.254	1.075
Insider Trading Law Enactment	.900	.163	4.854
Insider Trading Law Enforcement	4.218	1.428	.001
Business Cycle	.892	.172	4.464
Privatization	2.339	.474	.001

Table 7. Posterior properties of inefficiency distributions for different types of economies

For the DM countries, the baseline economy is defined by “economic freedom of the world = 1, country credit rating = 1, French origin = 0, German origin = 0, Scandinavian origin = 0, law and order = 1, shareholder rights = 1, insider trading law enactment = 1, insider trading law enforcement = 0, business cycle = 1”. For the EM countries, the baseline economy is defined by “economic freedom of the world = 1, country credit rating = 1, French origin = 0, German origin = 0, Liberalization = 1, law and order = 0, shareholder rights = 1, insider trading law enactment = 0, insider trading law enforcement = 1, business cycle = 0, privatization = 1”. Other types of economies are obtained by changing the values of the efficiency factors away from the baseline case, one at a time.

Type of Economy	Mean	Std. dev.
A. Developed Markets		
Base Case	.983	.020
Economic Freedom of the World = 0	.950	.058
Country Credit Rating = 0	.969	.038
French Origin = 1	.818	.164
German Origin = 1	.639	.256
Scandinavian Origin = 1	.864	.134
Law and Order = 0	.957	.050
Shareholder Rights = 0	.973	.033
Insider Trading Law Enactment = 0	.981	.023
Insider Trading Law Enforcement = 1	.980	.024
Business Cycle = 0	.982	.022
B. Emerging Markets		
Base Case	.940	.089
Economic Freedom of the World = 0	.850	.169
Country Credit Rating = 0	.943	.068
French Origin = 1	.940	.088
German Origin = 1	.883	.147
Liberalization = 0	.855	.170
Law and Order = 1	.929	.101
Shareholder Rights = 0	.919	.113
Insider Trading Law Enactment = 1	.934	.095
Insider Trading Law Enforcement = 0	.819	.194
Business Cycle = 1	.934	.096
Privatization = 0	.879	.153

Table 8. Posterior estimates of valuation efficiency over time

This table reports the level of valuation efficiency averaged across countries for each year during the sample period.

Year	Mean	Std. dev.	Year	Mean	Std. dev.
Developed Markets			Emerging Markets		
1974	.646	.095			
1975	.626	.095			
1976	.618	.096			
1977	.590	.091			
1978	.610	.089			
1979	.627	.092			
1980	.610	.092			
1981	.620	.099			
1982	.566	.094			
1983	.630	.111			
1984	.636	.107	1984	.082	.114
1985	.594	.104	1985	.095	.124
1986	.655	.112	1986	.114	.128
1987	.701	.108	1987	.134	.141
1988	.687	.106	1988	.193	.172
1989	.709	.104	1989	.192	.155
1990	.758	.107	1990	.290	.182
1991	.756	.114	1991	.330	.183
1992	.743	.111	1992	.436	.203
1993	.753	.111	1993	.531	.215
1994	.754	.109	1994	.568	.227
1995	.767	.108	1995	.622	.208
1996	.764	.106	1996	.655	.206
1997	.760	.107	1997	.686	.192

Table 9. Posterior estimates of valuation efficiency across countries

This table reports the level of valuation efficiency averaged over time for each country in the sample.

Country	Mean	Std. dev.	Country	Mean	Std. dev.
Developed Markets			Emerging Markets		
Australia	.971	.044	Argentina	.387	.170
Austria	.108	.075	Brazil	.748	.184
Belgium	.649	.226	Chile	.481	.121
Canada	.979	.030	Colombia	.221	.139
Denmark	.538	.205	Greece	.200	.104
France	.333	.168	India	.241	.121
Germany	.418	.207	Jordan	.363	.229
Ireland	.785	.176	South Korea	.220	.132
Italy	.429	.184	Malaysia	.570	.202
Japan	.429	.230	Mexico	.358	.129
Netherlands	.804	.180	Nigeria	.330	.193
Switzerland	.453	.231	Pakistan	.235	.134
UK	.965	.048	Philippines	.400	.140
US	.979	.031	Thailand	.301	.113
Hong Kong	.966	.052	Venezuela	.318	.153
Singapore	.981	.029	Zimbabwe	.259	.177

Table 10. Posterior estimates of growth rate components: developed markets

This table reports the actual annual growth rates of market capitalization ( $\Delta y$ ), the expected average annual growth rates of market capitalization (AVG, as predicted by the model) and its components: average annual growth rate in technology ATG, average annual growth rate in inputs AIG, and average annual growth rate in efficiency AEG. The sample period is 1974-1997.

	Observed Growth ( $\Delta y$ )	Expected Growth (AVG)	Valuation Tech. Growth (ATG)	Valuation Input Growth (AIG)	Valuation Eff. Growth (AEG)
Australia	.079	.078 (.013)	.022 (.016)	.056 (.012)	.000 (.001)
Austria	.161	.162 (.027)	.042 (.014)	.047 (.010)	.065 (.028)
Belgium	.088	.093 (.019)	.041 (.018)	.056 (.012)	-.005 (.017)
Canada	.118	.097 (.012)	.040 (.017)	.056 (.014)	.000 (.001)
Denmark	.097	.072 (.021)	.038 (.021)	.006 (.013)	.028 (.023)
France	.116	.107 (.023)	.039 (.020)	.033 (.013)	.032 (.024)
Germany	.108	.107 (.025)	.043 (.027)	.029 (.024)	.032 (.026)
Ireland	.100	.129 (.017)	.021 (.020)	.099 (.018)	.006 (.007)
Italy	.057	.059 (.021)	.018 (.019)	.027 (.011)	.013 (.023)
Japan	.119	.118 (.025)	.038 (.030)	.048 (.015)	.028 (.033)
Netherlands	.117	.122 (.019)	.056 (.022)	.064 (.013)	-.001 (.012)
Switzerland	.151	.140 (.024)	.018 (.023)	.065 (.017)	.052 (.025)
UK	.075	.090 (.014)	.029 (.019)	.057 (.017)	.001 (.002)
US	.061	.073 (.018)	.021 (.023)	.051 (.016)	.000 (.001)
Hong Kong	.119	.138 (.022)	.067 (.034)	.069 (.029)	.000 (.002)
Singapore	.182	.165 (.024)	.071 (.029)	.088 (.020)	.000 (.001)

Table 11. Posterior estimates of growth rate components: emerging markets

This table reports the actual annual growth rates of market capitalization ( $\Delta y$ ), the expected average annual growth rates of market capitalization (AVG, as predicted by the model) and its components: average annual growth rate in technology ATG, average annual growth rate in inputs AIG, and average annual growth rate in efficiency AEG. The sample period is 1984-1997.

	Observed Growth ( $\Delta y$ )	Expected Growth (AVG)	Valuation Tech. Growth (ATG)	Valuation Input Growth (AIG)	Valuation Eff. Growth (AEG)
Argentina	-.488	-.477 (.026)	-.683 (.043)	.102 (.085)	.523 (.164)
Brazil	-.780	-.774 (.013)	-.862 (.018)	.621 (.179)	.021 (.036)
Chile	.181	.109 (.056)	-.449 (.068)	-.279 (.080)	1.884 (.579)
Colombia	.043	.053 (.061)	-.558 (.055)	-.055 (.100)	1.564 (.257)
Greece	.187	.207 (.059)	-.617 (.027)	-.004 (.023)	2.181 (.248)
India	.183	.147 (.060)	-.731 (.023)	.105 (.031)	2.892 (.385)
Jordan	.041	.048 (.062)	.209 (.181)	-.160 (.083)	.054 (.128)
South Korea	.176	.208 (.069)	-.709 (.028)	.350 (.032)	2.102 (.339)
Malaysia	.097	.079 (.063)	-.209 (.142)	-.122 (.083)	.599 (.231)
Mexico	-.001	-.036 (.051)	-.641 (.062)	.045 (.045)	1.638 (.425)
Nigeria	-.202	-.191 (.048)	-.147 (.125)	-.257 (.075)	.313 (.216)
Pakistan	.111	.111 (.060)	-.530 (.040)	.111 (.035)	1.145 (.242)
Philippines	.292	.298 (.067)	-.406 (.085)	.086 (.107)	1.056 (.272)
Thailand	.146	.162 (.069)	-.617 (.037)	.000 (.063)	2.062 (.268)
Venezuela	-.158	-.142 (.052)	-.470 (.047)	-.153 (.047)	.926 (.196)
Zimbabwe	.084	.091 (.065)	-.138 (.132)	.075 (.061)	.208 (.203)